National Aeronautics and Space Administration
Langley Research Center

Scientific and Technical Information Program Office

Scientific and Technical Aerospace Reports

STAR

Volume 43 Issue 6

March 25, 2005

WHAT'S INSIDE

- NASA STI Program Overview
- Introduction
- NASA STI Availability Information
- Table of Contents
- Subject Term Index
- Personal Author Index

NASA STI Program ... in Profile

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Introduction

Scientific and Technical Aerospace Reports (*STAR*) is an online information resource listing citations and abstracts of NASA and world wide aerospace-related STI. Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related Research & Development (R&D) results.

STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

STAR includes citations to Research & Development (R&D) results reported in:

- NASA, NASA contractor, and NASA grantee reports
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- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

The NASA Scientific and Technical Information (STI) Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

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For more information on the most up to date NASA STI, visit the STI Program's website at http://www.sti.nasa.gov.

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NASA Center for AeroSpace Information (CASI)

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National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at http://www.ntis.gov.

The Federal Depository Library Program (FDLP)

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The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at http://www.uspto.gov/patft/.

Table of Contents

Subject Divisions/Categories

Document citations are grouped by division and then by category, according to the *NASA Scope and Coverage Category Guide.*

Aeronautics

01 Aeronautics (General) 1
02 Aerodynamics 3
03 Air Transportation and Safety 5
04 Aircraft Communications and Navigation 8
05 Aircraft Design, Testing and Performance 9
07 Aircraft Propulsion and Power 16
08 Aircraft Stability and Control 18

Astronautics

12 Astronautics (General) 18
15 Launch Vehicles and Launch Operations 22
16 Space Transportation and Safety 26
17 Space Communications, Spacecraft Communications, Command and Tracking 26
18 Spacecraft Design, Testing and Performance 27
19 Spacecraft Instrumentation and Astrionics 32
20 Spacecraft Propulsion and Power 32

Chemistry and Materials

23 Chemistry and Materials (General) 36
24 Composite Materials 39
25 Inorganic, Organic and Physical Chemistry 41
26 Metals and Metallic Materials 48
27 Nonmetallic Materials 51
28 Propellants and Fuels 56
29 Space Processing 57

Engineering

31 Engineering (General) 59
32 Communications and Radar 62
33 Electronics and Electrical Engineering 111
34 Fluid Mechanics and Thermodynamics 158
35 Instrumentation and Photography 164
36 Lasers and Masers 170
37 Mechanical Engineering 171
38 Quality Assurance and Reliability 175
39 Structural Mechanics 176

Geosciences

43 Earth Resources and Remote Sensing 176
44 Energy Production and Conversion 178
45 Environment Pollution 178
46 Geophysics 192
47 Meteorology and Climatology 196
48 Oceanography 204

Life Sciences

51 Life Sciences (General) 205
52 Aerospace Medicine 229
54 Man/System Technology and Life Support 230

Mathematical and Computer Sciences

59 Mathematical and Computer Sciences (General) 231
60 Computer Operations and Hardware 240
61 Computer Programming and Software 242
62 Computer Systems 248
63 Cybernetics, Artificial Intelligence and Robotics 250
64 Numerical Analysis 253
65 Statistics and Probability 269
66 Systems Analysis and Operations Research 271
67 Theoretical Mathematics 273

Physics

70 Physics (General) 274
71 Acoustics 287
72 Atomic and Molecular Physics 291
73 Nuclear Physics 292
74 Optics 293
75 Plasma Physics 294
76 Solid-State Physics 296
77 Physics of Elementary Particles and Fields 298

Social and Information Sciences

81 Administration and Management 299
82 Documentation and Information Science 299
85 Technology Utilization and Surface Transportation 305

Space Sciences

88 Space Sciences (General) 305
89 Astronomy 308
90 Astrophysics 314
91 Lunar and Planetary Science and Exploration 318
92 Solar Physics 324
93 Space Radiation 326

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for linking to the corresponding document citation from *NASA Thesaurus* terms and personal author names.

Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 43, MARCH 25, 2005

01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see *categories 02 through 09*. For information related to space vehicles *see 12 Astronautics*.

20050110293 Boeing Air Traffic Management, Seattle, WA, USA

Assessment of the NASA AvSTAR Project Plan

Ulrey, Michael L.; Haraldsdottir, Aslaug; Berge, Matthew E.; Hopperstad, Craig A.; Schwab, Robert W.; July 30, 2004; 40 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NASA Order A-53500-D; 727-04-20

Report No.(s): NASA/CR-2004-212822; A-0413068; No Copyright; Avail: CASI; A03, Hardcopy

This report is a preliminary evaluation of NASA's proposed Aviation System Technology Advanced Research (AvSTAR) Program during the early stages of its definition, in the first half of the year 2001. This evaluation focuses on how well the program goals address the needs of the U.S. National Airspace System, the technical feasibility of the program goals, and the logistical feasibility of the program plan. This report also provides recommendations on how the AvSTAR program could be strengthened and improved. This document has two appendices.

Author

NASA Programs; Air Traffic Control; Civil Aviation; Technology Assessment; Project Planning

20050111472 Pratt and Whitney Aircraft, East Hartford, CT, USA

Nozzle Aerodynamic Stability During a Throat Shift

Kawecki, Edwin J.; Ribeiro, Gregg L.; February 2005; 86 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS3-26618; WBS 22-714-07-46

Report No.(s): NASA/CR-2005-213333; E-14803; No Copyright; Avail: CASI; A05, Hardcopy

An experimental investigation was conducted on the internal aerodynamic stability of a family of two-dimensional (2-D) High Speed Civil Transport (HSCT) nozzle concepts. These nozzles function during takeoff as mixer-ejectors to meet acoustic requirements, and then convert to conventional high-performance convergent-divergent (CD) nozzles at cruise. The transition between takeoff mode and cruise mode results in the aerodynamic throat and the minimum cross-sectional area that controls the engine backpressure shifting location within the nozzle. The stability and steadiness of the nozzle aerodynamics during this so called throat shift process can directly affect the engine aerodynamic stability, and the mechanical design of the nozzle. The objective of the study was to determine if pressure spikes or other perturbations occurred during the throat shift process and, if so, identify the caused mechanisms for the perturbations. The two nozzle concepts modeled in the test program were the fixed chute (FC) and downstream mixer (DSM). These 2-D nozzles differ principally in that the FC has a large over-area between the forward throat and aft throat locations, while the DSM has an over-area of only about 10 percent. The conclusions were that engine mass flow and backpressure can be held constant simultaneously during nozzle throat shifts on this class of nozzles, and mode shifts can be accomplished at a constant mass flow and engine backpressure without upstream pressure perturbations.

Author

Aerodynamic Stability; Nozzle Geometry; Throats; Civil Aviation; Supersonic Transports

20050111476 Pratt and Whitney Aircraft, East Hartford, CT, USA

Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions

Harrington, Douglas, Technical Monitor; Schweiger, P.; Stern, A.; Gamble, E.; Barber, T.; Chiappetta, L.; LaBarre, R.; Salikuddin, M.; Shin, H.; Majjigi, R.; February 2005; 490 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS3-26618; NAS3-26617; WBS 22-714-09-46

Report No.(s): NASA/CR-2005-213324; E-14784; No Copyright; Avail: CASI; A21, Hardcopy

Hot flow aero-acoustic tests were conducted with Pratt & Whitney's High-Speed Civil Transport (HSCT) Mixer-Ejector Exhaust Nozzles by General Electric Aircraft Engines (GEAE) in the GEAE Anechoic Freejet Noise Facility (Cell 41) located in Evendale, Ohio. The tests evaluated the impact of various geometric and design parameters on the noise generated by a two-dimensional (2-D) shrouded, 8-lobed, mixer-ejector exhaust nozzle. The shrouded mixer-ejector provides noise suppression by mixing relatively low energy ambient air with the hot, high-speed primary exhaust jet. Additional attenuation was obtained by lining the shroud internal walls with acoustic panels, which absorb acoustic energy generated during the mixing process. Two mixer designs were investigated, the high mixing 'vortical' and aligned flow 'axial', along with variations in the shroud internal mixing area ratios and shroud length. The shrouds were tested as hardwall or lined with acoustic panels packed with a bulk absorber. A total of 21 model configurations at 1:11.47 scale were tested. The models were tested over a range of primary nozzle pressure ratios and primary exhaust temperatures representative of typical HSCT aero thermodynamic cycles. Static as well as flight simulated data were acquired during testing. A round convergent unshrouded nozzle was tested to provide an acoustic baseline for comparison to the test configurations. Comparisons were made to previous test results obtained with this hardware at NASA Glenn's 9- by 15-foot low-speed wind tunnel (LSWT). Laser velocimetry was used to investigate external as well as ejector internal velocity profiles for comparison to computational predictions. Ejector interior wall static pressure data were also obtained. A significant reduction in exhaust system noise was demonstrated with the 2-D shrouded nozzle designs.

Author

Aeroacoustics; Ejectors; Exhaust Nozzles; Mixers; Computational Fluid Dynamics; Two Dimensional Models; Vertical Takeoff; Subsonic Wind Tunnels

20050111478 General Electric Aircraft Engines, Cincinnati, OH, USA

Low Noise Exhaust Nozzle Technology Development

Majjigi, R. K.; Balan, C.; Mengle, V.; Brausch, J. F.; Shin, H.; Askew, J. W.; February 2005; 169 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-25415; WBS 22-714-09-46

Report No.(s): NASA/CR-2005-213325; E-14785; HSA044; No Copyright; Avail: CASI; A08, Hardcopy

NASA and the U.S. aerospace industry have been assessing the economic viability and environmental acceptability of a second-generation supersonic civil transport, or High Speed Civil Transport (HSCT). Development of a propulsion system that satisfies strict airport noise regulations and provides high levels of cruise and transonic performance with adequate takeoff performance, at an acceptable weight, is critical to the success of any HSCT program. The principal objectives were to: 1. Develop a preliminary design of an innovative 2-D exhaust nozzle with the goal of meeting FAR36 Stage III noise levels and providing high levels of cruise performance with a high specific thrust for Mach 2.4 HSCT with a range of 5000 nmi and a payload of 51,900 lbm, 2. Employ advanced acoustic and aerodynamic codes during preliminary design, 3. Develop a comprehensive acoustic and aerodynamic database through scale-model testing of low-noise, high-performance, 2-D nozzle configurations, based on the preliminary design, and 4. Verify acoustic and aerodynamic predictions by means of scale-model testing. The results were: 1. The preliminary design of a 2-D, convergent/divergent suppressor ejector nozzle for a variable-cycle engine powered, Mach 2.4 HSCT was evolved, 2. Noise goals were predicted to be achievable for three takeoff scenarios, and 3. Impact of noise suppression, nozzle aerodynamic performance, and nozzle weight on HSCT takeoff gross weight were assessed.

Author

Exhaust Nozzles; Low Noise; Technology Utilization; Civil Aviation; Ejectors; Aircraft Noise; Nozzle Design

20050123578 NASA Glenn Research Center, Cleveland, OH, USA

Dual Purpose Simulation: New Data Link Test and Comparison With VDL-2

Robinson, Daryl C.; February 2005; 17 pp.; In English; 21st Digital Avionics Systems Conference, 27 Oct. 2002, Irvine, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22-727-01-06

Report No.(s): NASA/TM-2005-213385; E-14893; No Copyright; Avail: CASI; A03, Hardcopy

While the results of this paper are similar to those of previous research, in this paper technical difficulties present there are eliminated, producing better results, enabling one to more readily see the benefits of Prioritized CSMA (PCSMA). A new analysis section also helps to generalize this research so that it is not limited to exploration of the new concept of PCSMA. Commercially available network simulation software, OPNET version 7.0, simulations are presented involving an important application of the Aeronautical Telecommunications Network (ATN), Controller Pilot Data Link Communications (CPDLC) over the Very High Frequency Data Link Mode 2 (VDL-2). Communication is modeled for essentially all incoming and outgoing nonstop air traffic for just three USA cities: Cleveland, Cincinnati, and Detroit. The simulation involves 111 Air Traffic Control (ATC) ground stations, 32 airports distributed throughout the U.S., which are either sources or destinations for the air traffic landing or departing from the three cities, and also 1,235 equally equipped aircraft taking off, flying realistic free-flight trajectories, and landing in a 24-hr period. Collision-less PCSMA is successfully tested and compared with the traditional CSMA typically associated with VDL- 2. The performance measures include latency, throughput, and packet loss. As expected, PCSMA is much quicker and more efficient than traditional CSMA. These simulation results show the potency of PCSMA for implementing low latency, high throughput and efficient connectivity. Moreover, since PCSMA outperforms traditional CSMA, by simulating with it, we can determine the limits of performance beyond which traditional CSMA may not pass. We are testing a new and better data link that could replace CSMA with relative ease. Work is underway to drastically expand the number of flights to make the simulation more representative of the National Aerospace System.
Author
Data Links; High Frequencies; Computer Systems Programs; Computerized Simulation; Telecommunication; Aeronautics

20050123579 NASA Glenn Research Center, Cleveland, OH, USA
High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD)
Midea, Anthony C.; Austin, Thomas; Pao, S. Paul; DeBonis, James R.; Mani, Mori; February 2005; 37 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS3-27235; WBS 22-714-09-46
Report No.(s): NASA/TM-2005-213384; E-14892; No Copyright; Avail: CASI; A03, Hardcopy

Nozzle boattail drag is significant for the High Speed Civil Transport (HSCT) and can be as high as 25 percent of the overall propulsion system thrust at transonic conditions. Thus, nozzle boattail drag has the potential to create a thrust drag pinch and can reduce HSCT aircraft aerodynamic efficiencies at transonic operating conditions. In order to accurately predict HSCT performance, it is imperative that nozzle boattail drag be accurately predicted. Previous methods to predict HSCT nozzle boattail drag were suspect in the transonic regime. In addition, previous prediction methods were unable to account for complex nozzle geometry and were not flexible enough for engine cycle trade studies. A computational fluid dynamics (CFD) effort was conducted by NASA and McDonnell Douglas to evaluate the magnitude and characteristics of HSCT nozzle boattail drag at transonic conditions. A team of engineers used various CFD codes and provided consistent, accurate boattail drag coefficient predictions for a family of HSCT nozzle configurations. The CFD results were incorporated into a nozzle drag database that encompassed the entire HSCT flight regime and provided the basis for an accurate and flexible prediction methodology.
Author
Boattails; Civil Aviation; Computational Fluid Dynamics; Nacelles; Supersonic Transports; Nozzle Design; Aerodynamic Drag

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also *34 Fluid Mechanics and Thermodynamics*.

20050110460 Stanford Univ., Stanford, CA USA
Computational Algorithms for High-Fidelity Multidisciplinary Design of Complex Aerospace Systems
Jameson, Anthony; Alonso, Juan J.; Dec. 2003; 21 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0291
Report No.(s): AD-A430007; AFRL-SR-AR-TR-05-0045; No Copyright; Avail: CASI; A03, Hardcopy

During the first year, with the help of S. Nadarajah, a number of different studies on the suitability of the continuous and

discrete adjoint formulations for design using the viscous Reynolds-Averaged Navier-Stokes equations were carried out. Our conclusion is that the implementation of the continuous formulation is more straightforward and leaves more freedom on the choices of discretization of the adjoint equations. We found, however, that the discrete adjoint approach can be very helpful in resolving some of the mathematical ambiguities that are left in the continuous approach when creating imposing boundary conditions.
DTIC
Aeronautical Engineering; Aerospace Systems; Algorithms; Complex Systems

20050110546 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Wind Tunnel Investigation of the Static Stability and Control Effectiveness of a Rotary Tail in a Portable UAV
Rivera Parga, Jose R.; Dec. 2004; 229 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430131; AFIT/GAE/ENY/04-D02; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Air Force Research Lab, Munitions Directorate, Flight Vehicles Integration Branch (AFRL/MNAV) developed a man-portable, carbon-fiber matrix UAV with a flexible rectangular wing of 24' span and 6' chord, 18.2' length. There is a need for the development of smaller and lighter UAV's to perform certain missions. The objective of this experimental study was to determine the behavior and the aerodynamic characteristics of rotary tails. The bird-inspired rotary tail mechanism studied enabled control of two degrees of freedom and was configured to provide elevator deflection and rotation. Its effects on the static stability and control effectiveness were measured using the Air Force Institute of Technology (AFIT) low speed wind tunnel. The yaw moment provided by each rotary tail was found to be on the same order of magnitude as a typical rudder, and in that respect it offers promise as an effective flight control scheme. However, it was also found that the side force, and consequently the yaw moment, generated by the two tail controls (elevator deflection and rotation) were strongly coupled, which could lead to challenging aircraft control issues. A benefit is that the configurations used in this thesis would reduce the storage length by 48%.
DTIC
Controllability; Drone Vehicles; Static Stability; Wind Tunnel Tests

20050111564 Nanjing Univ. of Aeronautics and Astronautics, Nanjing, China
Transactions of Nanjing University of Aeronautics & Astronautics, Vol. 21, No. 4, December 2004
Dewang, L.; Dec. 2004; 94 pp.; In English
Report No.(s): PB2005-102306; Copyright; Avail: National Technical Information Service (NTIS)

Partial Contents: DC Loop-Current Detecting and Restraining Methods for Parallel Inverter System; New Type of Linear Ultrasonic Motor with Two Degrees of Freedom Using Longitudinal and Bending Mode; Design and Implementation of Gust Response Alleviation Control System for Helicopters; Multi-Fighter Coordinated Multi-Target Attack System; Research of Voxelization Process in Swept-Volume Technique; New Method for Measuring Fuzziness in Rough Sets; Nonlinear Buckling Analysis of Tubing in Deviated Wells by Finite Element Method; Theoretical Investigation on Heat Transfer Characteristics with Rotating Thermal Source; Modeling and Numerical Simulation of Onboard Molecular Sieve Oxygen Generation System; Weighted Least Square Method for S-N Curve Fitting; Key Technology of Solid Simulation System of NC Milling Machining; ISAR Motion Compensation Using ROPE; Distributed Simulation System Based on Universal Components; Application of Mechanical Reliability Predication Based on Fuzzy Theory; Experimental Modeling of Middle-Rise Building via Ambient Modal Identification; Optimal Design for Stator of Three-DOF Ultrasonic Motor; Computation of Turbulence Flow on Hybrid Grids Using k-w Turbulence Model and Osher Scheme.
NTIS
Astronautics; Aeronautical Engineering

20050111571 NASA Glenn Research Center, Cleveland, OH, USA
Validation of a High-Order Prefactored Compact Code on Nonlinear Flows with Complex Geometries
Hixon, R.; Mankbadi, R. R.; Scott, J. R.; [2003]; 32 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-781; Copyright; Avail: CASI; A03, Hardcopy

A finite-difference time domain solution of the airfoil gust problem is obtained using a high-accuracy nonlinear computational aeroacoustics code. For computational efficiency, the equations are cast in chain-rule curvilinear form, and a structured multiblock solver is used in parallel. In order to fully investigate the performance of this solver, a test matrix of eight problems are computed (two airfoil geometries, two gust frequencies, and two gust configurations). These results are compared

to solutions obtained by the GUST3D frequency-domain solver both on the airfoil surface and in the far field. Grid density and domain size studies are included.
Author
Finite Difference Time Domain Method; Airfoils; Aeroacoustics; Nonlinear Equations

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety* and *85 Technology Utilization and Surface Transportation*.

20050109791 Bureau of Transportation Statistics, Washington, DC
America's Freight Transportation Gateways. Connecting Our Nation to Places and Markets Abroad
2004; 80 pp.; In English
Report No.(s): PB2005-103296; No Copyright; Avail: CASI; A05, Hardcopy

U.S. gateways handled increasing volumes of freight as the movement of merchandise trade to and from our nation rose. Some facilities increased in relative importance, while others declined. Changes in freight movement influenced investment needs for air and marine facilities, land border crossings, and connecting infrastructure linking gateways to commercial and population centers. The report is a data profile of the nation's leading international transportation gateways. It is a collection of information that highlights the top 25 freight gateways and provides the most recent annual information on the goods and infrastructure at these seaports, airports, and land border crossings.
NTIS
Air Cargo; Marine Transportation; Commerce

20050109797 Hughes Technical Center, Atlantic City International Airport, NJ, USA
Evaluation of Light Emitting Diode Linear Source Devices
Gallagher, D. W.; Jan. 2005; 40 pp.; In English
Report No.(s): PB2005-103182; No Copyright; Avail: CASI; A03, Hardcopy

With rapid advances in the light emitting diode (LED) design and production arena realized in the latter half of the 1990s, increases in intensity and reduction in cost made the use of LED source devices practical for airport use. In particular, airport engineers and designers realized that the LED, when configured in a linear array, might well serve to enhance and embolden the conventional paint markings on the airport movement area. This report describes the evaluation that was conducted to determine the effectiveness and applicability of the LED configured in a linear array to enhance paint markings on the airport surface, and to develop specifications and certification procedures for these sources. The evaluation was conducted over a 5-year period at the Federal Aviation Administration William J. Hughes Technical Center, and elsewhere, by subjective visual inspections and pilot opinion of various configurations, sizes, and colors. During this time, two different products were evaluated a flexible strip of encapsulated LEDs and a rigid strip of encapsulated LEDs. The results of the investigation showed that both the flexible and rigid linear LED strips enhanced the visibility of the paint markings as indicated by the increased acquisition distances. However, the installation and robustness of these sources needs more attention from the vendors to enable the use of this product on airports.
NTIS
Light Emitting Diodes; Runways

20050109840 Animal and Plant Health Inspection Service, Riverdale, MD, USA
Japanese Beetle Program Manual
2004; 138 pp.; In English
Report No.(s): PB2005-102715; No Copyright; Avail: CASI; A07, Hardcopy

Contents include the following: List of Tables; List of Figures; Introduction (Japanese Beetle Program Manual for Airports); General Information (Management and Compliance Agreements (CAs), Airport Monitoring and Classification, Monitoring Airports in JB-infested Areas, Determining the Risk at JB-infested Airports, Using the Emergency Action Notification (EAN) and Other Activities, Monitoring and Managing Airports in JB-free Areas); Control Measures (Overview,

Safety Procedures, Treatments for Aircraft, Treatments for Airport Grounds); Appendices.
NTIS
Information Management; Manuals; Safety

20050110290 NASA Ames Research Center, Moffett Field, CA, USA
A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic
Erzberger, Heinz; Meyn, Larry A.; Neuman, Frank; August 2004; 54 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TP-2004-212283; A-0412029; No Copyright; Avail: CASI; A04, Hardcopy

The basic objective of arrival sequencing in air traffic control automation is to match traffic demand and airport capacity while minimizing delays. The performance of an automated arrival scheduling system, such as the Traffic Management Advisor developed by NASA for the FAA, can be studied by a fast-time simulation that does not involve running expensive and time-consuming real-time simulations. The fast-time simulation models runway configurations, the characteristics of arrival traffic, deviations from predicted arrival times, as well as the arrival sequencing and scheduling algorithm. This report reviews the development of the fast-time simulation method used originally by NASA in the design of the sequencing and scheduling algorithm for the Traffic Management Advisor. The utility of this method of simulation is demonstrated by examining the effect on delays of altering arrival schedules at a hub airport.
Author
Air Traffic Control; Airports; Algorithms; Computerized Simulation; Arrivals; Scheduling

20050110294 NASA Ames Research Center, Moffett Field, CA, USA
Transforming the NAS: The Next Generation Air Traffic Control System
Erzberger, Heinz; October 08, 2004; 34 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TP-2004-212801; A-0412608; No Copyright; Avail: CASI; A03, Hardcopy

The next-generation air traffic control system must be designed to safely and efficiently accommodate the large growth of traffic expected in the near future. It should be sufficiently scalable to contend with the factor of 2 or more increase in demand expected by the year 2020. Analysis has shown that the current method of controlling air traffic cannot be scaled up to provide such levels of capacity. Therefore, to achieve a large increase in capacity while also giving pilots increased freedom to optimize their flight trajectories requires a fundamental change in the way air traffic is controlled. The key to achieving a factor of 2 or more increase in airspace capacity is to automate separation monitoring and control and to use an air-ground data link to send trajectories and clearances directly between ground-based and airborne systems. In addition to increasing capacity and offering greater flexibility in the selection of trajectories, this approach also has the potential to increase safety by reducing controller and pilot errors that occur in routine monitoring and voice communication tasks.
Author
Air Traffic Control; National Airspace System; Airline Operations

20050110297 Old Dominion Univ., Norfolk, VA, USA
Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight
Bliss, James P.; Fallon, Corey; Bustamante, Ernesto; Bailey, William R., III; Anderson, Brittany; January 31, 2005; 75 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG1-03061
Report No.(s): ODURF-130971; No Copyright; Avail: CASI; A04, Hardcopy

Display of information in the cockpit has long been a challenge for aircraft designers. Given the limited space in which to present information, designers have had to be extremely selective about the types and amount of flight related information to present to pilots. The general goal of cockpit display design and implementation is to ensure that displays present information that is timely, useful, and helpful. This suggests that displays should facilitate the management of perceived workload, and should allow maximal situation awareness. The formatting of current and projected weather displays represents a unique challenge. As technologies have been developed to increase the variety and capabilities of weather information available to flight crews, factors such as conflicting weather representations and increased decision importance have increased the likelihood for errors. However, if formatted optimally, it is possible that next generation weather displays could allow for clearer indications of weather trends such as developing or decaying weather patterns. Important issues to address include the integration of weather information sources, flight crew trust of displayed weather information, and the teamed reactivity of flight crews to displays of weather. Past studies of weather display reactivity and formatting have not adequately addressed

these issues; in part because experimental stimuli have not approximated the complexity of modern weather displays, and in part because they have not used realistic experimental tasks or participants. The goal of the research reported here was to investigate the influence of onboard and NEXRAD agreement, range to the simulated potential weather event, and the pilot flying on flight crew deviation decisions, perceived workload, and perceived situation awareness. Fifteen pilot-copilot teams were required to fly a simulated route while reacting to weather events presented in two graphical formats on a separate visual display. Measures of flight crew reactions included performance-based measures such as deviation decision accuracy, and judgment-based measures such as perceived decision confidence, workload, situation awareness, and display trust. Results demonstrated that pilots adopted a conservative reaction strategy, often choosing to deviate from weather rather than ride through it. When onboard and NEXRAD displays did not agree, flight crews reacted in a complex manner, trusting the onboard system more but using the NEXRAD system to augment their situation awareness. Distance to weather reduced situation awareness and heightened workload levels. Overall, flight crews tended to adopt a participative leadership style marked by open communication. These results suggest that future weather displays should exploit the existing benefits of NEXRAD presentation for situation awareness while retaining the display structure and logic inherent in the onboard system.
Author
Air Transportation; Flight Crews; Flight Simulation; Weather; Display Devices

20050110482 Army Safety Center, Fort Rucker, AL USA
FLIGHTFAX: Army Aviation Risk-Management Information. Volume 32, Number 12
Dec. 2004; 24 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430033; No Copyright; Avail: Defense Technical Information Center (DTIC)

This issue of Flightfax contains the following articles: 1) Cover Story: FY04 Aviation Safety Wrap-up. 2) Investigators' Forum: a) RSOI - The importance of Proper Integration; and b) Good Crew Mix Essential for Mission Success. 3) War Stories: a) Know Your Crew Limits; and b) The Weather Sucked! 4) Smoke in the Cockpit. 5) Don't Ever Do That to My Airplane Again! 6) 2004 Flightfax Index. 7) Accident Briefs. 8) 'Twas the Night Before Christmas.
DTIC
Aircraft Accidents; Aircraft Safety; Flight Safety; Information Management; Management Information Systems; Risk

20050110518 Naval Surface Warfare Center, Philadelphia, PA USA
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts
Anderson, Gregory W.; Borraccini, Joseph P.; Fitzpatrick, Brian K.; Lynch, William A.; McGinnis, Patrick J.; Oct. 2004; 56 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00024-04-WX-02717
Report No.(s): AD-A430083; NSWCCD-98-TR-2004/027; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Advanced Logistics Delivery System (ALDS) concept proposes the use of ship launched, unmanned gliders to re-supply shore based ground forces and requires a launch system capable of delivering unpowered UAVs to a range of 50 miles. A study to analyze the machinery technologies capable of meeting this requirement identified a near term solution based on electric linear motor technology derived from the Electromagnetic Aircraft Launch System (EMALS) and incorporating superconductive materials in the rotor, stator windings, and electrical wiring. The development of structurally robust, high capability cryo-cooling components was identified as the most critical effort required to field a prototype system in the 10 to 15 year timeframe. The far term solution proposed was based on advances in rail gun technology anticipated as a result of Navy rail gun technology development projects currently planned for the next decade.
DTIC
Gliders; Launchers; Launching; Logistics; Logistics Management; Supplying

20050110561 Air Force Flight Test Center, Edwards AFB, CA USA
Limited Evaluation of Automated Aerial Refueling Algorithm (Project Self Serve)
Armani, Clinton; Caldwell, Johnnie; Castelnuovo, Stefano; Lawrence, Kenneth; Tan, Nicholas; Jun. 2004; 116 pp.; In English
Report No.(s): AD-A430158; AFFTC-TIM-04-03; No Copyright; Avail: CASI; A06, Hardcopy

This report presents the results of Project SELF SERVE, Limited Evaluation of Autonomous Aerial Refueling Algorithm. The overall test objective was to gather flight test data of the Automated Aerial Refueling algorithm for the Air Force Research

Laboratory. The USAF Test Pilot School, Class 03B, conducted 4 flight test sorties totaling 6.5 hours at Edwards AFB, California, from 3 May to 4 May 04. All test objectives were met.
DTIC
Air to Air Refueling; Algorithms; Refueling

20050111550 General Accounting Office, Washington, DC
Aviation Security: Measures for Testing the Impact of Using Commercial Data for the Secure Flight Program
Feb. 2005; 34 pp.; In English
Report No.(s): PB2005-103219; GAO-05-324; No Copyright; Avail: CASI; A03, Hardcopy

The Transportation Security Administration (TSA) is developing a new passenger prescreening program, known as Secure Flight. Under the Secure Flight program, TSA plans to take over, from commercial airlines, the responsibility for comparing identifying information of domestic airline passengers against information on known or suspected terrorists. TSA is also considering using commercial data as part of Secure Flight if the data are shown, through testing, to improve the results of these comparisons. In the 2005 Homeland Security Appropriations Act (Public Law 108-334, Section 522(d)), Congress mandated that, prior to testing the use of commercial data for Secure Flight, TSA develop measures to assess the impacts of using commercial data on aviation security, and that GAO review the measures. In response to that mandate, we reviewed TSAs measures for commercial data testing and briefed congressional staff on January 11, 2005, on our findings. This report documents the results of our review, which we presented in that briefing.
NTIS
Transportation; Computer Information Security; Civil Aviation

20050111568 NASA Langley Research Center, Hampton, VA, USA
Turbulence Hazard Metric Based on Peak Accelerations for Jetliner Passengers
Stewart, Eric C.; February 2005; 37 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WU 23-728-40-30
Report No.(s): NASA/TP-2005-213528; L-18382; No Copyright; Avail: CASI; A03, Hardcopy

Calculations are made of the approximate hazard due to peak normal accelerations of an airplane flying through a simulated vertical wind field associated with a convective frontal system. The calculations are based on a hazard metric developed from a systematic application of a generic math model to 1-cosine discrete gusts of various amplitudes and gust lengths. The math model simulates the three degree-of- freedom longitudinal rigid body motion to vertical gusts and includes (1) fuselage flexibility, (2) the lag in the downwash from the wing to the tail, (3) gradual lift effects, (4) a simplified autopilot, and (5) motion of an unrestrained passenger in the rear cabin. Airplane and passenger response contours are calculated for a matrix of gust amplitudes and gust lengths. The airplane response contours are used to develop an approximate hazard metric of peak normal accelerations as a function of gust amplitude and gust length. The hazard metric is then applied to a two-dimensional simulated vertical wind field of a convective frontal system. The variations of the hazard metric with gust length and airplane heading are demonstrated.
Author
Passengers; Turbulence; Flight Hazards; Loads (Forces); Acceleration (Physics); Transport Aircraft

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also *06 Avionics and Aircraft Instrumentation, 17 Space Communications, Spacecraft Communications, Command and Tracking*, and *32 Communications and Radar*.

20050110118 NASA Ames Research Center, Moffett Field, CA, USA, Federal Aviation Administration, Cambridge, MA, USA
Deployment and Evaluation of the Helicopter In-Flight Tracking System (HITS)
Daskalakis, Anastasios; Martone, Patrick; December 30, 2004; 162 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NASA Order A-62818-D; 727-01-21
Report No.(s): NASA/TM-2004-213447; A-0412564; No Copyright; Avail: CASI; A08, Hardcopy

The Gulf of Mexico airspace has two major operating regions: low altitude offshore (below 7,000 ft) and high altitude

oceanic (above 18,000 ft). Both regions suffer significant inefficiencies due to the lack of continuous surveillance during Instrument Flight Rules operations. Provision of surveillance in the offshore region is hindered by its low-altitude nature, which makes coverage by conventional radars economically infeasible. Significant portions of the oceanic sectors are inaccessible to shore-based sensors, as they are beyond line-of-sight. Two emerging surveillance technologies were assessed that are relatively low cost and can be deployed on offshore platforms Wide Area Multilateration and Automatic Dependent Surveillance Broadcast. Performance criteria were formulated using existing FAA specifications. Three configurations were developed and deployed representative of systems serving full-size and reduced-sized domestic terminal areas and an en-route/oceanic region. These configurations were evaluated during nine flight test periods using fixed- and rotary-wing aircraft.
Author
Deployment; Helicopters; Tracking (Position); Airborne Surveillance Radar; Aircraft Configurations

20050110373 Naval Postgraduate School, Monterey, CA USA
Survivability Enhancement in a Combat Environment
Seow, Yoke W.; Dec. 2004; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429875; No Copyright; Avail: Defense Technical Information Center (DTIC)
The objective of this thesis is to provide an aircraft with an optimal route to its destination that avoids encroaching into surface-to-air weapons killing envelopes in real time. The optimal route computed will be updated dynamically, depending on the location of the vehicle and the location of the Surface to Air Missile (SAM) sites. The problem was solved using heuristic algorithms instead of the conventional Dijkstra's & Bellman Ford algorithms, which are computationally expensive. Data fusion techniques such as spatial correlation and triangulation algorithms are presented in detail. Such techniques are important for situational awareness in a real time combat environment. Important information provided by onboard sensors are merged with the preplanned data to provide the operator with a better integrated picture of the combat environment.
DTIC
Augmentation; Combat; Flight Paths; Launching Sites

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information see also *18 Spacecraft Design, Testing and Performance*; and *39 Structural Mechanics*. For land transportation vehicles see *85 Technology Utilization and Surface Transportation*.

20050092415 Agricultural Research Service, Washington, DC, USA
Aerial Applicators Spray Nozzle Handbook
Oct. 2004; 248 pp.; In English
Report No.(s): PB2005-100024; AH-726; No Copyright; Avail: CASI; A11, Hardcopy
Some pesticide product labels specify application with a certain droplet spectra classification, and labels for many new and re- registered products are expected to require application within a specified range of the spray droplet spectrum (for example, medium or coarse). Pesticide applicators should know about droplet spectra classification and compliance with crop protection product labels. Pesticide applicators will also need to know how to achieve the specified droplet spectra classification with their application. Spray nozzle parameters, pressure, and airspeed are primary factors that influence droplet spectra classification from aerial spray nozzles. Computer spreadsheet models for spray nozzles commonly used on fixed-wing and rotary-wing aircraft were developed to permit applicators to select their spray nozzle, input the operational conditions for an application, and predict the expected droplet spectra classification. Atomization models are presented for 11 of the most commonly used spray nozzles on fixed-wing aircraft and 11 of the most commonly used spray nozzles on rotary-wing aircraft, as determined from aerial applicator surveys. The models are included in this handbook, on CD-ROM, and on the Internet. These models provide a tool that aerial applicators can use to mitigate spray drift and ensure compliance with crop protection product label requirements when applying sprays with a specific droplet spectra classification. This handbook (with tabular model outputs from all of the nozzle models) is designed to be a reference manual for aerial applicators when computer access is inconvenient or unavailable. The results show that improved emission inventories are consistent with monitoring results; however, emissions rates derived from in-plume observations demonstrated greater disagreement with published emissions rates. Nonetheless, good agreement between monitoring and modeling emissions rates helps confirm that differences between

inventory estimates and in-plume observations are likely a result of complex chemical processing within ship plumes.
NTIS
Classifications; Computerized Simulation; Drops (Liquids); Farm Crops; Handbooks; Pesticides; Spray Nozzles

20050109790 Dayton Univ. Research Inst., OH, USA
Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations
Jones, T.; Rustenburg, J. W.; Skinn, D. A.; Tipps, D. O.; DeFiore, T.; Jan. 2005; In English
Report No.(s): PB2005-103181; No Copyright; Avail: National Technical Information Service (NTIS)

The Federal Aviation Administration (FAA), supported by the University of Dayton, conducts research on the structural integrity requirements for the U.S. commercial transport airplane fleet. The primary objective of this research is to support the FAA airborne data monitoring systems research program by developing new and improved methods and criteria for processing and presenting large commercial transport airplane flight and ground loads usage data. The scope of activities performed involved: (1) defining the service-related factors that affect the operational life of commercial aircraft; (2) designing an efficient software system to reduce, store, and process large quantities of optical quick-access recorder data; and (3) providing processed data in formats that will enable the FAA to reassess existing certification criteria. Equally important, these new data will also enable the FAA, the aircraft manufacturers, and the airlines to better understand and control those factors that influence the structural integrity of commercial transport aircraft. Presented herein are analyses and statistical summaries of the data collected from 11,066 flights representing 95,883 flight hours from Boeing 747-400 aircraft during operational usage recorded by a single airline. The flight loads data include statistical information on accelerations, speeds, altitudes, flight duration and distance, gross weights, speed brake cycles, thrust reverser usage, and gust velocities encountered.
NTIS
Statistical Analysis; Boeing 747 Aircraft; Commercial Aircraft; Operational Problems; Structural Failure

20050110221 NASA Langley Research Center, Hampton, VA, USA
Measurements of Flow Turbulence in the NASA Langley Transonic Dynamics Tunnel
Wiesman, Carol D.; Sleeper, Robert K.; February 2005; 176 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WU 23-762-55-MN
Report No.(s): NASA/TM-2005-213529; L-19024; No Copyright; Avail: CASI; A09, Hardcopy

An assessment of the flow turbulence in the NASA Langley Transonic Dynamics Tunnel (TDT) was conducted during calibration activities following the facility conversion from a Freon-12 heavy-gas test medium to an R134a heavy-gas test medium. Total pressure, static pressure, and acoustic pressure levels were measured at several locations on a stingmounted rake. The test measured wall static pressures at several locations although this paper presents only those from one location. The test used two data acquisition systems, one sampling at 1000 Hz and the second sampling at 125 000 Hz, for acquiring time-domain data. This paper presents standard deviations and power spectral densities of the turbulence points throughout the wind tunnel envelope in air and R134a. The objective of this paper is to present the turbulence characteristics for the test section. No attempt is made to assess the causes of the turbulence. The present paper looks at turbulence in terms of pressure fluctuations. Reference 1 looked at tunnel turbulence in terms of velocity fluctuations.
Author
Transonic Wind Tunnels; Wind Tunnel Tests; Transonic Flow; Turbulence

20050110326 Defence Science and Technology Organisation, Victoria, Australia
Flow Over a Body of Revolution in a Steady Turn
Gregory, P. A.; Joubert, P. N.; Chong, M. S.; Oct. 2004; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429701; DSTO-TR-1591; DODA-AR-013-126; No Copyright; Avail: Defense Technical Information Center (DTIC)

While the mechanisms of flow separation for a submarine in steady rectilinear flow are well understood, the flow separation behaviour of a submarine during a manoeuvre is not as well understood. The importance of this has led us to investigating the flow separation over a submarine-like body of revolution in a turn of fixed radius. The flow separation over the manoeuvring body is examined by using a deformed body placed in rectilinear flow to simulate the flowfield created by a body moving through a circular path. This method was used by Von Karman at the Guggenheim Airship Laboratory and by Gurzhienko in Moscow in the 1930s to investigate the manoeuvring of airships. The deformed model is constructed such that the local angle of attack is the same for a regular model placed in curved streamlines. Velocity should be varied linearly across

the test section to ensure the local velocities at the deformed model surface are equal to the velocity along the manoeuvring model. Numerical simulations conducted using the CFD code FLUENT show the validity of this transformation. Results for a body placed in a rotating reference frame are compared to a deformed body in rectilinear flow.
DTIC
Bodies of Revolution; Boundary Layer Separation; Separated Flow

20050110327 General Dynamics Advanced Information Systems, Buffalo, NY USA
Flight and Aerospace Research: Airborne Simulation and Research Investigations, 1999 - 2004
Weingarten, Norman; Feb. 2004; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-99-C-3000; Proj-2403
Report No.(s): AD-A429796; RPT-FARG-C00328-0001-Y04; AFRL-VA-WP-TR-2004-3108; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report summarizes General Dynamics Advanced Information Systems (GDAIS), (formerly Veridian) activities under the U.S. Air Force In-Flight Simulation and Research Investigations Contract No. F33615-99-C-3000, which became effective in February 1999. The contract was sponsored by the Air Vehicles Directorate of Air Force Research Laboratory (AFRL). The objective of this contract was to conduct in-flight simulation investigations and tests using the U.S. Air Force in-flight simulator aircraft--the NF-16D Variable Stability In-Flight Simulator and Test Aircraft (VISTA), S/N 86-0048 and the NC-13H Total In-Fight Simulator (TIFS), S/N 53-7793. An additional study task, not directly using these aircraft, was also performed. Each investigation was independent, had a specific objective, and was reported separately.
DTIC
Aerospace Environments; Evaluation; Flight Simulation; Flight Simulators; Simulation; System Effectiveness

20050110360 Naval Postgraduate School, Monterey, CA USA
Simulations of Diversity Techniques for Urban UAV Data Links
Poh, Seng Cheong Telly; Dec. 2004; 115 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429851; No Copyright; Avail: Defense Technical Information Center (DTIC)

In urbanized terrain, radiowave propagation is subjected to fading on large-scales and small-scales that would impede on the quality and reliability of data link transmission. This would have implications in many military applications. One example is the performance of unmanned aerial vehicle (UAV) data and communications links in complex urban environments. The purpose of this research is to study the effectiveness of diversity techniques on the performance of urban UAV data and communications links. The techniques investigated were spatial, polarization, and angle diversities. The ray tracing software, Urbana Wireless Toolset, was used in the modeling and simulation process. The various combinations of diversity techniques were simulated using a realistic urban city model. For the few transmit-receive geometries examined, it was found that angle diversity with a directive antenna provided the greatest increase in signal strength relative to the no diversity case.
DTIC
Computer Programs; Data Links; Drone Vehicles; Pilotless Aircraft; Simulation

20050110398 Aerospace Systems, Brunswick, Germany
MAV State-of-the-Art and Technology Drivers
Voersmann, Peter; Jul. 2004; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429910; No Copyright; Avail: Defense Technical Information Center (DTIC)

These briefing charts present the state of the art of micro air vehicles (MAVs). These vehicles include those that are unmanned, unattended, and unassisted. MAVs are in increasing use both in the commercial and military sectors. MAVs can be completely remote-controlled, semi-autonomous and able to keep altitude and track while the operator commands up-down or left-right, or fully autonomous in that they can follow waypoints with no operator intervention necessary. The charts provide specifications for a number of MAVs that are currently operational. These specifications include manufacturer, wingspan, mass, payload, time endurance, whether operational or under development (prototype), and level of autonomy. The MAVs reviewed include the Aerosonde (Australia), the MLB Bat (USA), the Aladin (Germany), the Carolo XL (Germany), the Mikado (Germany), the Carolo (Germany), the Mite 2 (USA), the Dornier MAV (Germany), the RWTH Aachen MAV (Germany), the Black Widow (USA), and the Entomopter (USA). The development of MAVs is a multidisciplinary research activity involving flight dynamics, aerodynamics, aircraft design, microelectronics, propulsion systems, and guidance and control. Charts include an internal diagram of Carolo's components; Carolo during wind tunnel tests; aerodynamic characteristics, including lift versus drag, minimum glide angle, optimal speed, uncritical stall behavior, and flow separation;

microelectronics components and actuator dynamics; flight dynamics; stability analysis; guidance and control systems, including flight and altitude controllers; and propulsion system. The presentation concludes with an overview of Carolo's ground control software and waypoint navigation system; Carolo's initial flight on 20 Dec 2002; and its first autonomous flight on 5 Sep 2003.
DTIC
Aerodynamic Characteristics; Drone Vehicles; Flight Control; Microelectronics; Microminiaturization; Reconnaissance Aircraft

20050110466 Army Research Lab., Aberdeen Proving Ground, MD USA
Human Factors Assessment of the UH-60M Crew Station During the Early User Demonstration Number 2 (EUD2)
Kennedy, Joshua S.; Durbin, David B.; Feb. 2005; 142 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430014; ARL-MR-0607; No Copyright; Avail: Defense Technical Information Center (DTIC)

Pilot workload, situational awareness (SA), and the pilot-vehicle interface (PVI) characteristics associated with the UH-60M Black Hawk crew station simulator were assessed during the Early User Demonstration No. 2. Additionally, simulator sickness was assessed to determine if the pilots experienced discomfort during missions and if the discomfort affected their perceived levels of workload and SA. Four highly experienced utility helicopter (UH)-60 pilots conducted a series of three different mission scenarios over the course of three days. Pilot feedback, which was obtained via a comprehensive questionnaire battery, showed that for the missions flown, workload in the UH-60M was comparable to the workload pilots experience in the UH-60A/L. Workload results showed that UH-60 aircrew training manual tasks related to digital messages and electronic radio navigation generated higher perceived workload in the UH-60M than in the A/L model. SA was reported to be similiar to the UH-60A/L, but major gains were reported from the digital mapping system. the pilots noted several problems with the PVI, which should be resolved. Pilots experienced very mild simulator sickness symptoms. A panel of subject matter experts independently observed and evaluated each mission and reported that pilots experienced low to moderated levels of workload during the missions and moderate levels of SA. Finally, and eye tracker system was used to assess visual gaze during several of the trials. The visual gaze data were used to assess visual workload.
DTIC
Crew Workstations; Helicopters; Human Factors Engineering; Situational Awareness; Workloads (Psychophysiology)

20050110553 Library of Congress, Washington, DC USA
Homeland Security: Protecting Airliners from Terrorist Missiles
Bolkcom, Christopher; Elias, Bartholomew; Mar. 2003; 11 pp.; In English
Report No.(s): AD-A430140; No Copyright; Avail: CASI; A03, Hardcopy

Recent events have focused attention on the threat that terrorists with shoulder fired surface-to-air missiles (SAMs) pose to commercial airliners. Most believe that no single solution exists to effectively mitigate this threat. Instead, a menu of options may be considered, including installing infrared (IR) countermeasures on aircraft; modifying flight operations and air traffic control procedures; improving airport and regional security; and strengthening missile non-proliferation efforts. Equipping aircraft with missile countermeasure systems can protect the aircraft even when operating in areas where ground-based security measures are unavailable or infeasible to implement. However, this option has a relatively high cost, between $ 1 million and $3 million per aircraft, and the time needed for implementation does allow for immediate response to the existing terrorist threat. Procedural improvements such as specific flight crew training, altering air traffic procedures to minimize exposure to the threat, and improved security near airports may be less costly than countermeasures and could more immediately help deter domestic terrorist attacks. However, these techniques by themselves cannot completely mitigate the risk of domestic attacks and would not protect U.S. airliners flying to and from foreign airports. On February 5, 2003, Rep. Steve Israel and Sen. Barbara Boxer introduced legislation (H.R. 580, 5. 311) calling for the installation of missile defense systems in all turbojet aircraft used in scheduled air carrier service. On March 13, 2003, during a mark-up session of the Senate Committee on Commerce, Science, and Transportation, Sen. Boxer offered an amendment to S. 165 that would direct the Secretary of Homeland Security to conduct a 90-day study of the threat and report to Congress on recommendations for protecting airliners against shoulder fired missiles. The committee adopted Sen. Boxer's amendment and ordered S. 165 reported favorably.
DTIC
Antimissile Defense; Commercial Aircraft; Missiles; Protection

20050110555 Library of Congress, Washington, DC USA
Homeland Security: Protecting Airliners from Terrorist Missiles
Bolkcom, Christopher; Elias, Bartholomew; Feb. 2003; 11 pp.; In English
Report No.(s): AD-A430143; No Copyright; Avail: CASI; A03, Hardcopy

Recent events have focused attention on the threat that terrorists with shoulder fired surface-to-air missiles (SAMs) pose to commercial airliners. Most believe that no single solution exists to effectively mitigate this threat. Instead, a menu of options may be considered, including installing infrared (IR) countermeasures on aircraft; modifying flight operations and air traffic control procedures; improving airport and regional security; and strengthening missile non-proliferation efforts. Equipping aircraft with missile countermeasure systems can protect the aircraft even when operating in areas where ground-based security measures are unavailable or infeasible to implement. However, this option has a relatively high cost, between $ 1 million and $3 million per aircraft, and the time needed for implementation does allow for immediate response to the existing terrorist threat. Procedural improvements such as specific flight crew training, altering air traffic procedures to minimize exposure to the threat, and improved security near airports may be less costly than countermeasures and could more immediately help deter domestic terrorist attacks. However, these techniques by themselves cannot completely mitigate the risk of domestic attacks and would not protect U.S. airliners flying to and from foreign airports. On February 5,2003, Rep. Steve Israel and Sen. Barbara Boxer introduced legislation (H.R. 580, 5. 311) calling for the installation of missile defense systems in all turbojet aircraft used in scheduled air carrier service, and other Members of Congress have expressed an interest in holding hearings on this matter. This report will be updated as needed.
DTIC
Commercial Aircraft; Missiles; Protection; Surface to Air Missiles

20050110556 Library of Congress, Washington, DC USA
Homeland Security: Protecting Airliners from Terrorist Missiles
Bolkcom, Christopher; Elias, Bartholomew; Feickert, Andrew; Nov. 2003; 21 pp.; In English
Report No.(s): AD-A430144; No Copyright; Avail: CASI; A03, Hardcopy

Recent events have focused attention on the threat that terrorists with shoulder fired surface-to-air missiles (SAMs) pose to commercial airliners. Most believe that no single solution exists to effectively mitigate this threat. Instead, a menu of options may be considered, including installing infrared (IR) countermeasures on aircraft; modifying flight operations and air traffic control procedures; improving airport and regional security; and strengthening missile non-proliferation efforts. Equipping aircraft with missile countermeasure systems can protect the aircraft even when operating in areas where ground-based security measures are unavailable or infeasible to implement. However, this option has a relatively high cost, between $ 1 million and $3 million per aircraft, and the time needed for implementation does not allow for immediate response to the existing terrorist threat. Procedural improvements such as specific flight crew training, altering air traffic procedures to minimize exposure to the threat, and improved security near airports may be less costly than countermeasures and could more immediately help deter domestic terrorist attacks. However, these techniques by themselves cannot completely mitigate the risk of domestic attacks and would not protect U.S. airliners flying to and from foreign airports. Legislation introduced in the 108th Congress (H.R. 580, S. 311) calls for the installation of missile defense systems in all turbojet aircraft used in scheduled air carrier service. The Department of Homeland Security (DHS) appropriations for Fiscal Year 2004 (P.L. 108-90) designated $60 million dollars for development and testing of a prototype missile countermeasure system for commercial aircraft. DHS anticipates a two year program totaling about $ 100 million to develop, test, and certify a suitable system.
DTIC
Commercial Aircraft; Missiles; Protection; Surface to Air Missiles

20050110557 Library of Congress, Washington, DC USA
Homeland Security: Protecting Airliners from Terrorist Missiles
Bolkcom, Christopher; Feickert, Andrew; Elias, Bartholomew; Oct. 2004; 27 pp.; In English
Report No.(s): AD-A430145; No Copyright; Avail: CASI; A03, Hardcopy

Recent events have focused attention on the threat that terrorists with shoulder fired surface-to-air missiles (SAMs), referred to as Man-Portable Air Defense Systems (MANPADS), pose to commercial airliners. Most believe that no single solution exists to effectively mitigate this threat. Instead, a menu of options may be considered, including installing infrared (IR) countermeasures on aircraft; modifying flight operations and air traffic control procedures; improving airport and regional security; and strengthening missile non-proliferation efforts. Equipping aircraft with missile countermeasure systems can protect the aircraft even when operating in areas where ground-based security measures are unavailable or infeasible to implement. However, this option has a relatively high cost, between $ 1 million and $3 million per aircraft, and the time

needed for implementation does not allow for immediate response to the existing terrorist threat. Procedural improvements such as specific flight crew training, altering air traffic procedures to minimize exposure to the threat, and improved security near airports may be less costly than countermeasures and could more immediately help deter domestic terrorist attacks. However, these techniques by themselves cannot completely mitigate the risk of domestic attacks and would not protect U.S. airliners flying to and from foreign airports. legislation introduced in the 108th Congress (H.R. 580, S.311) calls for the installation of missile defense systems in all turbojet aircraft used in scheduled air carrier service. While this legislation is still under consideration, Homeland Security appropriations designated $60 million in FY2004 and $61 million in FY2005 to fund a program to develop and test prototype missile countermeasure systems for commercial aircraft based on existing military technology. It is anticipated that at the conclusion of this program, Jan. 2006, the DHS will be able to provide an analysis of the suitabili7

DTIC

Commercial Aircraft; Missiles; Protection; Surface to Air Missiles

20050111473 General Electric Aircraft Engines, Cincinnati, OH, USA

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle

Balan, C.; Askew, J. W.; January 2005; 74 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS3-25951; WBS 22-714-09-46

Report No.(s): NASA/CR-2005-213321; E-14781; No Copyright; Avail: CASI; A04, Hardcopy

In pursuit of an acoustically acceptable, high performance exhaust system capable of meeting Federal Aviation Regulation 36 Stage 3 noise goals for the High Speed Civil Transport application, General Electric Aircraft Engines conducted a design study to incorporate a fluid shield into a 36-chute suppressor exhaust-nozzle system. After a full scale preliminary mechanical design of the resulting fluid shield exhaust system, scale model aerodynamic performance tests and acoustic tests were conducted to establish both aerodynamic performance and acoustic characteristics. Data are presented as thrust coefficients, discharge coefficients, chute-base pressure drags, and plug static pressure distributions.

Author

Civil Aviation; Exhaust Nozzles; Aerodynamic Characteristics; Aircraft Engines; Mechanical Engineering; Shielding; Fluid Flow; Static Pressure

20050111479 United Technologies Research Center, East Hartford, CT, USA

Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors

Tacina, Robert R., Technical Monitor; Cohen, J. M.; Padget, F. C.; Kwoka, D.; Wang, Q.; Lohmann, R. P.; February 2005; 132 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS3-26618; WBS 22-714-09-46

Report No.(s): NASA/CR-2005-213328; E-14788; HSR062; No Copyright; Avail: CASI; A07, Hardcopy

The objective of the task reported herein was to define, evaluate, and optimize variable geometry concepts suitable for use with a Rich-Quench-Lean (RQL) combustor. The specific intent was to identify approaches that would satisfy High Speed Civil Transport (HSCT) cycle operational requirements with regard to fuel-air ratio turndown capability, ignition, and stability margin without compromising the stringent emissions, performance, and reliability goals that this combustor would have to achieve. Four potential configurations were identified and three of these were refined and tested in a high-pressure modular RQL combustor rig. The tools used in the evolution of these concepts included models built with rapid fabrication techniques that were tested for airflow characteristics to confirm sizing and airflow management capability, spray patternation, and atomization characterization tests of these models and studies that were supported by Computational Fluid Dynamics analyses. Combustion tests were performed with each of the concepts at supersonic cruise conditions and at other critical conditions in the flight envelope, including the transition points of the variable geometry system, to identify performance, emissions, and operability impacts. Based upon the cold flow characterization, emissions results, acoustic behavior observed during the tests and consideration of mechanical, reliability, and implementation issues, the tri-swirler configuration was selected as the best variable geometry concept for incorporation in the RQL combustor evolution efforts for the HSCT.

Author

Civil Aviation; Combustion Chambers; Computational Fluid Dynamics; Engine Design; Fabrication

20050111501 NASA Glenn Research Center, Cleveland, OH, USA

Analyses of Elemental Partitioning in Advanced Nickel-Base Superalloy Single Crystals

Dreshfield, Robert L.; Thomas, Kimberly J.; January 2005; 24 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22-714-09-46

Report No.(s): NASA/TM-2005-213288; E-14735; No Copyright; Avail: CASI; A03, Hardcopy

Aircraft propulsion engines for the High Speed Civil Transport which may be developed early in the 21st century will require significantly different durability requirements than those which currently power civil aircraft. The durability will be more difficult to achieve because it is expected that the new aircraft engines will have to operate at near maximum power for more than half of each flight compared to 5 to 10 percent for typical current aircraft. To meet this requirement, a team of NASA, Pratt & Whitney Aircraft, and General Electric personnel have been formed to develop an appropriate alloy for the mission. This report summarizes the work performed by a part of that team up to the retirement of one of its members, R.L. Dreshfield. The prime purpose of the report is to assemble the data obtained in a single document so that it may be more accessible to those who may wish to pursue it at a later date.
Author
Civil Aviation; Heat Resistant Alloys; Nickel Alloys; Single Crystals; Chemical Analysis; Aircraft Engines

20050111580 NASA Dryden Flight Research Center, Edwards, CA, USA
Twist Model Development and Results From the Active Aeroelastic Wing F/A-18 Aircraft
Lizotte, Andrew; Allen, Michael J.; March 10, 2005; 34 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WU 710-61-14-SE-14
Report No.(s): NASA/TM-2005-212861; H-2579; No Copyright; Avail: CASI; A03, Hardcopy

Understanding the wing twist of the active aeroelastic wing F/A-18 aircraft is a fundamental research objective for the program and offers numerous benefits. In order to clearly understand the wing flexibility characteristics, a model was created to predict real-time wing twist. A reliable twist model allows the prediction of twist for flight simulation, provides insight into aircraft performance uncertainties, and assists with computational fluid dynamic and aeroelastic issues. The left wing of the aircraft was heavily instrumented during the first phase of the active aeroelastic wing program allowing deflection data collection. Traditional data processing steps were taken to reduce flight data, and twist predictions were made using linear regression techniques. The model predictions determined a consistent linear relationship between the measured twist and aircraft parameters, such as surface positions and aircraft state variables. Error in the original model was reduced in some cases by using a dynamic pressure-based assumption and by using neural networks. These techniques produced excellent predictions for flight between the standard test points and accounted for nonlinearities in the data. This report discusses data processing techniques and twist prediction validation, and provides illustrative and quantitative results.
Author
Aeroelasticity; Wings; Flexibility; Flight Simulation; Real Time Operation; Dynamic Pressure

20050111584 General Accounting Office, Washington, DC
Contract Management: The Air Force Should Improve How It Purchases AWACS Spare Parts
Feb. 2005; 32 pp.; In English
Report No.(s): PB2005-103212; GAO-05-169; No Copyright; Avail: CASI; A03, Hardcopy

Over the past several years, the Air Force has negotiated and awarded more than $23 million in contracts to the Boeing Corporation for the purchase of certain spare parts for its Airborne Warning and Control System (AWACS) aircraft. Since they first became operational in March 1977, AWACS aircraft have provided U.S. and allied defense forces with the ability to detect, identify, and track airborne threats. In March 2003, GAO received allegations that the Air Force was overpaying Boeing for AWACS spare parts. This report provides the findings of GAOs review into these allegations. Specifically, GAO identified spare parts price increases and determined whether the Air Force obtained and evaluated sufficient information to ensure the prices were fair and reasonable. GAO also determined the extent to which competition was used to purchase the spare parts. GAO recommends that the Secretary of Defense direct the Secretary of the Air Force to take action to ensure that contracting officers obtain and evaluate data needed to determine spare parts prices are fair and reasonable, develop a strategy to promote competition to the maximum extent possible in future spare parts purchases, and clarify the Air Forces access to AWACS technical data and drawings. DOD concurred with GAOs recommendations.
NTIS
Boeing Aircraft; Awacs Aircraft; Contract Management

20050123590 Pratt and Whitney Aircraft, West Palm Beach, FL, USA
Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport
Champagne, G. A.; Ward, E. J.; January 2005; 81 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS3-25954; NAS3-26618; WBS 22-714-09-46
Report No.(s): NASA/CR-2005-213135; E-14649; No Copyright; Avail: CASI; A05, Hardcopy

A study to examine Supersonic Through-Flow Fan engines that operate at a maximum Mach number 2.4. The engines incorporate a NASA Glenn air-start fan concept and component, material, and structural technologies which are projected to be available in the year 2000. The scope of this study included: studies by NASA Glenn to define the engine cycle and STFF design characteristics; flowpath analyses to determine component arrangement, dimensions, performance, and rotor speeds; mechanical conceptual design of all engine components; weight analysis of the entire engine; and engine performance analysis.
Author
Supersonic Speed; Gas Turbine Engines; Engine Design; Supersonic Flow; Mechanical Engineering; Mach Number; Fan Blades

20050123600 NASA Langley Research Center, Hampton, VA, USA
Shape Sensing a Morphed Wing with an Optical Fiber Bragg Grating
Tai, Hsiang; [2005]; 11 pp.; In English; SPIE International Symposia on Smart Structures and Materials, 6-10 Mar. 2005, San Diego, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

We suggest using distributed fiber Bragg sensors systems which were developed locally at Langley Research Center carefully placed on the wing surface to collect strain component information at each location. Then we used the fact that the rate change of slope in the definition of linear strain is very small and can be treated as a constant. Thereby the strain distribution information of a morphed surface can be reduced into a distribution of local slope information of a flat surface. In other words a morphed curve surface is replaced by the collection of individual flat surface of different slope. By assembling the height of individual flat surface, the morphed curved surface can be approximated. A more sophisticated graphic routine can be utilized to restore the curved morphed surface. With this information, the morphed wing can be further adjusted and controlled. A numerical demonstration is presented.
Author
Bragg Gratings; Optical Fibers; Shapes; Wings; Detection; Mathematical Models

20050123609 Pratt and Whitney Aircraft, West Palm Beach, FL, USA
Applications of Endothermic Reaction Technology to HSCT and AST
Glickstein, Marvin R.; Bengtson, Robert J.; Spadaccini, Louis J.; January 2005; 31 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS3-27397; WBS 22-714-09-46
Report No.(s): NASA/CR-2005-213133; UTRC-R97-5.101.0037-5/19; E-14644; No Copyright; Avail: CASI; A03, Hardcopy

The success of strategies for controlling emissions and enhancing performance in High Speed Research and Advanced Subsonic Technology applications may be increased by more effective utilization of the heat sink afforded by the fuel in the vehicle thermal management system. This study quantifies the potential benefits associated with the use of supercritical preheating and endothermic cracking of jet fuel prior to combustion to enhance the thermal management capabilities of the propulsion systems in the High Speed Civil Transport (HSCT) and the Advanced Subsonic Transport (AST). A fuel-cooled thermal management system, consisting of plate-fin heat exchangers and a small auxiliary compressor, is defined for the HSCT, integrated with the engine, and an assessment of the effect on engine performance, weight, and operating cost is performed. Critical requirements for system development are identified, and an approach for validating the concept is described.
Author
Civil Aviation; Endothermic Reactions; Subsonic Speed; Technology Utilization; Supersonic Transports; High Speed

07
AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power; 28 Propellants and Fuels*; and *44 Energy Production and Conversion*.

20050111467 NASA Glenn Research Center, Cleveland, OH, USA
A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow
Holdeman, J. D.; Smith, T. D.; Clisset, J. R.; Lear, W. E.; February 2005; 91 pp.; In English
Contract(s)/Grant(s): WBS 22-714-20-05
Report No.(s): NASA/TM-2005-213137; E-14651; No Copyright; Avail: CASI; A05, Hardcopy

An interactive computer code, written with a readily available software program, Microsoft Excel (Microsoft Corporation, Redmond, WA) is presented which displays 3 D oblique plots of a conserved scalar distribution downstream of jets mixing with a confined crossflow, for a single row, double rows, or opposed rows of jets with or without flow area convergence and/or a non-uniform crossflow scalar distribution. This project used a previously developed empirical model of jets mixing in a confined crossflow to create an Microsoft Excel spreadsheet that can output the profiles of a conserved scalar for jets injected into a confined crossflow given several input variables. The program uses multiple spreadsheets in a single Microsoft Excel notebook to carry out the modeling. The first sheet contains the main program, controls for the type of problem to be solved, and convergence criteria. The first sheet also provides for input of the specific geometry and flow conditions. The second sheet presents the results calculated with this routine to show the effects on the mixing of varying flow and geometric parameters. Comparisons are also made between results from the version of the empirical correlations implemented in the spreadsheet and the versions originally written in Applesoft BASIC (Apple Computer, Cupertino, CA) in the 1980's.
Author
Cross Flow; Spreadsheets; Mathematical Models; Gas Turbines; Jet Mixing Flow

20050123580 NASA Glenn Research Center, Cleveland, OH, USA
A Comparative Propulsion System Analysis for the High-Speed Civil Transport
Berton, Jeffrey J.; Haller, William J.; Senick, Paul F.; Jones, Scott M.; Seidel, Jonathan A.; February 2005; 106 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS3-26617; NAS3-6618; NAS3-25965; NAS3-25963; WBS 22-714-09-46
Report No.(s): NASA/TM-2005-213414; E-14934; HSR007; No Copyright; Avail: CASI; A06, Hardcopy

Six of the candidate propulsion systems for the High-Speed Civil Transport are the turbojet, turbine bypass engine, mixed flow turbofan, variable cycle engine, Flade engine, and the inverting flow valve engine. A comparison of these propulsion systems by NASA's Glenn Research Center, paralleling studies within the aircraft industry, is presented. This report describes the Glenn Aeropropulsion Analysis Office's contribution to the High-Speed Research Program's 1993 and 1994 propulsion system selections. A parametric investigation of each propulsion cycle's primary design variables is analytically performed. Performance, weight, and geometric data are calculated for each engine. The resulting engines are then evaluated on two airframer-derived supersonic commercial aircraft for a 5000 nautical mile, Mach 2.4 cruise design mission. The effects of takeoff noise, cruise emissions, and cycle design rules are examined.
Author
Propulsion System Configurations; Supersonic Aircraft; Turbine Engines; Aircraft Engines; Multiphase Flow; Turbojet Engines; Variable Cycle Engines

20050123670 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Quiet Plan for Tomorrow's Jet Engines
Wilson, J. R.; Aerospace America; February 2005; ISSN 0740-722X, pp. 38-42; In English; Original contains color illustrations; Copyright; Avail: Other Sources

As bankruptcies. reorganizations, and cutbacks continue to plague global airlines, the market for new large jet liners and their specialized powerplants has tightened significantly for the world's three commercial jet engine makers. With Boeing selecting General Electric's GENX (GE Next Generation) and Rolls-Royce's Trent 1000 for its new 7E7 Dreamliner, and Airbus opting for Trent and the Engine Alliance GP7000 (a single-product joint venture by GE and Pratt & Whitney), P&W has been left without a direct customer for a new big engine. (In December, Airbus announced the start-up of the A350 to compete with the 7E7, and specified the same engines as the Boeing craft.) And while P&W declined an interview with Aerospace America, both GE and Rolls-Royce agree there is little likelihood of another new aircraft in that size range before 2025, at the earliest. Such a lengthy gap will impact new engine development at all three companies.
Author
Jet Engines; Commercial Aircraft; Engine Design; Product Development

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

20050110225 NASA Langley Research Center, Hampton, VA, USA
Robust Control Design for Systems With Probabilistic Uncertainty
Crespo, Luis G.; Kenny, Sean P.; March 2005; 53 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS1-97046; WU 23-090-50-70
Report No.(s): NASA/TP-2005-213531; L-19084; No Copyright; Avail: CASI; A04, Hardcopy

This paper presents a reliability- and robustness-based formulation for robust control synthesis for systems with probabilistic uncertainty. In a reliability-based formulation, the probability of violating design requirements prescribed by inequality constraints is minimized. In a robustness-based formulation, a metric which measures the tendency of a random variable/process to cluster close to a target scalar/function is minimized. A multi-objective optimization procedure, which combines stability and performance requirements in time and frequency domains, is used to search for robustly optimal compensators. Some of the fundamental differences between the proposed strategy and conventional robust control methods are: (i) unnecessary conservatism is eliminated since there is not need for convex supports, (ii) the most likely plants are favored during synthesis allowing for probabilistic robust optimality, (iii) the tradeoff between robust stability and robust performance can be explored numerically, (iv) the uncertainty set is closely related to parameters with clear physical meaning, and (v) compensators with improved robust characteristics for a given control structure can be synthesized.
Author
Robustness (Mathematics); Controllers; Probability Theory; Control Systems Design; Random Variables; Scalars

20050111523 NASA Marshall Space Flight Center, Huntsville, AL, USA, Boeing Co., Huntington Beach, CA, USA
Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test
Chung, Y. T.; Fowler, Samuel B.; Lo, Wenso; Towner, Robert; [2005]; 10 pp.; In English; 23rd International Modal Analysis Conference, 31 Jan. -3 Feb. 2005, Orlando, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-02070; Copyright; Avail: CASI; A02, Hardcopy

Transmissibility analyses and tests were conducted on a composite panel with thermal protection system foams to evaluate the quality of the measured frequency response functions. Both the analysis and the test results indicate that the vehicle dynamic responses are fully transmitted to the accelerometers mounted on the thermal protection system in the normal direction below a certain frequency. In addition, the in-plane motions of the accelerometer mounted on the top surface of the thermal protection system behave more actively than those on the composite panel due to the geometric offset of the accelerometer from the panel in the test set-up. The transmissibility tests and analyses show that the frequency response functions measured from the accelerometers mounted on the TPS will provide accurate vehicle responses below 120 Hz for frequency and mode shape identification. By confirming that accurate dynamic responses below a given frequency can be obtained, this study increases the confidence needed for conducting the modal testing, model correlation, and model updating for a vehicle installed with TPS. ‘
Author
Vibration Tests; Thermal Protection; Tiles; Ground Tests; Frequency Response; Composite Structures; Dynamic Response

12
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20050109876 NASA Marshall Space Flight Center, Huntsville, AL, USA
Are we There Yet? ... Developing In-Situ Fabrication and Repair (ISFR) Technologies to Explore and Live on the Moon and Mars
Bassler, Julie A.; Bodiford, Melanie P.; Fiske, Michael R.; Strong, Janet D., et al.; [2005]; 1 pp.; In English; AIAA Conference, 30 Jan. - 2 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA's human exploration initiative poses great opportunity and great risk for manned missions to the Moon and Mars. Engineers and Scientists at the Marshall Space Flight Center are evaluating current technologies for in situ exploration habitat and fabrication and repair applications. Several technologies to be addressed in this paper have technology readiness levels (TRLs) that are currently mature enough to pursue for exploration purposes. However, many technologies offer promising applications but these must be pulled along by the demands and applications of this great initiative. The In Situ Fabrication and Repair (ISFR) program will supply and push state of the art technologies for applications such as habitat structure development, in situ resource utilization for tool and part fabrication, and repair and replacement of common life support elements. This paper will look at the current and future habitat technology applications such as the implementation of in situ environmental elements such as caves, rilles and lavatubes, the development of lunar regolith concrete and structure design and development, thin film and inflatable technologies. We will address current rapid prototyping technologies, their ISFR applications and near term advancements. We will discuss the anticipated need to utilize in situ resources to produce replacement parts and fabricate repairs to vehicles, habitats, life support and quality of life elements. All ISFR technology developments will incorporate automated deployment and robotic construction and fabrication techniques. The current state of the art for these applications is fascinating, but the future is out of this world.
Author
In Situ Resource Utilization; Space Maintenance; Space Colonies

20050109881 NASA Marshall Space Flight Center, Huntsville, AL, USA
In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC
Bodiford, Melanie P.; Burks, Kevin H.; Fiske, Michael R.; Strong, Janet D.; McGregor, Walter; [2005]; 1 pp.; In English; AIAA Conference, 30 Jan. - 2 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

As the nation prepares to return to the Moon and subsequently to Mars, it is apparent that the viability of long duration visits with appropriate radiation shielding/crew protection, hinges on the development of habitat structures, preferably in advance of a manned landing, and preferably utilizing in-situ resources. A relatively large number of habitat structure configurations can be developed from a relatively small set of in-situ resource-based construction products, including, blocks, raw regolith, reinforced concrete, and glass products. A much larger group of habitat designs can be developed when 'imported' material are brought from Earth, including thin films and liners, and foldable, or expandable metal structures. These, and other technologies have been identified, and subjected to a rigorous trade study evaluation with respect to exploration and other performance criteria. In this paper, results of this trade study will be presented, as well as various habitat structure design concepts and concepts for construction automation. Results of initial tests aimed at concrete, block and glass production using Lunar regolith simulants will also be presented. Key issues and concerns will be discussed, as well as design concepts for a Lunar environment testbed to be developed at MSFC's Microgravity Development Laboratory (MDL).
Author
In Situ Resource Utilization; Space Habitats; Construction Materials; Lunar Bases; Mars Bases

20050110135 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Strategic Roadmap to Centauri
Johnson, Les; Harris, David; Trausch, Ann; Matloff, Gregory L.; Taylor, Travis; Cutting, Kathleen; January 2005; 41 pp.; In English
Contract(s)/Grant(s): SAIC-440055739; Copyright; Avail: CASI; A03, Hardcopy

This paper discusses the connectivity between in-space propulsion and in-space fabrication/repair and is based upon a workshop presentation by Les Johnson, manager of the In-Space Propulsion (ISP) Technology Project at NASA's Marshall Space Flight Center (MSFC) in Huntsville, Ala.. Technologies under study by ISP include aerocapture, advanced solar-electric propulsion, solar-thermal propulsion, advanced chemical propulsion, tethers and solar-photon sails. These propulsion systems are all approaching technology readiness levels (TRLs) at which they can be considered for application in space-science and exploration missions. Historically, human frontiers have expanded as people have learned to live off the land in new environments and to exploit local resorces. With this expansion, frontier settlements have required development of transportation improvements to carry tools and manufactured products to and from the frontier. It is demonstrated how ISP technologies will assist in the development of the solar-system frontier. In-space fabrication and repair will both require and assist the development of ISP propulsion systems, whether humans choose to settle planetary surfaces or to exploit resources of small Solar System bodies. As was true for successful terrestrial pioneers, in-space settlement and exploitation will require sophisticated surveys of inner and outer Solar System objects. ISP technologies will contribute to the success of these surveys, as well as to the efforts to retrieve Solar System resources. In a similar fashion, the utility of ISP products will be greatly enhanced by the technologies of in-space repair and fabrication. As in-space propulsion, fabrication and repair develop, human

civilization may expand well beyond the Earth. In the future, small human communities (preceded by robotic explorers) may utilize these techniques to set sail for the nearest stars.
Author
Technology Assessment; Spacecraft Propulsion; Space Maintenance; Interstellar Travel

20050110350 Naval Postgraduate School, Monterey, CA USA
Nuclear Power Systems for Manned Mission to Mars
McGinnis, Scott J.; Dec. 2004; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429836; No Copyright; Avail: Defense Technical Information Center (DTIC)

Nuclear power is the next enabling technology in manned exploration of the solar system. Scientists and engineers continue to design multi-megawatt power systems, yet no power system in the 100 kilowatt, electric range has been built and flown. Technology demonstrations and studies leave a myriad of systems from which decision makers can choose to build the first manned space nuclear power system. While many subsystem engineers plan in parallel, an accurate specific mass value becomes an important design specification, which is still uncertain. This thesis goes through the design features of the manned Mars mission, its power system requirements, their design attributes as well as their design faults. Specific mass is calculated statistically as well as empirically for 1-15MWe systems. Conclusions are presented on each subsystem as well as recommendations for decision makers on where development needs to begin today in order for the mission to launch in the future.
DTIC
Manned Mars Missions; Mars Missions; Nuclear Electric Propulsion; Space Missions

20050110383 Air Force Research Lab., Wright-Patterson AFB, OH USA
Development of Improved Thermal Control Coatings for Space Assets
Johnson, Joel A.; Haines, Amber I.; Bedrossian, Laura A.; Kenny, Michael T.; Nov. 2004; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-M06R
Report No.(s): AD-A429892; AFRL-ML-WP-TP-2004-411; No Copyright; Avail: Defense Technical Information Center (DTIC)

Thermal control coatings play a critical role in the thermal management of space assets through reflection of incident solar energy and emittance of infrared heat. An investigation into the potential minimization of required film thickness through optimization of zinc oxide pigment particle size was performed. The utilization of a 1.5-micron average particle size pigment in the coating formulation resulted in a slightly improved solar absorbance/emittance value of 0.132 in comparison with the currently used 5.0 micron average particle size pigment. Furthermore, this improved value was obtained at a dry film thickness 18% thinner (4.9 mils) than the current state of the art, which translates to weight savings without a sacrifice in thermal management properties. Use of the smaller particle size pigment also resulted in an improvement in the measured emittance (0.94), likely due to a more uniform surface roughness and fewer large pores present in the film.
DTIC
Aerospace Environments; Temperature Control; Thermal Control Coatings; Zinc Oxides

20050111563 General Accounting Office, Washington, DC
Technology Development: New DOD Space Science and Technology Strategy Provides Basis for Optimizing Investments, but Future Versions Need to Be More Robust
Jan. 2005; 40 pp.; In English
Report No.(s): PB2005-103153; GAO-05-155; No Copyright; Avail: CASI; A03, Hardcopy

The Department of Defense (DOD) is depending heavily on new space based technologies to support and transform future military operations. Yet there are concerns that efforts to develop technologies for space systems are not tied to strategic goals for space and are not well planned or coordinated. In the National Defense Authorization Act for 2004, the Congress required DOD to develop a space science and technology (S&T) strategy that sets out goals and a process for achieving those goals. The Congress also required GAO to assess this strategy as well as the required coordination process.
NTIS
Military Operations; Defense Program; Technologies; Aerospace Sciences

20050111572 Eagle Engineering, Inc., Houston, TX, USA

A Review of Man-Rating in Past and Current Manned Space Flight Programs

Bond, Aleck C.; May 20, 1988; 42 pp.; In English

Contract(s)/Grant(s): NAS1-17900; TO-87-23

Report No.(s): EEI-88-193; Copyright; Avail: CASI; A03, Hardcopy

The idea of man-rating a hardware system for safe use by humans is not limited to a normal consequence of the designer's and developer's intuitive approach for making a system accommodate the human and at the same time making it safe for man's usage. There are many examples, such as the automobile industry, the heavy equipment industry, the building industry, etc., where some form of man-rating is applied and which is associated with the safety, reliability and quality requirements for those hardware systems. This is especially so for the aircraft industry which as a result of its growth and development has emphasized and pursued the need for high levels of safety and reliability. Many of these design criteria and practices have been adopted and further expanded. The need for the development and application of man-rating criteria, requirements and the relatively low success ratios and reliability data for the tactical missiles (Redstone, Atlas, and Titan II), which were to be used as launch vehicles, were examined. Since cost is a major factor in the achievement of reliability, the military requirements were balanced to provide moderate reliability for reasonable cost. This, of course, was not acceptable for manned space flight and thus aggressive and definitive man-rating programs had to be undertaken to provide the desired safety and reliability of the launch vehicles and spacecraft. The subject of man-rating has a wide range of connotations to engineers and technical personnel involved in the design and development of systems and subsystems for spacecraft and launch vehicles. To some it means the total system design and development process involved in producing flight hardware, to others it is regard only to certain aspects of the process such as safety and quality. In view of this confusion concerning the context of man-rating it is the purpose of this paper to clarify the ramifications and implications of the subject area though a survey of the concepts which were developed and applied on the past and current manned space flight programs, including design philosophies, design criteria and general design practices.

Author (revised)

Manned Space Flight; Launch Vehicles; Design Analysis; Aerospace Safety; Ratings

20050111578 NASA Marshall Space Flight Center, Huntsville, AL, USA, Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development

Khoshnevis, Behrokh; Bodiford, Melanie P.; Burks, Kevin H.; Ethridge, Ed; Tucker, Dennis; Kim, Won; Toutanji, Houssam; Fiske, Michael R.; December 14, 2005; 13 pp.; In English; AIAA 43rd Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS8-00187; NSF 95-22982; NSF 96-15690; NSF 02-30398

Report No.(s): AIAA Paper 2005-2424; Copyright; Avail: CASI; A03, Hardcopy

As the nation prepares to return to the Moon, it is apparent that the viability of long duration visits with appropriate radiation shielding/crew protection, hinges on the development of Lunar structures, preferably in advance of a manned landing, and preferably utilizing in-situ resources. Contour Crafting is a USC-patented technique for automated development of terrestrial concrete-based structures. The process is relatively fast, completely automated, and supports the incorporation of various infrastructure elements such as plumbing and electrical wiring. This paper will present a conceptual design of a Lunar Contour Crafting system designed to autonomously fabricate integrated structures on the Lunar surface using high-strength concrete based on Lunar regolith, including glass reinforcement rods or fibers fabricated from melted regolith. Design concepts will be presented, as well as results of initial tests aimed at concrete and glass production using Lunar regolith simulant. Key issues and concerns will be presented, along with design concepts for an LCC testbed to be developed at MSFC's Prototype Development Laboratory (PDL).

Author

Regolith; Concrete Structures; Lunar Bases; In Situ Resource Utilization; Lunar Resources; Lunar Soil; Automatic Control

20050123635 George Washington Univ., Washington, DC, USA

A Program of Research and Education in Astronautics

Tolson, Robert; [2005]; 8 pp.; In English

Contract(s)/Grant(s): NCC1-331; No Copyright; Avail: CASI; A02, Hardcopy

This final report lists the seminars, publications and presentations produced under the grant, as well as the participants, including Graduate Research Scholar Assistants.

Author

University Program; Aerospace Engineering; Bibliographies

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

20050092372 NASA Marshall Space Flight Center, Huntsville, AL, USA, United Space Alliance, USA
STS Derived Exploration Launch Operations
Best, Joel; Sorge, L.; Siders, J.; Sias, Dave; September 24, 2004; 1 pp.; In English; AIAA 1st Space Explorations Conference, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA
Contract(s)/Grant(s): NAS9-20000; Copyright; Avail: Other Sources; Abstract Only

A key aspect of the new space exploration programs will be the approach to optimize launch operations. A STS Derived Launch Vehicle (SDLV) Program can provide a cost effective, low risk, and logical step to launch all of the elements of the exploration program. Many benefits can be gained by utilizing the synergy of a common launch site as an exploration spaceport as well as evolving the resources of the current Space Shuttle Program (SSP) to meet the challenges of the Vision for Space Exploration. In particular, the launch operation resources of the SSP can be transitioned to the exploration program and combined with the operations efficiencies of unmanned EELVs to obtain the best of both worlds, resulting in lean launch operations for crew and cargo missions of the exploration program. The SDLV Program would then not only capture the extensive human space flight launch operations knowledge, but also provide for the safe fly-out of the SSP through continuity of system critical skills, manufacturing infrastructure, and ability to maintain and attract critical skill personnel. Thus, a SDLV Program can smoothly transition resources from the SSP and meet the transportation needs to continue the voyage of discovery of the space exploration program.
Author
Shuttle Derived Vehicles; Spacecraft Launching; Preflight Operations

20050092397 NASA Marshall Space Flight Center, Huntsville, AL, USA
Shuttle-Derived Launch Vehicles' Capablities: An Overview
Rothschild, William J.; Bailey, Debra A.; Henderson, Edward M.; Crumbly, Chris; [2005]; 12 pp.; In English; Space Exploration Conference, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Shuttle-Derived Launch Vehicle (SDLV) concepts have been developed by a collaborative team comprising the Johnson Space Center, Marshall Space Flight Center, Kennedy Space Center, ATK-Thiokol, Lockheed Martin Space Systems Company, The Boeing Company, and United Space Alliance. The purpose of this study was to provide timely information on a full spectrum of low-risk, cost-effective options for STS-Derived Launch Vehicle concepts to support the definition of crew and cargo launch requirements for the Space Exploration Vision. Since the SDLV options use high-reliability hardware, existing facilities, and proven processes, they can provide relatively low-risk capabilities to launch extremely large payloads to low Earth orbit. This capability to reliably lift very large, high-dollar-value payloads could reduce mission operational risks by minimizing the number of complex on-orbit operations compared to architectures based on multiple smaller launchers. The SDLV options also offer several logical spiral development paths for larger exploration payloads. All of these development paths make practical and cost-effective use of existing Space Shuttle Program (SSP) hardware, infrastructure, and launch and flight operations systems. By utilizing these existing assets, the SDLV project could support the safe and orderly transition of the current SSP through the planned end of life in 2010. The SDLV concept definition work during 2004 focused on three main configuration alternatives: a side-mount heavy lifter (approximately 77 MT payload), an in-line medium lifter (approximately 22 MT Crew Exploration Vehicle payload), and an in-line heavy lifter (greater than 100 MT payload). This paper provides an overview of the configuration, performance capabilities, reliability estimates, concept of operations, and development plans for each of the various SDLV alternatives. While development, production, and operations costs have been estimated for each of the SDLV configuration alternatives, these proprietary data have not been included in this paper.
Author
Launch Vehicles; Shuttle Derived Vehicles; General Overviews; Space Transportation System; NASA Space Programs

20050110336 Naval Research Lab., Monterey, CA USA

The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS)

Baker, Nancy L.; Hogan, T. F.; Campbell, W. F.; Pauley, R. L.; Swadley, S. D.; Feb. 2005; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-PN-X-2342

Report No.(s): AD-A429811; NRL/MR/7530-05-8836; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Navy Operational Global Atmospheric Prediction System (NOGAPS) is the U.S. Department of Defense's high-resolution global weather prediction system, which is used for operational mesoscale and oceanographic models and numerical weather prediction (NWP) research. The analysis for NOGAPS is produced by the NRL Atmospheric Variational Data Assimilation System (NAVDAS). On June 9, 2004, NAVDAS began operational assimilation of ASMU-A radiances from the Advanced TIROS Operational Vertical Sounder (ATOVS) sensor suite onboard NOAA 15 and 16 for NOGAPS. The direct assimilation of AMSU-A radiances replaced the assimilation of ATOVS temperature retrievals produced by NOAA's National Environmental Satellite, Data and Information Service (NESDIS). The results of medium-range forecast tests of radiance assimilation versus NESDIS ATOVS retrieval assimilation show substantial improvement in the forecasts of height, wind, and temperature in both the Northern and Southern Hemispheres. In the tropics, the tropical cyclone track errors are smaller with radiance assimilation, even though the upper- and lower-level errors are essentially the same. Overall, there are fewer forecast 'busts' with radiance assimilation, especially in the Southern Hemisphere.

DTIC

Assimilation; Atmospheric Models; Data Acquisition; Forecasting; Meteorological Satellites; Multisensor Fusion; Prediction Analysis Techniques; Radiance; Satellite Observation

20050110342 Naval Postgraduate School, Monterey, CA USA

Hypervelocity Impact Analysis of International Space Station Whipple and Enhanced Stuffed Whipple Shields

Kalinski, Michael E.; Dec. 2004; 299 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429821; No Copyright; Avail: Defense Technical Information Center (DTIC)

The International Space Station (ISS) must be able to withstand the hypervelocity impacts of micrometeoroids and orbital debris that strike its many surfaces. In order to design and implement shielding which will prevent hull penetration or other operational losses, NASA must first model the orbital debris and micrometeoroid environment. Based upon this environment, special multi-stage shields called Whipple and Enhanced Stuffed Whipple Shields are developed and implemented to protect the ISS surfaces. Ballistic limit curves that establish shield failure criteria are determined via ground testing. These curves are functions of material strength, shield spacing, projectile size, shape and density, as well as a number of other variables. The combination of debris models and ballistic limit equations allows NASA to model risk to the ISS using a hydrocode called BUMPER. This thesis modifies and refines existing ballistic limit equations for U.S. Laboratory Module shields to account for the effects of the projectile (debris/ micro-meteoroid) densities. Using these refined ballistic limit equations this thesis also examines alternative shielding materials and configurations to optimize shield design for minimum mass and maximum stopping potential, proposing alternate shield designs for future NASA ground testing. A final goal of this thesis is to provide the Department of Defense a background in satellite shield theory and design in order to improve protection against micrometeoroid and orbital debris impacts on future space-based national systems.

DTIC

Hypervelocity Impact; International Space Station; Space Stations

20050110348 Naval Postgraduate School, Monterey, CA USA

Aerosol Optical Depth Model Assessment With High Resolution Multiple Angle Sensors

Martin, Joseph S.; Dec. 2004; 53 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429833; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis assesses the performance of the Naval Postgraduate School Aerosol Optical Depth (NPS AOD) model utilizing very high spatial resolution QuickBird (QB) satellite data. QuickBird derived AOD results are compared to other satellite and ground based AOD results, specifically, AErosol RObotic NETwork (AERONET), MODerate resolution Imaging Spectroradiometer (MODIS), Multi-angle Imaging SpectroRadiometer (MISR), and Advanced Very High Resolution Radiometer (AVHRR). Data is collected around Sir Bu Nuair Island, United Arab Emirates in September 2004 as part of the UAE2 Campaign. Satellite measured radiances are calibrated and due to spatial resolution differences between sensors, modal radiances are calculated for areas matching the highest resolution sensor. The AOD model is based on AVHRR wavelengths; hence, the modal satellite measured radiances are linearly extrapolated to the effective wavelengths of AVHRR. Results show

application of the NPS AOD model to QuickBird data yields findings that are consistent with other satellite and ground based retrievals. In general, the NPS AOD model works well for nadir and near-nadir view angles, but not for high zenith angles. DTIC

Aerosols; Artificial Satellites; Atmospheric Models; High Resolution; Optical Properties; Optical Thickness; Spectroradiometers

20050110378 Naval Postgraduate School, Monterey, CA USA

Development Of A Control Moment Gyroscope Controlled, Three Axis Satellite Simulator, With Active Balancing For The Bifocal Relay Mirror Initiative

Kulick, Wayne J.; Dec. 2004; 125 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429886; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis develops and implements a Control Moment Gyroscope (CMG) steering law, controller and active balancing system for a three-axis satellite simulator (TASS). The CMGs are configured in a typical pyramid configuration (the fourth CMG position being null). The development was done primarily with simulation and experiments utilizing Real Time Workshop and XPC Target of MATLAB and SIMULINK. The TASS is a double circular platform mounted on a spherical air bearing with the center of rotation (CR) about the approximate physical geometric center of the simulator. The TASS utilizes three moveable masses in the three body axes for balancing which actively eliminate any center of gravity (CG) offset and return the CG to the CR. The TASS supports an optics payload designed to acquire, track and point a received laser beam onto an off-satellite target. The target may be stationary or moving. Actively balancing the TASS reduces the torque output requirement for the CMGs while maintaining either a stabilized level platform or a particular commanded attitude. Reduction or elimination of torque output from the CMGs results in a more stabilized platform, less structural induced vibration, less jitter in payload optics and less power required in spacecraft applications. DTIC

Artificial Satellites; Balancing; Control Moment Gyroscopes; Gyroscopes; Mirrors; Simulators

20050110450 Colorado Univ., Boulder, CO USA

Student Hands-On Training (SHOT) Workshop Summer 2003 and 2004

Koehler, Chris; Sep. 2004; 4 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0344

Report No.(s): AD-A429995; 1537115; AFRL-SR-AR-TR-05-0044; No Copyright; Avail: CASI; A01, Hardcopy

The Student Hands-On Training (SHOT) I & II workshops will provide students beginning the AFRL's University Nanosat 3 program with basic space hardware hands-on and in-flight training. The objective of SHOT I & II workshops are to provide these new students exposure to some of the basics of spacecraft construction, the teamwork and coordination involved, as well as the challenges with integration, test and launch of a satellite. Each workshop was completed in three days. Participants traveled to Boulder, Colorado, to receive their hands-on training. Day three was devoted to launch, recovery, and data analysis of their BalloonSat or experiment. During the SHOT I workshop student teams constructed a simple 500 gram satellite called a BalloonSat and launched it to 30 km. The SHOT I workshop training was geared for the novice experimenter but provided a complete program from requirements, design, build, test, launch and analysis. During the SHOT II workshop students brought their own BalloonSats which contained experiments and prototypes that will support their team's University Nanosat 3 mission. DTIC

Aerospace Systems; Education; Students; Summer

20050110488 Surrey Univ., Guildford, UK

The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center

Oelrich, Brian; Underwood, Craig; Mackin, Stephen; Feb. 2005; 5 pp.; In English

Report No.(s): AD-A430042; AFIT-CI04-954; No Copyright; Avail: CASI; A01, Hardcopy

In 2004, the four-micro-satellite Disaster Monitoring Constellation (DMC) became operational. While the constellation currently utilizes visible and near-infrared (IR) imagers, a candidate instrument for future DMC satellites is one operating in the thermal-infrared (TIR). In this research program, a prototype TIR imaging radiometer compatible with the DMC imaging suite was engineered. The 2.5 kg prototype instrument uses a 2-dimensional, commercial-off-the-shelf (COTS) uncooled micro-bolometer array to collect data in any of several mid-wave and long-wave IR bands (3-5, 8-10, 10-12, and 8-14 micrometers). After characterizing the performance of the prototype, a computer model was created to predict its on-orbit

performance. Analysis showed that a flight version of this instrument would yield around a 0.5 K noise equivalent temperature difference (NETD) for a 300 K ground scene, a 300-meter ground sample distance (GSD), and a 185-kilometer ground swath. Its application in special niche, or currently ill-served mission areas, is proposed. One such application is autonomous global thermal change detection, dedicated to highly specialized user communities.
DTIC
Earth Observations (From Space); Infrared Detectors; Infrared Imagery; Infrared Radiation; Low Cost; Radiometers; Satellite Imagery; Thermal Radiation

20050110560 Wright Lab., Wright-Patterson AFB, OH USA
Human Interfaces for Space Situational Awareness
Ianni, John D.; Jan. 2002; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430156; No Copyright; Avail: Defense Technical Information Center (DTIC)

USA defense operations are greatly enhanced by satellites, however these key assets are vulnerable to perils such as space weather or acts of aggression. Unfortunately it is not only difficult to defend against such threats, it can be difficult to determine the cause from the ground. What may at first appear to be a routine system glitch may in fact be something much more serious. This situation is aggravated by the fact that Air Force satellite control centers use antiquated technology requiring multiple human controllers per satellite, each viewing alphanumeric displays that degrade situational awareness, increase crew workload and invite confusion during demanding wartime scenarios. The Air Force Research Laboratory (AFRL/HECP) in conjunction with various organizations at Schriever Air Force Base are conducting research to increase situational awareness of the orbital battlespace by allowing operators to navigate through three-dimensional displays with voice-activated commands. This speech interface to Satellite Tool Kit which will be discussed in this paper is intended to be an initial step at enabling operators to quickly gather information from satellites or constellations. Future research plans call for applying usability engineering techniques to the satellite attack identification and reporting process, and then applying the optimal configuration of human interface technologies.
DTIC
Artificial Satellites; Human-Computer Interface; Situational Awareness

20050111429 Naval Postgraduate School, Monterey, CA USA
Multiple Satellite Trajectory Optimization
Mendy Jr, Paul B.; Dec. 2004; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429834; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis develops and validates a satellite trajectory optimization model. A summary is given of the general mathematical principles of dynamic optimal control to minimize fuel consumed or transfer time. The dynamic equations of motion for a satellite are based upon equinoctial orbital elements in order to avoid singularities for circular or equatorial orbits. The study is restricted to the two-body problem, with engine thrust as the only possible perturbation. The optimal control problems are solved using the general purpose dynamic optimization software, DIDO. The dynamical model together with the fuel optimal control problem is validated by simulating several well known orbit transfers. By replicating the single satellite model, this thesis shows that a multi-satellite model which optimizes all vehicles concurrently can be easily built. The specific scenario under study involves the injection of multiple satellites from a common launch vehicle; however, the methods and model are applicable to spacecraft formation problems as well.
DTIC
Artificial Satellites; Launch Vehicles; Trajectory Optimization

20050123651 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Trial by Fire
Covault, Craig; Aviation Week and Space Technology; February 21, 2005; ISSN 0005-2175; Volume 162, No. 6, pp. 48-51; In English; Original contains color illustrations; Copyright; Avail: Other Sources

Boeing is preparing a range of Delta IV Heavy launcher options for NASA Crew Exploration Vehicle (CEV) and unmanned cargo transportation architectures to the Moon and Mars, now that the massive new rocket has been flight tested. The December 21 launch of the 232-ft. vehicle on 2 million lb. thrust marked the largest all-liquid expendable booster flown since the last Saturn V in 1973. A second Delta IV Heavy mission is scheduled for this summer carrying a U.S. Air Force missile warning satellite. The first launch carried a dummy payload. Boeing wants NASA to consider the Delta IV Heavy for manned CEV missions, but is also pushing the Heavy for unmanned exploration launch roles. One Delta IV Medium version

could also be a CEV player. Boeing says even modest upgrades could double the Delta Heavy's Earth orbit capability to more than 50 metric tons, including being able to fire up to 20 metric tons on escape trajectories to Mars.
Author
Delta 4 Launch Vehicle; Commercial Spacecraft; Propulsion System Configurations; Propulsion System Performance; Space Exploration; Manned Space Flight; Upgrading

16
SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20050123666 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Tests Narrowed
Covault, Craig; Aviation Week and Space Technology; February 21, 2005; ISSN 0005-2175; Volume 162, No. 8, pp. 36; In English; Original contains color illustrations; Copyright; Avail: Other Sources

The space shuttle program is preparing three thermal protection system and wing leading edge repair tests that the STS-114 return-to-flight astronaut crew would perform during their mission on board Discovery, tentatively scheduled for mid-May.
Author
Space Shuttles; Spacecrews; Astronaut Training; Space Maintenance; Leading Edges; Thermal Protection; Caulking

20050123669 Space News, Springfield, VA, USA
ISOP To Focus on Shuttle Transition
Berger, Brian; Space News; February 28, 2005; Volume 16, Issue 8; 2 pp.; In English; Copyright; Avail: Other Sources

Even as NASA targets May 15 for its first space shuttle launch since Columbia broke up over the Western USA Feb. 1, 2003 on its way home to the Kennedy Space Center after two weeks in orbit conducting science experiments, many in the agency are working diligently to prepare the agency for life without the shuttle after 2010. Prior to the Columbia accident, NASA officials were making plans for keeping the shuttle in service until 2020 or beyond. NASA plans to conduct as many as three missions this year and five missions every year hereafter until the end of the decade. In the meantime, NASA's three remaining space shuttle orbiters and all the supporting infrastructure will continue to age. Even the space station, the first pieces of which were launched in 1998, is starting to show signs of wear and tear, with some components expected to reach the end of their design lives not long after the shuttle is due to retire. Anticipating the many technical, business and budgetary issues likely to come up as NASA and its stable of contractors head toward the shuttle's 2010 retirement date is the focus of the Integrated Space Operations Planning (ISOP) summit the agency is hosting March 24-31 in Nashville, Tenn.
Author
Space Shuttles; Retirement For Cause; Conferences; Management Planning

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation*; and *32 Communications and Radar*.

20050111575 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Martian Infotech
Covault, Craig; Aviation Week and Space Technology; February 28, 2005; ISSN 0005-2175; Volume 162, No. 9, pp. 54-55; In English; Original contains color and black and white illustrations; Copyright; Avail: Other Sources

The U.S. is beginning an $800-million project to create an information technology infrastructure at Mars. This will be essentially a Martian internet where robotic spacecraft will conduct high-data-rate exchanges between themselves and with their Earth-based teams. The objective is to better control increasingly ambitious robotic missions and to return more imagery and data from those flights for faster distribution to the science community and public. The focal point will be the Mars Telecommunication Orbiter (MTO), a Mars orbiting communications satellite already approved and funded by Congress for

launch to the red planet in 2009.MTO's advanced operational microwave capability should be able to relay to Earth magnitudes more information than current spacecraft, as well as near real-time images from Nasa's next generation of rovers, also set for launch in 2009.
Derived from text
Communication Satellites; Information Systems; Mars (Planet); Telecommunication; Robotics; Launching; Internets; Imagery

20050123576 NASA Glenn Research Center, Cleveland, OH, USA
ACTS Battery and Solar Array Assembly On-Orbit Measured Performance
Hilderman, Don R.; February 2005; 20 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-329-10-00
Report No.(s): NASA/TM-2005-213370; E-14839; No Copyright; Avail: CASI; A03, Hardcopy

The Advanced Communications Technology Satellite (ACTS) is a NASA experimental communications satellite system designed to demonstrate on-orbit Ka-band communications and switching technologies that will be used by NASA and the commercial sector in the 21st century. The ACTS was launched on September 12, 1993, and has performed over 10 years of successful experimental operations. The purpose of this report is to describe the ACTS power subsystem and the ACTS solar array and battery assemblies located within the power subsystem and then to document on-orbit measured performance from launch to mission end on April 28, 2004. Solar array and battery performance data is presented, and respective conclusions are drawn. The total solar array power available to the spacecraft was measured each year at the same time, and battery voltage performance was measured twice per year at the same times during peak solar eclipse. At the highest spacecraft power demand, the ACTS uses approximately 1113 W of electrical power during the low-burstrate experiment to operate all six satellite subsystems. After 10 years of on-orbit operation, solar array available output power normal to the Sun measured 1508 W, which represents 395 W of excess margin. The ACTS batteries have successfully supported the ACTS experiment program for over 10 years and operated in excess of 900 charge and discharge cycles through 21 eclipse seasons.
Author
Communication Satellites; Solar Arrays; Nickel Cadmium Batteries; Spacecraft Power Supplies; ACTS

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance; 39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20050092370 Jacobs Sverdrup Technology, Inc., Huntsville, AL, USA
Concepts to Automate Fluid Transfer Capability of Low Impact Docking System (LIDS)
Miernik, Janie H.; Lukens, Scott; Robertson, Jeff; [2005]; 1 pp.; In English; 1st Space Exploration Conference, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-00187; Copyright; Avail: Other Sources; Abstract Only

The capability to transfer mass between spacecraft is necessary for many mission scenarios. Docking and berthing operations have enabled fluid, electrical, crew and equipment transfers to some degree on all manned space operations since the Gemini program. The Apollo program performed some sophisticated docking maneuvers to land men on the moon and return them safely to Earth. These programs primarily transferred crew, equipment, and pressurized atmosphere between docked spacecraft. The International Space Station (ISS) U.S. modules are connected by Common Berthing Mechanism (CBM) portals. They provide many feed-through ports for electrical, and fluid transfer between modules, as well as a large diameter crew and equipment tunnel. Fluid and electrical jumpers are manually installed after the CBM sealing surfaces have been securely mated to maintain the pressurized cabin environment. CBM berthing and subsequent fluid transfer capability requires a lengthy manual process involving an active interface that mates with a passive half. The Androgynous Peripheral Attach System (MAS) a Russian technology that docked the Russian Zarya module to Unity, or Node 1, is a more complex system that also is capable of fuel transfer, enabling refueling of the Russian re-boost engines on ISS. For several years, a Low Impact Docking System (LIDS) has been under development at Johnson Space Center (JSC). This docking technology has a requirement to be androgynous in order to allow the fabrication of a single configuration that can dock with all other LIDS units. It is desired to make electrical and fluid coupling mating an automated process to enable routine docking and undocking operations to support future exploration missions. It is envisioned that modular design and vehicle assembly will require an

efficient LIDS for fuel, electrical, crew, and equipment transfer. Marshall Space Flight Center (MSFC) has joined the LIDS development effort and plans to employ fluid transfer concepts and technology from previous development programs, such as the Automated Fluid Interface System (AFIS) and the Ohital Fluid Transfer System (OFTS) that were developed and tested by MSFC. Orbital Expressderived robotic satellite servicing technology is scheduled to fly soon to demonstrate fluid transfer technology developed for the Air Force. This paper will compare known technology against possible fluid transfer requirements for LIDS to develop design strategies for automated fluid transfer.
Author
Spacecraft Docking; Mass Transfer; Automatic Control

20050092376 NASA Marshall Space Flight Center, Huntsville, AL, USA
Atmospheric/Space Environment Support Lessons Learned Regarding Aerospace Vehicle Design and Operations
Vaughan, William W.; Anderson, B. Jeffrey; [2005]; 11 pp.; In English; 43rd AIAA Aerospace Sciences Meeting, 8-13 Jan. 2005, Reno, NV, USA; Copyright; Avail: CASI; A03, Hardcopy

In modern government and aerospace industry institutions the necessity of controlling current year costs often leads to high mobility in the technical workforce, 'one-deep' technical capabilities, and minimal mentoring for young engineers. Thus, formal recording, use, and teaching of lessons learned are especially important in the maintenance and improvement of current knowledge and development of new technologies, regardless of the discipline area. Within the NASA Technical Standards Program Website http://standards.nasa.gov there is a menu item entitled 'Lessons Learned/Best Practices'. It contains links to a large number of engineering and technical disciplines related data sets that contain a wealth of lessons learned information based on past experiences. This paper has provided a small sample of lessons learned relative to the atmospheric and space environment. There are many more whose subsequent applications have improved our knowledge of the atmosphere and space environment, and the application of this knowledge to the engineering and operations for a variety of aerospace programs.
Derived from text
Aerospace Environments; Aerospace Vehicles; Spacecraft Design; NASA Programs

20050092383 NASA Marshall Space Flight Center, Huntsville, AL, USA
Nondestructive Evaluation of Space Shuttle External Tank Foam
Thom, Robert L.; Walker, James L.; [2005]; 5 pp.; In English; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy

During launch of Shuttle Columbia, mission STS-107, a large piece of spray on foam insulation (SOFI) separated from the external tank left bipod ramp area impacting the shuttle orbiter left wing leading edge. 'Analysis showed that this large piece of foam struck Columbia on the underside of the left wing after launch. Later, analysis showed that the larger piece struck Columbia on the underside of the left wing, around Reinforced Carbon-Carbon (RCC) panels 5 through 9, at 81.9 seconds after launch. Further photographic analysis revealed that the large foam piece was approximately 21 to 27 inches long and 12 to 18 inches wide and was moving at a relative velocity to the Shuttle stack of 625 to 840 feet per second (416 to 573 miles per hour) at the time of impact.' This impact damaged the wing leading edge resulting in loss of orbiter thermal protection. The piece of errant foam was part of a bipod ramp which was designed to meet thermal and aerodynamic requirements in that region of the external tank (ET).
Derived from text
Nondestructive Tests; External Tanks; Foams; Thermal Protection

20050092395 NASA Marshall Space Flight Center, Huntsville, AL, USA
Survey of Technologies Relevant to Defense From Near-Earth Objects
Adams, R. B.; Alexander, R.; Bonemetti, J.; Chapman, J.; Fincher, S.; Hopkins, R.; Kalkstein, M.; Polsgrove, T.; Statham, G.; White, S.; July 2004; 1 pp.; In English
Report No.(s): NASA/TP-2004-213089; M-1100; No Copyright; Avail: Other Sources; Abstract Only

Several recent near-miss encounters with asteroids and comets have focused attention on the threat of a catastrophic impact with the Earth. This Technical Publication reviews the historical impact record and current understanding of the number and location of near-Earth objects (NEOs) to address their impact probability. Various ongoing projects intended to survey and catalog the NEO population are also reviewed. Details are given of a Marshall Space Right Center-led study intended to develop and assess various candidate systems for protection of the Earth against NEOs. Details of analytical tools, trajectory tools, and a tool that was created to model both the undeflected inbound path of an NEO as well as the modified, post-deflection path are given. A representative selection of these possible options was modeled and evaluated. It is hoped that

this study will raise the level of attention about this very real threat and also demonstrate that successful defense is both possible and practicable, provided appropriate steps are taken.
Author
Near Earth Objects; Technologies; Asteroids; Comets; Models

20050110122 NASA Marshall Space Flight Center, Huntsville, AL, USA
Learning Lessons from the X-37 Project
Turner, Susan; Spanyer, Karen; [2005]; 2 pp.; In English; Continuing the Voyage of Discovery, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: CASI; A01, Hardcopy

The X-37 was planned as an automated vehicle capable of flight-testing new aerospace technologies in combined environments that are beyond the capability of existing ground or flight platforms. Flight demonstration with the X-37 architecture and configuration in relevant environments was planned to reduce the risk of developing launch vehicle technologies for sustainable, affordable exploration and other aerospace applications. Current plans are for the X-37 Approach and Landing Test Vehicle (ALTV) to be atmospheric tested in 2005 from Scaled Composite's White Knight carrier aircraft at up to 40,000 feet over California's Mojave Spaceport, with and turnaround maintenance performed. The fight Operations Control Center will conduct the mission, using a streamlined operations concept. Taxi-tow and captive-carry tests will be conducted prior to the atmospheric-test series. Sponsored by the Defense Advanced Research Projects Agency (DARPA) with NASA participation, technical objectives are to: (1) mature Computed Air Data System/Remote Pressure Sensor technology, (2) manage energy during Terminal Area Energy Management/Heading Alignment Cone maneuvers, and (3) validate the aerodatabase. The X-37 Project began in 1999 under a cooperative agreement as an element of NASA's Future X Program and transitioned to a NASA Research Announcement under the Space Launch Initiative. In mid-2004, NASA transferred ownership to DARPA, with its heritage of performing high-risk, high-payoff research and development. NASA contributes technical expertise, including risk analysis and system integration. The Boeing Company is the prime contractor, with nationwide suppliers. This recent partnership exemplifies the synergy attainable when NASA Centers, other Government agencies, and industry work together toward a common goal - contributing to the knowledge base for U.S. exploration and other aerospace endeavors. The X-37 team represents a range of space transportation disciplines - from engineering to management. Some members have been with the project since its inception. All have gained priceless experience during the design, manufacturing, and testing of the ALTV, as well as through developing advanced orbital flight technologies, such as state-of-the-art Thermal Protection Systems and hot structures. Throughout this process, the X-37 Project team captures lessons that are directly applicable to other such efforts. The upcoming ALTV flights offer another dimension of data and first-hand experience that will prove invaluable to those designing new generations of reusable spacecraft. And ongoing technology developments will expand the aerospace knowledge base. Delivering prototype hardware is always a risky proposition. During the course of the X-37 effort, the team has experienced many challenging opportunities, delivering significant accomplishments and learning numerous lessons in the process. The ability to manage the risk landscape is key to overcoming obstacles, especially technical hurdles that are encountered in progressing hardware from design to flight. The approach to managing risk under this partnership is evolving but, in general, the team allocates resources to reduce the likelihood of severe-consequence risks, thus maximizing mission success and ensuring that the X-37 Project delivers value to its stakeholders. As the team sharpens its focus on operations, it continues to contribute knowledge to those who would undertake high-risk, high-payoff research and development and provides valuable experience to implement the exploration vision.
Author
Aerospace Engineering; X-37 Vehicle; NASA Space Programs; Spacecraft Configurations

20050110166 NASA Marshall Space Flight Center, Huntsville, AL, USA
Hardware Progress Made in the Early Flight Fission Test Facilities (EFF-TF) To Support Near-Term Space Fission Systems
VanDyke, Melissa; Martin, James; [2005]; 8 pp.; In English; STAIF 2005 Conference, 13-17 Feb. 2005, Albuquerque, NM, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The EFF-TF provides a facility to experimentally evaluate thermal hydraulic issues through the use of highly effective non-nuclear testing. These techniques provide a rapid, more cost effective method of evaluating designs and support development risk mitigation when concerns are associated with non-nuclear aspects of space nuclear systems. For many systems, electrical resistance thermal simulators can be used to closely mimic the heat deposition of the fission process, providing axial and radial profiles. A number of experimental and design programs were underway in 2004. Initial evaluation of the SAFE-100a (19 module stainless steel/sodium heat pipe reactor with integral gas neat exchanger) was performed with

tests up to 17.5 kW of input power at core temperatures of 1000 K. A stainless steel sodium SAFE-100 heat pipe module was placed through repeated freeze/thaw cyclic testing accumulating over 200 restarts to a temperature of 1000 K. Additionally, the design of a 37-fuel pin stainless steel pumped sodium/potassium (NaK) loop was finalized and components procured. Ongoing testing at the EFF-TF is geared towards facilitating both research and development necessary to field a near term space nuclear system. Efforts are coordinated with DOE laboratories, industry, universities, and other NASA centers. This paper describes some of the 2004 efforts.
Author
Aerospace Systems; Fission; Test Facilities; Hardware

20050110219 NASA Marshall Space Flight Center, Huntsville, AL, USA
Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space
Minow, Joseph I.; Altstatt, Richard; NeergaardParker, Linda; Skipworth, William; [2004]; 1 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2004, Reno, NV, USA
Report No.(s): AIAA Paper 2005-1379; No Copyright; Avail: Other Sources; Abstract Only

Spacecraft surfaces in interplanetary space are exposed to solar wind ions. The bulk of the ions exhibit energies of a few kilovolts and are important only to surface interactions while a fraction of the solar wind extends to greater energies and may penetrate below the material surface. The importance of including solar wind ions in analysis of space environment effects on spacecraft is becoming more important as new spacecraft designs are considered which include systems such as sunshades, solar sail propulsion systems, and other mission critical features based on very thin materials. This paper provides a status report on development of solar wind ion environments to support engineering analysis of materials exposed to the space environment including techniques for reconstructing ion environments from solar wind plasma moments and energetic flux measurements and comparison of statistical flux environments to integrated mission fluence.
Author
Surface Reactions; Aerospace Environments; Environment Effects; Interplanetary Space; Solar Wind; Ions

20050123603 NASA Langley Research Center, Hampton, VA, USA
Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles
Anastasi, Robert F.; Madaras, Eric I.; [2005]; 7 pp.; In English; SPIE International Symposia on Smart Structures and Materials, 6-10 Mar. 2005, San Diego, CA, USA; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Terahertz NDE is being examined as a method to inspect the adhesive bond-line of Space Shuttle tiles for defects. Terahertz signals are generated and detected, using optical excitation of biased semiconductors with femtosecond laser pulses. Shuttle tile samples were manufactured with defects that included repair regions unbond regions, and other conditions that occur in Shuttle structures. These samples were inspected with a commercial terahertz NDE system that scanned a tile and generated a data set of RF signals. The signals were post processed to generate C-scan type images that are typically seen in ultrasonic NDE. To improve defect visualization the Hilbert-Huang Transform, a transform that decomposes a signal into oscillating components called intrinsic mode functions, was applied to test signals identified as being in and out of the defect regions and then on a complete data set. As expected with this transform, the results showed that the decomposed low-order modes correspond to signal noise while the high-order modes correspond to low frequency oscillations in the signal and mid-order modes correspond to local signal oscillations. The local oscillations compare well with various reflection interfaces and the defect locations in the original signal.
Author
Defects; Detection; Hilbert Transformation; Low Frequencies; Nondestructive Tests; Space Shuttles; Tiles

20050123662 NASA Marshall Space Flight Center, Huntsville, AL, USA
Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development
Khoshnevis, Behrokh; Bodiford, Melanie P.; Burks, Kevin H.; Ethridge, Ed; Tucker, Dennis; Kim, Won; Toutanji, Houssam; Fiske, Michael R.; [2005]; 16 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-14 Jan. 2005, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS8-00187; NCC8-200; Copyright; Avail: CASI; A03, Hardcopy

1. Habitat Structures at MSFC is one element of the In-Situ Fabrication and Repair (ISFR) Program: ISFR develops technologies for fabrication, repair and recycling of tools, parts, and habitats/structures using in-situ resources. ISRU - based habitat structures are considered Class III. 2. Habitat Structure Purpose: Develop Lunar and/or Martian habitat structures for

manned missions that maximize the use of in-situ resources to address the following agency topics: bioastronautics critical path roadmap; strategic technical challenges defined in H&RT formulation plan: margins and redundancy; modularity, robotic network, space resource utilization; autonomy, affordable logistics pre-positioning.
Derived from text
Habitats; Fabrication; Recycling; Maintenance

20050123668 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
From Mercury to CEV: Space Capsules Reemerge
Sietzen, Frank, Jr.; Aerospace America; February 2005; ISSN 0740-722X, pp. 26-33; In English; Original contains color illustrations; Copyright; Avail: Other Sources

Sometime this year, most likely in the spring, China will launch Shenzhou 6, its second manned spaceflight. Following the success of its first manned mission, Shenzhou 5, this next flight will carry two Chinese astronauts in a more advanced spacecraft than the one that flew Senior Col. Yang Liwei in October 2003. The Shenzhou configuration is an adaptation of Russia's veteran Soyuz design. Soyuz is a space capsule whose cargo and payload capabilities are limited. It also requires a retrorocket to brake the machine's descent prior to touchdown. Some U.S. space officials privately scoffed at the Chinese vehicle when it first flew, hinting that it was in essence 30-year-old technology. Shenzhou, whose name means 'divine vessel' may well be an upgraded version of an old spacecraft, but the return of the space capsule will probably not be limited to flights in Asian skies. The successor to the space shuttle, the Crew Exploration Vehicle (CEV), would likely be some capsule derivative. And therein lies a tale of space vehicles, past, present, and future.
Author
Space Capsules; Chinese Spacecraft; Spacecraft Design; Manned Spacecraft

20050123672 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Skeleton Crew for the Space Station
Iannotta, Ben; Aerospace America; January 2005; ISSN 0740-722X, pp. 32-36; In English; Original contains color illustrations; Copyright; Avail: Other Sources

NASA and Russian officials are currently operating the International Space Station with a skeleton crew of two, mostly because of a shortage of drinking water caused by the grounding of the US. space shuttle fleet in 2003. Russian Progress cargo capsules now deliver the water, which was once produced on orbit as a by-product of the shuttle's electricity-producing fuel cells. Two people simply cannot do the work of three, so US. station managers have trimmed the total number cf hours planned for scientific research and cut some of the crew's housekeeping chores. Without the shuttle to carry home spare or broken hardware, the crew now spends considerable time storing and repairing equipment aboard the station. NASA's goal is to keep the station occupied and at least somewhat productive scientifically until the shuttle fleet begins flying again, perhaps in May, managers say. Without the shuttle, crewmembers cannot receive new scientific experiments or send competed ones home. 'They're basically repeating the same experiments,' says NASA spokesman Rob Navias. Russian officials have used Progress capsules to bring small experiments up to the station, but these craft are not designed to carry experiments or other equipment home. Station crewmembers load the capsules with trash and dispatch them to burn up in the atmosphere. Russia's Soyuz capsules are reserved for delivering crewmembers to and from the station. This paper discusses how the crew of Expedition 9 learned how to make on-the-spot repairs and also how they found creative ways to solve other problems.
Derived from text
International Space Station; Spacecrews; NASA Space Programs; Manned Space Flight

20050123841 Tor Vergata Univ., Rome, Italy
Time-Domain Analysis of the Electromagnetic Coupling in Satellite Environments
Mattocco, Gaetano; Monti, Massimiliano; Bardatai, Fernando; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2022-2025; In English; See also 20050123676; Copyright; Avail: Other Sources

Inward electromagnetic radiation aboard a satellite may damage the internal electronic equipments. To model the energy coupling through the chassis apertures, numerical hybrid techniques are sometimes used. In this context, a time-domain analysis, based on the FDTD method and signal processing tools, is proposed to account for the dependence of internal observables on the aperture electric fields.
Author
Electromagnetic Coupling; Spacecraft Charging; Spacecraft Electronic Equipment; Earth Orbital Environments; Artificial Satellites

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information see also *06 Avionics and Aircraft Instrumentation*; for spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; for spaceborne telescopes and other astronomical instruments see *89 Astronomy*.

20050109874 NASA Marshall Space Flight Center, Huntsville, AL, USA
X-Ray Calibration Facility/Advanced Video Guidance Sensor Test
Johnston, N. A. S.; Howard, R. T.; Watson, D. W.; September 1, 2004; 1 pp.; In English
Report No.(s): NASA/TM-2004-213393; M-1122; No Copyright; Avail: CASI; A01, Hardcopy

The advanced video guidance sensor was tested in the X-Ray Calibration facility at Marshall Space Flight Center to establish performance during vacuum. Two sensors were tested and a timeline for each are presented. The sensor and test facility are discussed briefly. A new test stand was also developed. A table establishing sensor bias and spot size growth for several ranges is detailed along with testing anomalies.
Author
Guidance Sensors; Calibrating; Video Communication; X Rays; Test Stands

20
SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20050092388 Science Applications International Corp., Huntsville, AL, USA, Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
Solar Electric and Chemical Propulsion for a Titan Mission
Cupples, Michael; Green, Shaun E.; Donahue, Benjamin B.; Coverstone, Victoria L.; [2005]; 31 pp.; In English; AIAA JPC, July 2003, Huntsville, AL, USA
Report No.(s): AIAA Paper 2003-4728; Copyright; Avail: CASI; A03, Hardcopy

Systems analyses were performed for a Titan Explorer Mission characterized by Earth-Saturn transfer stages using solar electric power generation and propulsion systems for primary interplanetary propulsion, and chemical propulsion for capture at Titan. An examination of a range of system factors was performed to determine their effect on the payload delivery capability to Titan. The effect of varying launch vehicle type, solar array power level, ion thruster number, specific impulse, trip time, and Titan capture stage chemical propellant choice was investigated. The major purpose of the study was to demonstrate the efficacy of applying advanced ion propulsion system technologies like NASA's Evolutionary Xenon Thruster (NEXT), coupled with state-of-the-art (SOA) and advanced chemical technologies to a Flagship class mission. This study demonstrated that a NASA Design Reference Mission (DRM) payload of 406 kg could be successfully delivered to Titan using the baseline advanced ion propulsion system in conjunction with SOA chemical propulsion for Titan capture. In addition, the SEPS/Chemical system of this study is compared to an all- chemical NASA DRM mission. Results showed that the NEXT-based SEPS/Chemical system was able to deliver the required payload to Titan in 5 years less transfer time and on a smaller launch vehicle than the SOA chemical option.
Author
Chemical Propulsion; Solar Electric Propulsion; Titan; Systems Analysis; Electric Generators; Ion Propulsion; Propulsion System Configurations; Propulsion System Performance

20050109882 NASA Marshall Space Flight Center, Huntsville, AL, USA
Transient Approximation of SAFE-100 Heat Pipe Operation
Bragg-Sitton, Shannon M.; Reid, Robert S.; [2005]; 10 pp.; In English; STAIF 2005 Conference, 13-17 Feb. 2005, Albuquerque, NM, USA; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Engineers at Los Alamos National Laboratory (LANL) have designed several heat pipe cooled reactor concepts, ranging in power from 15 kWt to 800 kWt, for both surface power systems and nuclear electric propulsion systems. The Safe, Affordable Fission Engine (SAFE) is now being developed in a collaborative effort between LANL and NASA Marshall Space

Flight Center (NASA/MSFC). NASA is responsible for fabrication and testing of non-nuclear, electrically heated modules in the Early Flight Fission Test Facility (EFF-TF) at MSFC. In-core heat pipes must be properly thawed as the reactor power starts. Computational models have been developed to assess the expected operation of a specific heat pipe design during start-up, steady state operation, and shutdown. While computationally intensive codes provide complete, detailed analyses of heat pipe thaw, a relatively simple. concise routine can also be applied to approximate the response of a heat pipe to changes in the evaporator heat transfer rate during start-up and power transients (e.g., modification of reactor power level) with reasonably accurate results. This paper describes a simplified model of heat pipe start-up that extends previous work and compares the results to experimental measurements for a SAFE-100 type heat pipe design.
Author
Fission; Heat Pipes; Approximation; Transient Heating; Fabrication

20050109914 NASA Marshall Space Flight Center, Huntsville, AL, USA
Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module
Martin, James; Mireles, Omar; Reid, Robert; [2005]; 8 pp.; In English; STAIF 2005 Conference, 13-17 Feb. 2005, Albuquerque, NM, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A heat pipe cooled reactor is one of several candidate reactor cores being considered for space power and propulsion systems to support future space exploration activities. Long life heat pipe modules. with designs verified through a combination of theoretical analysis and experimental evaluations. would be necessary to establish the viability of this option. A hardware-based program was initiated to begin experimental testing of components to verify compliance of proposed designs. To this end, a number of stainless steel/sodium heat pipe modules have been designed and fabricated to support experimental testing of a Safe Affordable Fission Engine (SAFE) project, a 100-kWt core design pursued jointly by the Marshall Space Flight Center and the Los Alamos National Laboratory. One of the SAFE heat pipe modules was successfully subjected to over 200 restarts. examining the behavior of multiple passive freeze/thaw operations. Typical operation included a 1-hour startup to an average evaporator temperature of 1000 K followed by a 15 minute hold at temperature. Nominal maximum input power during the hold period was 1.9 kW. Between heating cycles the module was cooled to less than 325 K, returning the sodium to a frozen state in preparation fop the next startup cycle.
Author
Reactor Cores; Heat Pipes; Propulsion System Configurations; Propulsion System Performance; Spacecraft Power Supplies; Space Exploration

20050110123 NASA Marshall Space Flight Center, Huntsville, AL, USA
Technology Challenges for Deep-Throttle Cryogenic Engines for Space Exploration
Brown, Kendall K.; Nelson, Karl W.; [2005]; 8 pp.; In English; Space Technology and Applications International Forum, 13-17 Feb. 2005, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy

Historically, cryogenic rocket engines have not been used for in-space applications due to their additional complexity, the mission need for high reliability, and the challenges of propellant boil-off. While the mission and vehicle architectures are not yet defined for the lunar and Martian robotic and human exploration objectives, cryogenic rocket engines offer the potential for higher performance and greater architecture/mission flexibility. In-situ cryogenic propellant production could enable a more robust exploration program by significantly reducing the propellant mass delivered to low earth orbit, thus warranting the evaluation of cryogenic rocket engines versus the hypergolic bi-propellant engines used in the Apollo program. A multi-use engine. one which can provide the functionality that separate engines provided in the Apollo mission architecture, is desirable for lunar and Mars exploration missions because it increases overall architecture effectiveness through commonality and modularity. The engine requirement derivation process must address each unique mission application and each unique phase within each mission. The resulting requirements, such as thrust level, performance, packaging, bum duration, number of operations; required impulses for each trajectory phase; operation after extended space or surface exposure; availability for inspection and maintenance; throttle range for planetary descent, ascent, acceleration limits and many more must be addressed. Within engine system studies, the system and component technology, capability, and risks must be evaluated and a balance between the appropriate amount of technology-push and technology-pull must be addressed. This paper will summarize many of the key technology challenges associated with using high-performance cryogenic liquid propellant rocket engine systems and components in the exploration program architectures. The paper is divided into two areas. The first area describes how the mission requirements affect the engine system requirements and create system level technology challenges. An engine system architecture for multiple applications or a family of engines based upon a set of core technologies, design, and fabrication approaches may reduce overall programmatic cost and risk. The engine system discussion will also address the characterization of engine cycle figures of merit, configurations, and design approaches for some in-space vehicle alternatives

under consideration. The second area evaluates the component-level technology challenges induced from the system requirements. Component technology issues are discussed addressing injector, thrust chamber, ignition system, turbopump assembly, and valve design for the challenging requirements of high reliability, robustness, fault tolerance, deep throttling, reasonable performance (with respect to weight and specific impulse).
Author
Cryogenics; Space Exploration; Throttling; Technology Utilization; Rocket Engine Design

20050110133 NASA Marshall Space Flight Center, Huntsville, AL, USA
Preliminary Design of a Manned Nuclear Electric Propulsion Vehicle Using Genetic Algorithms
Irwin, Ryan W.; Tinker, Michael L.; [2005]; 4 pp.; In English; Space Technology and Applications International Forum (STAIF) 2005, 13-17 Feb. 2005, Albuquerque, NM, USA
Contract(s)/Grant(s): 090-26-E2; Copyright; Avail: CASI; A01, Hardcopy

Nuclear electric propulsion (NEP) vehicles will be needed for future manned missions to Mars and beyond. Candidate designs must be identified for further detailed design from a large array of possibilities. Genetic algorithms have proven their utility in conceptual design studies by effectively searching a large design space to pinpoint unique optimal designs. This research combined analysis codes for NEP subsystems with a genetic algorithm. The use of penalty functions with scaling ratios was investigated to increase computational efficiency. Also, the selection of design variables for optimization was considered to reduce computation time without losing beneficial design search space. Finally, trend analysis of a reference mission to the asteroids yielded a group of candidate designs for further analysis.
Author
Nuclear Electric Propulsion; Manned Space Flight; Spacecraft Design; Design Optimization

20050110218 NASA Marshall Space Flight Center, Huntsville, AL, USA
Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative
Best, Philip J.; Unger, Ronald J.; Waits, David A.; [2005]; 1 pp.; In English; AIAA 1st Space Exploration Conference, 30 Jan. - 2 Feb. 2005, Orlando, FL, USA
Report No.(s): AIAA-2005-TBD; No Copyright; Avail: Other Sources; Abstract Only

The Space Launch Initiative (SLI) procurement mechanism NRA8-30 initiated the Auxiliary Propulsion System/Main Propulsion System (APS/MPS) Project in 2001 to address technology gaps and development risks for non-toxic and cryogenic propellants for auxiliary propulsion applications. These applications include reaction control and orbital maneuvering engines, and storage, pressure control, and transfer technologies associated with on-orbit maintenance of cryogens. The project has successfully evolved over several years in response to changing requirements for re-usable launch vehicle technologies, general launch technology improvements, and, most recently, exploration technologies. Lessons learned based on actual hardware performance have also played a part in the project evolution to focus now on those technologies deemed specifically relevant to the Exploration Initiative. Formal relevance reviews held in the spring of 2004 resulted in authority for continuation of the Auxiliary Propulsion Project through Fiscal Year 2005 (FY05), and provided for a direct reporting path to the Exploration Systems Mission Directorate. The tasks determined to be relevant under the project were: continuation of the development, fabrication, and delivery of three 870 lbf thrust prototype LOX/ethanol reaction control engines; the fabrication, assembly, engine integration and testing of the Auxiliary Propulsion Test Bed at White Sands Test Facility; and the completion of FY04 cryogenic fluid management component and subsystem development tasks (mass gauging, pressure control, and liquid acquisition elements). This paper presents an overview of those tasks, their scope, expectations, and results to-date as carried forward into the Exploration Initiative.
Author
Auxiliary Propulsion; Cryogenic Rocket Propellants; Fluid Management; Launch Vehicles; Ethyl Alcohol; Liquid Oxygen

20050111481 ATK-Thiokol Propulsion, Brigham City, UT, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster
Nielsen, D.; Townsend, J.; Kappus, K.; Driskill, T.; Torres, I.; Parks, R.; [2005]; 19 pp.; In English; IMAC XX111, 31 Jan. 3 Feb. 2005, Orlando, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-97238; Copyright; Avail: CASI; A03, Hardcopy

The complex interactions between internal motor generated pressure oscillations and motor structural vibration modes associated with the static test configuration of a Reusable Solid Rocket Motor have potential to generate significant dynamic thrust loads in the 5-segment configuration (Engineering Test Motor 3). Finite element model load predictions for worst-case

conditions were generated based on extrapolation of a previously correlated 4-segment motor model. A modal survey was performed on the largest rocket motor to date, Engineering Test Motor #3 (ETM-3), to provide data for finite element model correlation and validation of model generated design loads. The modal survey preparation included pretest analyses to determine an efficient analysis set selection using the Effective Independence Method and test simulations to assure critical test stand component loads did not exceed design limits. Historical Reusable Solid Rocket Motor modal testing, ETM-3 test analysis model development and pre-test loads analyses, as well as test execution, and a comparison of results to pre-test predictions are discussed.
Author
Space Shuttle Boosters; Modal Response; Ground Tests; Engine Tests; Full Scale Tests

20050123667 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
SMART Use for Electric Propulsion
Hermant, Eric; Aerospace America; February 2005; ISSN 0740-722X, pp. 34-37; In English; Original contains color illustrations; Copyright; Avail: Other Sources

The European probe SMART-1 (Small Mission for Advanced Research on Technology-1) is now orbiting the Moon after what has been a long but very efficient flight. Its mission began on September 27, 2003, when it was launched by an Ariane 5 into geostationary transfer orbit (GTO). After the launch, SMART-1 began spiraling to progressively increase its distance from the Earth until it was captured by the Moons gravity in mid-November 2004. The probe then began to spiral down to reach an orbit close to the Moon. Although this might seem a surpnsing way to get from the Earth to the Moon, the strategy reflects SMART- 1's objectives to reduce mission costs and to demonstrate and/or evaluate new technologies and procedures that would improve European capabilities for interplanetary missions. And despite its low cost, SMART-1 is actually working very well, both in in-flight vaiidation of advanced technologies and through lessons learned about how to operate a spacecraft using these technologies in the various enxironments encountered on this type of flight. Among the most cntical technologies validated on the mission is electric propulsion based on the Hall-effect thruster (HET). SMART-1's primary propulsion system, developed and built by Snecma Moteurs of France, uses a single PPS 1350-G, a HET also developed by the company.
Derived from text
Hall Thrusters; Spacecraft Propulsion; Lunar Probes; Propulsion System Performance

20050123895 NASA Marshall Space Flight Center, Huntsville, AL, USA
Materials Requirements for Advanced Propulsion Systems
Whitaker, Ann F.; Cook, Mary Beth; Clinton, R. G., Jr.; [2005]; 1 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA's mission to 'reach the Moon and Mars' will be obtained only if research begins now to develop materials with expanded capabilities to reduce mass, cost and risk to the program. Current materials cannot function satisfactorily in the deep space environments and do not meet the requirements of long term space propulsion concepts for manned missions. Directed research is needed to better understand materials behavior for optimizing their processing. This research, generating a deeper understanding of material behavior, can lead to enhanced implementation of materials for future exploration vehicles. materials providing new approaches for manufacture and new options for In response to this need for more robust materials, NASA's Exploration Systems Mission Directorate (ESMD) has established a strategic research initiative dedicated to materials development supporting NASA's space propulsion needs. The Advanced Materials for Exploration (AME) element directs basic and applied research to understand material behavior and develop improved materials allowing propulsion systems to operate beyond their current limitations. This paper will discuss the approach used to direct the path of strategic research for advanced materials to ensure that the research is indeed supportive of NASA's future missions to the moon, Mars, and beyond.
Author
Propulsion System Configurations; Manned Space Flight; Mars Missions; Aerospace Environments; Strategic Materials

23
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20050092403 NASA Marshall Space Flight Center, Huntsville, AL, USA
Materials Challenges in Space Exploration
Bhat, Biliyar N.; [2005]; 1 pp.; In English; Aero India 2005, 7-9 Feb. 2005, Bangalore, India; No Copyright; Avail: Other Sources; Abstract Only

USA civil space program administered by National Aeronautics and Space Administration (NASA) has a new strategic direction to explore the solar system. This new 'vision for space exploration' encompasses a broad range of human and robotic missions, including the Moon, Mars and destinations beyond. These missions require advanced systems and capabilities that will accelerate the development of many critical technologies, including advanced materials and structural concepts. Specifically, it is planned to develop high-peformance materials for vehicle structures, propulsion systems, and space suits; structural concepts for modular assembly for space infrastructure; lightweight deployable and inflatable structures for large space systems and crew habitats; and highly integrated structural systems and advanced thermal management systems for reducing launch mass and volume. This paper will present several materials challenges in advanced space systems-high performance structural and thermal materials, space durable materials, radiation protection materials, and nano- structural materials. The paper will also address smart materials and structures and examine space environmental effects on materials and methods of mitigating them. Finally, the paper will take a look at the possibility of utilizing materials in situ, i.e., processing and using desired materials on the surface of the Moon and Mars.
Author
Aerospace Environments; Large Space Structures; Radiation Protection; Inflatable Structures; Space Suits

20050109857 FluoreScience, Inc., Oak Ridge, TN, USA, Tennessee Technological Univ., Cookeville, TN, USA
Development of On-Line Temperature Measurement Instrumentation for Gasification Process Control
Noel, B. W.; Nov. 2002; 12 pp.; In English
Report No.(s): DE2004-829605; No Copyright; Avail: Department of Energy Information Bridge

This progress report covers continuing work to develop a temperature probe for a coal gasifier. A workable probe design requires finding answers to crucial questions involving the probe materials. We report on attempts to answer those questions. We designed, assembled, and tested a portable test fixture that can give relative quantitative data on the condition of phosphors. It needs a more-sensitive detector for optimum performance. We ordered an appropriate detector. An experimental test of the survivability of thermographic phosphor in an ambient environment similar to that in a slagging gasifier showed no substantial deterioration of the phosphor. We consider this result so important that we delayed the date of publication of this report by one month to accommodate it. We assembled the first version of a prototype probe and were preparing to test it at the time of this report.
NTIS
Gasification; On-Line Systems; Temperature Measurement; Coal

20050110180 NASA Marshall Space Flight Center, Huntsville, AL, USA
Research Opportunities Supporting the Vision for Space Exploration from the Transformation of the Former Microgravity Materials Science Program
Clinton, R. G., Jr.; Szofran, Frank; Bassler, Julie A.; Schlagheck, Ronald A.; Cook, Mary Beth; [2005]; 1 pp.; In English; American Inst. of Aeronautics and Astronautics Space Exploration Conference, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

The Microgravity Materials Science Program established a strong research capability through partnerships between NASA and the scientific research community. With the announcement of the vision for space exploration, additional emphasis in strategic materials science areas was necessary. The President's Commission recognized that achieving its exploration objectives would require significant technical innovation, research, and development in focal areas defined as 'enabling technologies.' Among the 17 enabling technologies identified for initial focus were: advanced structures, advanced power and propulsion; closed-loop life support and habitability; extravehicular activity systems; autonomous systems and robotics; scientific data collection and analysis, biomedical risk mitigation; and planetary in situ resource utilization. Mission success may depend upon use of local resources to fabricate a replacement part to repair a critical system. Future propulsion systems

will require materials with a wide range of mechanical, thermophysical, and thermochemical properties, many of them well beyond capabilities of today's materials systems. Materials challenges have also been identified by experts working to develop advanced life support systems. In responding to the vision for space exploration, the Microgravity Materials Science Program aggressively transformed its research portfolio and focused materials science areas of emphasis to include space radiation shielding; in situ fabrication and repair for life support systems; in situ resource utilization for life support consumables; and advanced materials for exploration, including materials science for space propulsion systems and for life support systems. The purpose of this paper is to inform the scientific community of these new research directions and opportunities to utilize their materials science expertise and capabilities to support the vision for space exploration.
Author (revised)
Materials Science; Research and Development; Strategic Materials

20050110215 NASA Marshall Space Flight Center, Huntsville, AL, USA
Simulated Space Environment Effects on Tether Materials with Protective Coatings
Finckenor, Miria M.; Watts, Ed; [2005]; 2 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Atomic oxygen (AO) erodes most organic materials. and ultraviolet radiation embrittles polymers. A previous study indicated untreated polymers such as ultra-high molecular weight polyethylene (UHMWPE) are severely degraded when exposed to AO. This test series was performed to determine the effect of AO and UV on the mechanical integrity of tether materials that were treated with AO-protective coatings. Three coating systems were evaluated for their ability to protect the underlying material from AO erosion. The first coating system is the Photosil surface modification process which incorporates silicon-containing functional groups into the top micron of an organic material. The Photosil process has had favorable results with polyurethane- and epoxy-based thermal control coatings . The second coating system is metallization, in this case nickel. The third coating system is silsesquioxane. The Marshall Space Flight Center Atomic Oxygen Beam Facility (AOBF) was used to simulate low Earth orbit AO of 5 eV energy. In addition, some tether samples were exposed to ultraviolet radiation then evaluated for any changes in mechanical strength. Tether missions, such as a momentum-exchange/electrodynamic reboost (MXER) tether, may benefit from this research.
Author
Space Environment Simulation; Environment Effects; Oxygen Atoms; Tetherlines; Protective Coatings; Ultraviolet Radiation

20050110340 Air Force Research Lab., Wright-Patterson AFB, OH USA
Scholarly Research Program. Delivery Order 0007: Characterization of Ionic Liquids as Fuel Cell Electrolytes
Keitz, Thomas L.; Katovic, Vladimir; Davidson, Amanda; Nov. 2004; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-98-2867; Proj-3145
Report No.(s): AD-A429817; AFRL-PR-WP-TR-2004-2130; No Copyright; Avail: Defense Technical Information Center (DTIC)

The object of this work was to synthesize the room temperature ionic liquids, EMImBF4, BMImBF4 and BMPBETI, and to study the electrochemical behavior of ethanol in these electrolytes on the Pt electrode. The electrochemical oxidation of EtOH on Pt electrodes in acidic medium involves several reaction pathways. The predominant pathway involves oxidation of bulk EtOH to CH3CHO which can be further partially oxidized to acetic acid. The secondary reaction involves oxidation of a strongly bound adsorbate, breaking the C-C bond and the formation of CO2. The electrochemical behavior of EtOH in ionic liquid was investigated and compared to the one obtained in acid aqueous electrolyte. It is expected that the use of the room-temperature ionic liquids might prevent poisoning of Pt electrode, by formation of PtO2 , and oxidize EtOH to CH3COOH or CO2.
DTIC
Electrochemistry; Electrolytic Cells; Fuel Cells; Liquids

20050110483 Michigan State Univ., East Lansing, MI USA
Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes
Namani, Madhu; Geng, Hai-Ping; Lee, Andre; Blanski, Rusty L.; Oct. 2004; 38 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A430036; No Copyright; Avail: Defense Technical Information Center (DTIC)

Polyhedral oligomeric silsesquioxane (POSS) offers a unique approach to examine the effect of molecularly dispersed

nanoscopic fillers on rheological properties of entangled polymer melts. Experiments were performed using a nearly-monodisperse molecular weight polystyrene (PS) blended with varying amounts of two fully condensed POSS molecules surrounded with phenethyl and styrenyl groups. Due to the chemical similarity between these organic moieties surrounding the silicon-oxygen framework (SiO1.5) of POSS and PS, we were able to obtain polymer blends with molecular dispersed nanoscopic fillers needed to study the effect of intermolecular nanoparticle-nanoparticle interactions and the associated intramolecular interactions on the dynamics of the polymer chains. Differential Scanning Calorimetry (DSC), Wide-angle X-ray Diffraction (WAXD) and Transmission Electron Microscopy (TEM) were used to characterize the thermal properties and morphologies of the POSS/PS blends. Smallstrain oscillatory shear and/or tensile method was used to probe the dynamics of polymer chains as influenced by the addition of different chemical moiety of POSS at the glass transition, rubbery state and the terminal-flow transition regions. Results obtained from the thermal and mechanical characterization methods were compared with morphological observations to better understand the structure-property relationship of polymers containing molecularly dispersed nanoscopic fillers.
DTIC
Morphology; Oligomers; Polystyrene; Siloxanes; Viscoelasticity

20050111434 Hughes Associates, Inc., Baltimore, MD USA
An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications
Back, G.; Forssell, E.; Wakelin, A.; Beene, D.; Nash, L.; Dec. 2004; 161 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DTCG39-00-D-R00008; DTCG-03-F-100047
Report No.(s): AD-A430075; CG-D-07-04; No Copyright; Avail: Defense Technical Information Center (DTIC)

Full-scale fire tests were conducted to identify the fire extinguishing capabilities and limitations of High Expansion Foam Fire Suppression Systems (HEFFSS) in shipboard machinery space applications. A total of 35 tests were conducted in this evaluation utilizing the equipment and foam concentrates from three manufacturers: Ansul, Buckeye and Chemguard. All three systems easily extinguished the pan fires included in this evaluation independent of the type of fuel (heptane or diesel). The differences in the systems' capabilities were observed during the extinguishment of the heptane spray fires that presented a major challenge to the HEFFSS. The difficulty observed in extinguishing spray fires and, conversely, the ease in extinguishing the pan fires, demonstrates that the current high expansion foam test protocol (MSC/Circ. 670) is inadequate for approving HEFFSS for machinery space applications. As a result, it is recommended that HEFFSS be approved using a modified version of the gaseous agent test protocol MSC/Circ. 848, rather than MSC/Circ. 670. Recommendations on how to modify the protocol to account for the differences between high expansion foam and gaseous agent technologies are provided in the report as well as issues requiring further research.
DTIC
Evaluation; Fire Extinguishers; Fires; Foams; System Effectiveness; Technology Utilization

20050111484 Ohio Univ., Athens, OH, USA
Evaluation of HPC Pavement in Nelsonville, Ohio
Sargand, S. M.; Dec. 2004; In English
Report No.(s): PB2005-103588; No Copyright; Avail: National Technical Information Service (NTIS)

A test of concrete maturity and durability was conducted on a segment of US Route 33 during a road reconstruction project in Nelsonville, Ohio. Three different mixes were compared: Mix A had 30% blast furnace slag and used no.57 aggregate; Mix B had 30% blast furnace slag and used no.357 aggregate; and Mix C was a standard ODOT mix with no slag and no.57 aggregate. Sections of 1000 ft (305 m) were constructed using each mix. Half of each section was cured using wet burlap and the other half was cured using a spray-on membrane. In one slab in each half section, thermocouples were installed at the center and at one corner to monitor temperatures during curing. Small batches of each mix of concrete were also made in the laboratory and cured in a climate controlled chamber.
NTIS
Concretes; Pavements; Durability

20050123581 NASA Glenn Research Center, Cleveland, OH, USA
Atomic Oxygen Treatment and Its Effect on a Variety of Artist's Media
Miller, Sharon K. R.; Banks, Bruce A.; Waters, Deborah L.; February 2005; 13 pp.; In English; 2004 Fall Meeting, 29 Nov. - 3 Dec. 2004, Boston, MA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-612-50-81-08; WBS 22-090-20-C3
Report No.(s): NASA/TM-2005-213434; E-15006; No Copyright; Avail: CASI; A03, Hardcopy

Atomic oxygen treatment has been investigated as an unconventional option for art restoration where conventional methods have not been effective. Exposure of surfaces to atomic oxygen was first performed to investigate the durability of materials in the low Earth orbit environment of space. The use of the ground based environmental simulation chambers, developed for atomic oxygen exposure testing, has been investigated in collaboration with conservators at a variety of institutions, as a method to clean the surfaces of works of art. The atomic oxygen treatment technique has been evaluated as a method to remove soot and char from the surface of oil paint (both varnished and unvarnished), watercolors, acrylic paint, and fabric as well as the removal of graffiti and other marks from surfaces which are too porous to lend themselves to conventional solvent removal techniques. This paper will discuss the treatment of these surfaces giving an example of each and a discussion of the treatment results.
Author
Oxygen Atoms; Paints; Acrylic Resins

24
COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20050092378 NASA Marshall Space Flight Center, Huntsville, AL, USA
Distributed Sensing of Composite Over-wrapped Pressure Vessel Using Fiber-Bragg Gratings at Ambient and Cryogenic Temperatures
Grant, Joseph; September 27, 2004; 1 pp.; In English; SPIE Smart Materials, Nano and Micro-Smart Systems 2004, 12-15 Dec. 2004, Sydney, Australia
Contract(s)/Grant(s): 104-07-01-00; No Copyright; Avail: Other Sources; Abstract Only

Fiber Bragg gratings are use to monitor the structural properties of composite pressure vessels. These gratings optically inscribed into the core of a single mode fiber are used as a tool to monitor the stress strain relation in laminate structure. The fiber Bragg sensors are both embedded within the composite laminates and bonded to the surface of the vessel with varying orientations with respect to the carbon fiber in the epoxy matrix. The response of these fiber-optic sensors is investigated by pressurizing the cylinder up to its burst pressure of around 2800 psi. This is done at both ambient and cryogenic temperatures using water and liquid nitrogen. The recorded response is compared with the response from conventional strain gauge also present on the vessel. Additionally, several vessels were tested that had been damaged to simulate different type of events, such as cut tow, delimitation and impact damage.
Author
Bragg Gratings; Pressure Vessels; Carbon Fibers; Laminates; Stress-Strain Relationships; Fiber Composites

20050092384 NASA Marshall Space Flight Center, Huntsville, AL, USA
Feasibility Assessment for Pressure Casting of Ceramic-Aluminum Composites for NASA's Propulsion Applications
Lee, Jonathan A.; [2005]; 1 pp.; In English; 29th Conference on Advanced Ceramics and Composites, 23-28 Jan. 2005, Cocoa Beach, FL, USA
Contract(s)/Grant(s): 090-26-RD; No Copyright; Avail: Other Sources; Abstract Only

Feasibility assessment of pressure casting of ceramic-aluminum composites for NASA% propulsion applications is summarized. A combination of several demonstration projects to produce three unique components for liquid hydrogen-oxygen rocket engine% flanges, valves and turbo-pump housing are conducted. These components are made from boron carbide, silicon carbide and alumina powders fabricated into complex net shaped parts using dry green powder compaction, slip casting or a novel 3D ink-jet printing process, followed by sintering to produce performs that can be pressure cast by infiltration with molten aluminum. I n addition, joining techniques are also explored to insure that these components can be assembled into a structure without degrading their highly tailored properties. The feasibility assessment was made to determine if these new materials could provide a significant weight savings, thereby reducing vehicle launch costs, while being durable materials to increase safety and performance for propulsion system.
Derived from text
Feasibility Analysis; Ceramic Matrix Composites; Casting; Aluminum Oxides

20050110223 NASA Langley Research Center, Hampton, VA, USA

Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity

Pinho, Silvestre T.; Davilla, C. G.; Camanho, P. P.; Iannucci, L.; Robinson, P.; February 2005; 69 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WU 23-064-30-22

Report No.(s): NASA/TM-2005-213530; L-19089; No Copyright; Avail: CASI; A04, Hardcopy

A set of three-dimensional failure criteria for laminated fiber-reinforced composites, denoted LaRC04, is proposed. The criteria are based on physical models for each failure mode and take into consideration non-linear matrix shear behaviour. The model for matrix compressive failure is based on the Mohr-Coulomb criterion and it predicts the fracture angle. Fiber kinking is triggered by an initial fiber misalignment angle and by the rotation of the fibers during compressive loading. The plane of fiber kinking is predicted by the model. LaRC04 consists of 6 expressions that can be used directly for design purposes. Several applications involving a broad range of load combinations are presented and compared to experimental data and other existing criteria. Predictions using LaRC04 correlate well with the experimental data, arguably better than most existing criteria. The good correlation seems to be attributable to the physical soundness of the underlying failure models.

Author

Failure Modes; Mathematical Models; Nonlinearity; Shear Stress; Three Dimensional Models; Mechanical Properties; Fiber Composites

20050110377 State Univ. of New York, Albany, NY USA

Fracture Toughness Improvement of Composites Reinforced with Optimally Shaped Short Ductile Fibers

Wetherhold, Robert C.; Patra, Abani K.; Jan. 2001; 9 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0529

Report No.(s): AD-A429880; ARO-42188.1-MS; No Copyright; Avail: Defense Technical Information Center (DTIC)

The fracture toughness of brittle matrix composites reinforced with ductile fibers has been greatly improved by shaping the fibers so that they fully contribute their plastic work to the fracture process. This has been accomplished by anchoring the fiber ends so that the largest possible fiber volume contributes to the toughness during pullout. A combined experimental and analytical program has shown that it is possible to organize fibers into shape families and to optimize the toughness with respect to geometric parameters within a given shape family. The interface conditions during pullout have been modeled using a new cohesive zone/Coulomb friction model with three parameters. Furthermore, adaptive methods in space and time were developed to reduce computational time. New indicators for error in spatial and temporal discretizations were derived and implemented. Once these parameters were inferred from one embedded length from the single fiber pullout test (SFP), predicted pullout toughness values at other embedded depths matched well with experimental results. In addition, fracture values predicted from SFP tests matched well with experimental composite fracture values. A list of 19 publications and technical reports on this topic and a bibliography are included.

DTIC

Ductility; Fiber Composites; Fracture Strength; Matrix Materials; Metal Fibers; Toughness

20050110522 Denver Univ., Denver, CO USA

Fundamental Issues Regarding the High Temperature Failure Properties of Graphite/Polyimide Fabric Composites

Kumosa, M. S.; Oct. 2004; 172 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0159

Report No.(s): AD-A430088; AFRL-SR-AR-TR-05-0011; No Copyright; Avail: CASI; A08, Hardcopy

In this work, a method based on X-ray diffraction (XRD) measurements of internal stresses in embedded metallic ellipsoidal inclusions is briefly described. The method has been recently developed for the determination of residual thermal stresses in high temperature graphite/polyimide composites. The effects of external bending loads and aging on the measurements of the internal stress in unidirectional and woven graphite fiber (T650-3 5)/polyimide (PMR-15) composites were examined in addition to several other factors which could influence the accuracy of the stress measurements. Such factors as the volume fraction of inclusions, their aspect ratios and the interaction between individual embedded inclusions were also evaluated in this study. It has been show that despite its complexity the proposed method can be successfully applied to the evaluation of residual stresses in high temperature polymer matrix composites subjected to external loads and aging.

DTIC

Fabrics; Failure; Graphite; High Temperature; Polyimides; X Ray Diffraction

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20050109774 Westinghouse Savannah River Co., Aiken, SC, USA
Six Sigma Evaluation of the High Level Waste Tank Farm Corrosion Control Program at the Savannah River Site
Hill, P. J.; 2003; In English
Report No.(s): DE2004-826257; No Copyright; Avail: National Technical Information Service (NTIS)

Six Sigma is a disciplined approach to process improvement based on customer requirements and data. The goal is to develop or improve processes with defects that are measured at only a few parts per million. The process includes five phases: Identify, Measure, Analyze, Improve, and Control. This report describes the application of the Six Sigma process to improving the High Level Waste (HLW) Tank Farm Corrosion Control Program. The report documents the work performed and the tools utilized while applying the Six Sigma process from September 28, 2001 to April 1, 2002.
NTIS
Corrosion Prevention; Radioactive Wastes

20050109783
Estimation of Radiolytic Gas Generation Rate for Cylindrical Radioactive Waste Packages - Application to Spent Ion Exchange Resin Containers
Husain, A.; Lewis, B. J.; 2004; 16 pp.; In English
Report No.(s): DE2004-827152; No Copyright; Avail: Department of Energy Information Bridge

Radioactive waste packages containing water and/or organic substances have the potential to radiolytically generate hydrogen and other combustible gases. Typically, the radiolytic gas generation rate is estimated from the energy deposition rate and the radiolytic gas yield. Estimation of the energy deposition rate must take into account the contributions from all radionuclides. While the contributions from non-gamma emitting radionuclides are relatively easy to estimate, an average geometry factor must be computed to determine the contribution from gamma emitters. Hitherto, no satisfactory method existed for estimating the geometry factors for a cylindrical package. In the present study, a formulation was developed taking into account the effect of photon buildup. A prototype code, called PC-CAGE, was developed to numerically solve the integrals involved. Based on the selected dimensions for a cylinder, the specified waste material, the photon energy of interest and a value for either the absorption or attenuation coefficient, the code outputs values for point and average geometry factors. These can then be used to estimate the internal dose rate to the material in the cylinder and hence to calculate the radiolytic gas generation rate. Besides the ability to estimate the rates of radiolytic gas generation, PC-CAGE can also estimate the dose received by the container material. This is based on values for the point geometry factors at the surface of the cylinder. PC-CAGE was used to calculate geometry factors for a number of cylindrical geometries. Estimates for the absorbed dose rate in container material were also obtained. The results for Ontario Power Generation's 3 m3 resin containers indicate that about 80% of the source gamma energy is deposited internally. In general, the fraction of gamma energy deposited internally depends on the dimensions of the cylinder, the material within it and the photon energy; the fraction deposited increases with increasing dimensions of the cylinder and decreases with increasing photon energy.
NTIS
Waste Management; Radioactive Wastes; Ion Exchange Resins; Spent Fuels; Containers

20050109818 Pennsylvania State Univ., University Park, PA, USA
Reaction Mechanisms of Magnesium Silicates with Carbon Dioxide in Microwave Fields
White, W. B.; Silsbee, M. R.; Feb. 18, 2004; In English
Report No.(s): DE2004-826203; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of the investigation was to determine whether microwave fields would enhance the reactions of CO2 with silicates that are relevant to the sequestration of carbon dioxide. Three sets of experiments were conducted. (1) Serpentine and CO2 were reacted directly at one atmosphere pressure in a microwave furnace. Little reaction was observed. (2) Serpentine was dehydroxylated in a microwave furnace. The reaction was rapid, reaching completion in less than 30 minutes. A detailed investigation of this reaction produced an S-shaped kinetics curve, similar to the kinetics from dehydroxylating serpentine in a resistance furnace, but offset to 100 DGC lower temperature. This set of experiments clearly demonstrates the effect of

microwaves for enhancing reaction kinetics. (3) Reactions of serpentine with alkaline carbonates and in acid solution were carried out in a microwave hydrothermal apparatus.
NTIS
Carbon Dioxide; Silicates

20050109850 Kentucky Univ., Lexington, KY, USA
Innovative Integrated Approach to Minimizing Gypsum and Pyrite Wastes by Conversion to Marketable Products
Jun. 2000; In English
Report No.(s): DE2004-828887; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of this research program is to develop a novel integrated process to eliminate millions of tons of gypsum and pyrite wastes generated annually by the U. S. energy industries and reduce the emission of millions of tons of greenhouse gas carbon dioxide. This was accomplished by converting gypsum and pyrite wastes to marketable products such as lime, direct reduced iron (DRI), and sulfur products and obviating the need to calcine millions of tons of limestone for use in utility scrubbers.
NTIS
Waste Management; Gypsum; Solid Wastes

20050110331 California State Univ., Northridge, CA USA
Electronic Structure and Mechanical Properties of Metals and Intermetallics
Kioussis, Nicholas; Dec. 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0049; AMSRD-ACC-R-70-1T
Report No.(s): AD-A429805; ARO-41226.6-PH; No Copyright; Avail: Defense Technical Information Center (DTIC)

State-of-the-art first-principles electronic structure calculations based on the full-potential linear-muffin-tin-orbital method and the pseudopotential method were employed to study systematically: 1) The dislocation core properties of the clean aluminum and silver systems; 2) The effect of sampling scheme of the misfit energy across the glide plane; 3) The Hydrogen-enhanced local plasticity in aluminum; 4) The correlation of the topology of the electronic charge density with the energetics and stability of planar faults in fcc metals; 5) The grain boundary sliding properties in aluminum and the effect of a vacancy on the grain boundary migration; 6) The effect of hydrogenation on the electronic structure of single-walled carbon nanotubes; 7)The electronic structure of metal/ceramic interfaces between Al2O3 and titanium overlayers; 8) The adsorption properties of a monomer H2O molecule on the Ni3Al (001) surface; and (9) The dislocation core properties of Cu-Al alloys.
DTIC
Electronic Structure; Intermetallics; Mechanical Properties; Metals

20050110338 Cranfield Univ., Cranfield, UK
Porous Media Combustors for Clean Gas Turbine Engines
Noordally, E.; Przybylski, J. M.; Witton, J. J.; Dec. 2004; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0393
Report No.(s): AD-A429813; TR-9210/1-01/04; No Copyright; Avail: Defense Technical Information Center (DTIC)

A preliminary assessment has been made of a combustor in which the reaction is stabilized in a porous, incombustible medium. Its performance at elevated pressures and inlet temperatures has been studied with emissions and stability determined over a wide range of conditions together with the pressure loss and diffusivity of the porous matrix elements from which the combustor is made. The combustor was formed of reticulated porous ceramics, untreated to augment or sustain chemical reaction. The characteristics of combustion within porous media which are attractive in a propulsion context are the ability to burn leaner and hotter than a free flame. with low emissions, no cooling requirement for the combustor itself and the potential to operate free from combustion-induced noise. The reduced combustion loading resulting from lean burn operation is partially offset by heat transferred within the porous matrix raising the maximum reaction temperature. Data has been obtained at pressures to 1200kPa, reactant preheat to 700K, with methane, methane-hydrogen mixtures and hydrogen alone. The results show that the combustor operates in a 'super-adiabatic' mode, with low emissions. Intrinsic pressure loss is within values commonly accepted for propulsion gas turbines. No durability problems were found, within operating durations of approximately 40 hours per matrix assembly.
DTIC
Combustion Chambers; Gas Turbine Engines; Gas Turbines; Porosity; Porous Materials

20050110351 Naval Postgraduate School, Monterey, CA USA

Infrared Characterization of SiN Films on Si for High Speed Electronics Applications

Tellez, Galdino M.; Dec. 2004; 50 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429837; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this thesis SiN films grown on Si substrates were characterized using Fourier Transform Infrared (FTIR) spectroscopy. The stress in SiN films can be used to enhance of mobility of electrons and holes which increases the performance of metal-oxide-semiconductor (MOS) transistors. The samples used in this study were prepared by Applied Materials using chemical vapor deposition (CVD) technique with different growth parameters. The stress of the samples varied from 1.3 GPa compressive to 1 GPa tensile depending on the growth conditions employed. The FTIR measurement showed three distinct absorption peaks associated with Si-N, Si-H and N-H vibrational modes. The hydrogen was unintentionally incorporated into the SiN film during the CVD process due to its use as the carrier gas for the precursors. It was found from the FTIR data that the area under Si-H and N-H peaks (amount of bonds) varies in opposite directions when the film stress changes from compressive to tensile. In addition, the peak position of the Si-H absorption shifted to higher energy while the opposite was true for N-H as the stress changes from compressive to tensile. The strength and the position of the Si-N absorption peak were found to be relatively insensitive to the stress of the film. This indicates that the amount of Si-H and N-H bonds in the film is responsible for controlling the stress of the film. The use of quantum calculation of SiN molecules with different amount of Si-H and N-H bonds was used toward understanding the experimental absorption spectra.

DTIC

Electron Mobility; High Speed; Infrared Radiation; Infrared Spectra; Infrared Spectroscopy; Metal Oxide Semiconductors; Silicon Nitrides; Transistors

20050110397 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter

Buettner, Leonard C.; Vickers, Eugene L.; Friday, David K.; Oct. 2004; 48 pp.; In English

Report No.(s): AD-A429909; ECBC-TR-393; No Copyright; Avail: CASI; A03, Hardcopy

The Program Manager, Elimination of Chemical Weapons, tasked the U.S. Army Edgewood Chemical Biological Center (ECBC), Chemical Biological Filtration Team, to estimate the protection time afforded by the Oquirrh Mountain Facility's (OMF) process filter for lewisite. To accomplish this, it was necessary to construct a test apparatus to measure lewisite breakthrough data and develop a defensible methodology to convert these data into a process filter performance estimate. This report provides all the details of the experimental system design, data measured, and analysis used to generate the process filter protection time. In addition, data were measured for two additional adsorbents: (1) 12 x 30 mesh ASZM-TEDA carbon to establish protection times for a C2 canister, and (2) 6 x 16 mesh ASZM-TEDA carbon to determine if using this material would be more suitable than using the Vapure 612 in the process filter. The process filter using the Vapure 612 carbon currently installed at the OMF site will prevent lewisite from penetrating the first 3-foot bed section for at least 5 years. This estimate assumes the worst operating conditions possible. There is a potential for false positives due primarily to the fact that the Vapure 612 will not retain HCl. The authors recommend changing one filter bank of Vapure 612 carbon with the Calgon's ASZM-TEDA carbon to prevent this.

DTIC

Adsorbents; Carbon; Filtration; Mountains; Protection; Test Stands

20050110407 Cornell Univ., Ithaca, NY USA

Support for Advanced Imaging of Premixed Turbulent Combustion Processes

Gouldin, F. C.; Nov. 2004; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0251

Report No.(s): AD-A429927; ARO-45741.1-EG; No Copyright; Avail: Defense Technical Information Center (DTIC)

The laser imaging diagnostics of crossed-plane laser tomography (CPLT) and stereo particle image velocimetry (SPIV) have been combined for a systematic study of premixed turbulent combustion in CH4-air, V-burner and swirl-burner flames. Data sets comprised of between 1500 and 2000 realizations have been obtained for 11 different V-flame conditions and 5 different swirl-burner flame conditions. These raw data sets are being analyzed to build a unique database that quantifies mean flame properties (e.g., mean progress variable fields), chemical reaction sheet wrinkling by turbulence (e. g., reaction sheet orientation statistics, curvatures and surface density data) and important velocities (e. g., velocity field of reactants, reaction sheet displacement speeds and gas velocity correlations at the reaction sheet surface). The most significant finding to date is

that of negative displacement speeds and a correlation between displacement speed and reaction sheet curvature. These developments are outlined in this report.
DTIC
Combustion Physics; Diagnosis; Flames; Imaging Techniques; Lasers; Particle Image Velocimetry; Premixing; Turbulent Combustion; Turbulent Flow

20050110430 Old Dominion Univ., Norfolk, VA USA
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA)
Burdige, David J.; Donat, John R.; Gordon, Andrew S.; Apr. 2005; 5 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0894
Report No.(s): AD-A429965; No Copyright; Avail: CASI; A01, Hardcopy

This project was a modeling and synthesis effort that examined metal and metal-complexing ligand dynamics in a major US Naval harbor, the Elizabeth River (VA). It built on our past work (funded through the ONR Harbor Processes program) studying the biogeochemical cycling of Cu, Cd, Zn, and Mn in the water column and sediments of the Elizabeth River.
DTIC
Complexity; Cycles; Harbors; Ligands; Metals; Rivers; Toxicity; Water Pollution

20050110437 Southwest Research Inst., San Antonio, TX USA
Investigation of On-Vehicle Fuel Catalyst System
Frame, Edwin A.; Sep. 2004; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAE07-99-C-L053-WD16
Report No.(s): AD-A429975; TFLRF-375; No Copyright; Avail: Defense Technical Information Center (DTIC)

On-vehicle pre-combustion fuel catalytic devices have the potential to improve fuel performance in the areas of decreased fuel consumption reduced exhaust emissions and restored fuel properties. SwRI/TFLRF subcontracted with Advanced Power Systems Incorporated (APSI) to develop enhanced fuel pre-combustion catalyst systems for use with diesel fuel and JP-8 fuel. APSI developed and delivered three fuel pre-combustion catalyst systems. The systems will be evaluated in the future by TACOM. SwRI/TFLRF evaluated a baseline fuel catalyst system for its effect on fuel economy and fuel property changes. Under the conditions tested no fuel economy benefit was observed for the baseline device. The stability of aged diesel fuel was not improved by flowing fuel through the baseline device.
DTIC
Catalysts; Combustion; Diesel Fuels; Fuel Systems

20050110440 California Inst. of Tech., Pasadena, CA USA
Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities
Culick, Fred E.; Ratner, Albert; Kang, Dal M.; Matveev, Konstantin I.; Pun, Winston; Dec. 2004; 56 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0384
Report No.(s): AD-A429980; AFRL-SR-AR-TR-05-0009; No Copyright; Avail: CASI; A04, Hardcopy

This report is the final report of a six-month program with a six-month NCE comprising experimental work on problems arising with unsteady combustion of gases intended for use in propulsion systems. The experimental work comprises measurements providing the basis for inferring the local response function of a reacting mixture and is based on great extended equipment purchased before this program began, with a DURIP grant from AFOSR. The basic part of the facility is apparatus for PLIF (planar laser induced fluorescence) measurements of a combustion system exposed to a sinusoidally varying pressure field, p', with q', the local fluctuation of heat release, appropriate measurements allow inference of q'/p' proportional to the response function and q'p', the integral over volume is proportional to the Rayleigh factor. In principal knowledge of these two quantities permits deduction of all important dynamical properties of a dynamical system. The greatest part of work during this year has been directed to determining the effect of fluctuations in fuel mixture ratio, most of the experimental work has been based on the use of acetone PLIF.
DTIC
Combustion; Combustion Chemistry; Combustion Control; Reaction Kinetics; Stability

20050110463 Delaware Univ., Newark, DE USA

Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion

Wang, Hai; Dec. 2004; 6 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0008; Proj-2328

Report No.(s): AD-A430011; AFRL-SR-AR-TR-05-0024; No Copyright; Avail: CASI; A02, Hardcopy

Studies were conducted to finalize a fundamental and predictive reaction model for the combustion of hydrogen and carbon monoxide through a multi-parameter optimization. These studies showed that reliable data of hydrogen and carbon monoxide oxidation at high temperatures can be reconciled be a single kinetic model. An advanced approach to solve the master equation of collision energy transfer was developed to predict the rate constants of combustion reactions of arbitrary complexities. Studies were also conducted on a class of unique combustion reactions that involve spin state crossing-one of the last few unresolved theoretical problems in combustion reaction kinetics.

DTIC

Carbon Monoxide; Combustion; Fuel Combustion; Hydrocarbon Fuels; Hydrogen; Liquid Fuels; Predictions; Reaction Kinetics

20050110479 Massachusetts Inst. of Tech., Cambridge, MA USA

Bio-Derived Photonic Assemblies

Thomas, Edwin L.; Morris, Cohen; Mickiewicz, Rafal; Jan. 2005; 21 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0509

Report No.(s): AD-A430030; AFRL-SR-AR-TR-05-0038; No Copyright; Avail: CASI; A03, Hardcopy

Biologically derived photonic assemblies were created using two different approaches. The first method employed the periodic, bi-continuous exoskeleton structure of a sea urchin as a template for the construction of a 3-dimensional (3-D) photonic crystal. The second approach involved viral particles of the Wiseana iridescent virus (W!V), assembled by various means to produce colloidal photonic crystals. In the first case, a novel cyclic size reduction scheme was devised to shrink the native sea urchin skeleton structure to the relevant size scale. This method produced high fidelity replicas of the original structure with a 50% decrease in linear dimensions at each iteration. The silicon oxycarbide (SiOC): air replica was subsequently infiltrated with tellurium (Te) and etched to increase the dielectric contrast, resulting in a Te: air structure exhibiting a sharp, well defined reflectivity peak in the mid-IR range. In the second case, sedimentation, centrifugation, and flow-assisted assembly were successfully used to guide virus particles into ordered colloidal crystals with photonic properties in the visible range. The centrifugation and flow-assisted techniques created larger area crystals with better defined spectral properties than the sedimentation technique. Significantly, the spectral properties (color) of both disordered and polycrystalline assemblies could be tuned by swelling the cross-linked colloidal crystals with water and varying processing parameters.

DTIC

Crystals; Sea Urchins

20050110523 North Carolina State Univ., Raleigh, NC USA

Environmental Life Cycle Techniques for New Weapons Acquisition Systems

Overcash, Michael; Sep. 2004; 59 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0265

Report No.(s): AD-A430092; ARO-45623.1-RT; No Copyright; Avail: Defense Technical Information Center (DTIC)

Environmental issues are an integral part of new systems acquisitions, from the simplest product to the more complex systems. This project is a part of the effort to understand the product variables for new systems and the methods for environmental improvement. The first system studied, in this joint US. Swedish project, is a PFHE shell grenade. We have begun by improving the techniques for determining the chemical emissions and energy requirements of the components of the PFHE shell. These components are weighting factors for making trade-offs of alternative materials and chemicals for such munitions. The shell life cycle was subdivided into eight subsystems, five of which are related to manufacturing. Since many munitions are not used in training or war, these manufacturing subsystems were discovered to be of significant importance. Our effort in this reporting period has been to develop the life cycle inventory of several chemicals not currently in the Swedish database. These were, di n-amyl phthalic acid ester, ammonium nitrate, trinitrotoluene, silver azide, and lead azide. The next step is to understand the relative environmental impact of the materials and chemicals architecture of this munition in relation to the overall product life cycle.

DTIC

Grenades; Life (Durability); Weapon Systems

20050110535 Nomadics, Inc., Stillwater, OK USA

Explosive Chemical Signature-Based Detection of IEDs

Fisher, Mark; Dec. 2004; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-M-0382

Report No.(s): AD-A430111; No Copyright; Avail: Defense Technical Information Center (DTIC)

The objectives of this contract were as follows: To further characterize and understand the explosive chemical signature of improvised explosive devices (IEDs); Develop and adapt high-volume sampling methods for use against IEDs and for incorporation into a robotic platform; Modify and adapt the Fido sensor device to operation on a small robot; Integrate the Fido and high-volume sampling functions into a small footprint commensurate with operation of a small robot; and Test the integrated prototype in the laboratory and in the field. These objectives were achieved and were demonstrated in a proof-of-concept test at the U.S. Army Yuma Proving Grounds (YPG) countermine test facility from December 13-17, 2004. During these tests, a Fido vapor sensor modified to include high-volume sampling capability was deployed on a Dragon Runner robotic platform. The combined system was able to detect a range of IEDs throughout the course of the test. Nomadics personnel were able to quickly train an EOD technician and a Marine Corps Captain to operate the sensor and detect targets deployed along a roadway. These targets were detected by the integrated platform while providing substantial standoff between the system operator and IED. Targets concealed in vehicles also were detected. In related work, trace-level contamination on personnel that had handled explosives (i.e., EOD technicians), and trace contamination spread by persons that had handled explosives was demonstrated with the sensor when operated in a handheld mode. This report discusses work completed towards achieving each objective listed above, and provides suggestions for future work to enhance the capability of the system for the warfighter.

DTIC

Chemical Analysis; Explosives Detection; Robots; Signatures; Vapors

20050110550 Purdue Univ., West Lafayette, IN USA

Demonstration of Silicon Carbide Power Devices in Practical Power Conversion Systems

Cooper, James A., Jr.; Sudhoff, Scott D.; Kwon, C.; Glover, S. F.; Jan. 2005; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0077

Report No.(s): AD-A430136; No Copyright; Avail: Defense Technical Information Center (DTIC)

The goals of this project are: (1) to develop a design and processing sequence for high-power 4H-SiC bipolar junction transistors (BJTs) with blocking voltages above 1,000 V and on-state currents above 25 A; (2) to fabricate and package sufficient quantities of these devices to implement a demonstration motor control system; (3) to design and develop a prototype 40-100 kW motor control system for demonstrating the SiC BJTs; and (4) to operate the SiC BJTs in the prototype system as a real-world test of the feasibility of this technology for practical power conversion systems.

DTIC

Bipolar Transistors; Energy Conversion; Junction Transistors; Silicon Carbides

20050111587 Lawrence Livermore National Lab., Livermore, CA

Gamma-Ray Identification of Nuclear Weapon Materials

Gosnell, T. B.; Hall, J. M.; Ham, C. L.; Knapp, D. A.; Koenig, Z. M.; Feb. 1997; In English

Report No.(s): DE2004-16135; UCRL-ID-127436; No Copyright; Avail: National Technical Information Service (NTIS)

There has been an accelerating national interest in countering nuclear smuggling. This has caused a corresponding expansion of interest in the use of gamma-ray spectrometers for checkpoint monitoring, nuclear search, and within networks of nuclear and collateral sensors. All of these are fieldable instruments-ranging from large, fixed portal monitors to hand-held and remote monitoring equipment. For operational reasons, detectors with widely varying energy resolution and detection efficiency will be employed. In many instances, such instruments must be sensitive to weak signals, always capable of recognizing the gamma-ray signatures from nuclear weapons materials (NWM), often largely insensitive to spectral alteration by radiation transport through intervening materials, capable of real-time implementation, and able to discriminate against signals from commonly encountered legitimate gamma-ray sources, such as radiopharmaceuticals. Several decades of experience in classified programs have shown that all of these properties are not easily achieved and successful approaches were of limited scope-such as the detection of plutonium only. This project was originally planned as a two-year LDRD-ER. Since funding for 1997 was not sustained, this is a report of the first year's progress.

NTIS

Gamma Ray Spectrometers; Nuclear Weapons

20050123611 NASA Glenn Research Center, Cleveland, OH, USA

Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development

Ilhan, Faysal; Tyson, Daniel S.; Smith, Deedee; Meador, Mary Ann; Meador, Michael A.; [2004]; 2 pp.; In English; American Chemical Society National Meeting, 28 Mar. - 1 Apr. 2004, Anaheim, CA, USA

Contract(s)/Grant(s): 22-708-04-04

Report No.(s): E-14340; No Copyright; Avail: CASI; A01, Hardcopy

Diels-Alder cycloadditions have often been utilized in polymer synthesis as an alternative to condensation reactions. In our earlier efforts, we developed a new method for the preparation of linear aromatic polyimides, which employs o-quionodimethanes (o-QDMs), generated by a well-known photochemical reaction: the photoenolization of o-methylphenyl ketones. Photolysis of o-methylbenzophenone 1 produces hydroxy-o-quino- diemthane 2, which can be trapped with dienophiles, such as dimethyl acetylenedicarboxylate, to efficiently yield the corresponding cycloadduct (Scheme 1). Here we extend this approach to a novel photocuring process for development of polymer films. We synthesized a series of molecules with multi o-mehtylphenyl ketone functionalities. We further investigated these molecules as photoreactive monomers to obtain polyester films through Diels-Alder cycloadditions.

Derived from text

Acrylic Resins; Diels-Alder Reactions; Dienes; Photochemical Reactions; Esters; Polymeric Films

20050123900 Toledo Univ., OH, USA

Sulfur Oxidation and Contrail Precursor Chemistry

DeWitt, Kenneth; Hwang, Soon M.; March 08, 2005; 79 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG3-2674; Copyright; Avail: CASI; A05, Hardcopy

Sulfuric acid (H2SO4), formed in commercial aircraft operations via Fuel-S (right arrow) SO2 + SO3 (right arrow) H2SO4, plays an important role in affecting the global climate change through atmospheric chemical reactions and radiative forcing. Measurement of the sulfur oxidation rates is critical to the understanding of the contrail formation. The principle reaction pathway is SO2 + O + M (right arrow) SO3 + M. Although there are many measurements for the rates of this reaction, it has never been measured in the temperature and pressure regime available to aircraft operation. In this investigation, a series of experiments were performed behind the reflected shock waves in a shock tube. OH radicals were produced in lean, shock heated SO2/H2/O2/Ar mixtures. The reaction progress was followed using OH absorption spectroscopy at 310 nm. The data were analyzed with the aid of computer modeling/simulation. The mean value of the rate coefficients of R21 determined is k(sub 21,0)/[M]= 3.9 x 10(exp 15) cm(sup 6) per square mole per second at T = 960 - 1150 K and rho = 16-30 micromole per cubic centimeter with uncertainty limits of plus or minus 30%. A non-Arrhenius fit to our data together with all existing data gives k(sub 21,0)/[M] = 1.3 x 10(exp 24) T (exp -2.5) exp(-2350 K/T) cm(sup 6) per square mole per second at T = 300 - 2500 K with the same uncertainty limits given above. The calculated conversion of S(IV)(SO2) to S(VI) (SO3 + H2SO4) was about 2% in our experimental conditions.

Author

Contrails; Oxidation; Sulfur; Aircraft Fuels; Chemical Reactions

20050123913 NASA Glenn Research Center, Cleveland, OH, USA

Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials

Meador, Mary Ann B.; Fabrizio, Eve F.; Ilhan, Faysal; Dass, Amala; Zhang, Guo-Hui; Vassilaras, Plousia; Johnston, J. Chris; Leventis, Nicholas; [2005]; 44 pp.; In English

Contract(s)/Grant(s): 22-714-85-08

Report No.(s): E-15035; Copyright; Avail: CASI; A03, Hardcopy

The mesoporous surfaces of TMOS-derived silica aerogels have been modified with amines by co-polymerization of TMOS with APTES. The amine sites have become anchors for crosslinking the nanoparticles of the skeletal backbone of the aerogel by attachment of di-, tri and tetra-functional epoxies. The resulting conformal coatings increase the density of the native aerogels by a factor of 2-3 but the strength of the resulting materials may increase by more than two orders of magnitude. Processing variables such as amount of APTES used to make the gels, the epoxy type and concentration used for crosslinking, as well as the crosslinking temperature and time were varied according to a multivariable design-of-experiments (DOE) model. It was found that while elastic modulus follows a similar trend with density, maximum strength is attained neither at the maximum density nor at the highest concentration of -NH2 groups, suggesting surface saturation effects. Aerogels crosslinked with the tri-functional epoxide always show improved strength compared with aerogels crosslinked with

the other two epoxides under identical conditions. Solid C-13 NMR studies show residual unreacted epoxides, which condense with ne another by heating crosslinked aerogels at 150 C.
Author
Aerogels; Amines; Crosslinking; Epoxy Resins; Porous Materials; Silicon Dioxide

26
METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20050109816 Houston Univ., TX, USA, Brookhaven National Lab., Upton, NY, USA
Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal
Klemradt, U.; Aspelmeyer, M.; Abe, H.; Wood, L. T.; Moss, S. C.; 1999; 16 pp.; In English
Report No.(s): DE2004-770708; BNL-67181; No Copyright; Avail: Department of Energy Information Bridge

Both X-ray diffuse reflectivity and laser light scattering have been used to investigate the temperature-dependent surface behavior of a Ni(63)Al(37) single crystal on different length scales. In-situ experiments were performed above the conventional martensitic start temperature M(sub s). to search for premartensitic phenomena. X-ray experiments showed the presence of a surface precursor with second-order (continuous) character several 10 K above M(sub s). This premonitory effect corresponds to a height-height-correlation function which changes on the nanometer scale as the martensitic transformation is approached. At the martensitic transformation, the surface morphology changed from nanoscopic roughness to macroscopic relief within a temperature interval of less than 1 K via intermediate stages.
NTIS
X Rays; Nickel; Aluminum; Martensitic Transformation; Laser Outputs; Temperature Effects

20050109838 McDermott Technology, Inc., Alliance, OH, USA, Electric Power Research Inst., Palo Alto, CA, USA, Foster Wheeler Corp., Livingston, NJ, USA
Boiler Materials for Ultrasupercritical Coal Power Plants. Third Quarterly Report April 1 to June 30, 2004
Viswanathan, R.; Coleman, K.; Shingledecker, J.; Sarver, J.; Stanko, G.; Jul. 2004; In English
Report No.(s): DE2004-829612; No Copyright; Avail: National Technical Information Service (NTIS)

The U.S. Department of Energy (DOE) and the Ohio Coal Development Office (OCDO) have recently initiated a project aimed at identifying, evaluating, and qualifying the materials needed for the construction of the critical components of coal-fired boilers capable of operating at much higher efficiencies than current generation of supercritical plants. This increased efficiency is expected to be achieved principally through the use of ultrasupercritical steam conditions (USC). The project goal initially was to assess/develop materials technology that will enable achieving turbine throttle steam conditions of 760 deg. C (1400 deg. F)/35 MPa (5000 psi), although this goal for the main steam temperature had to be revised down to 732 deg. C (1350 deg. F), based on a preliminary assessment of material capabilities. The project is intended to build further upon the alloy development and evaluation programs that have been carried out in Europe and Japan. Those programs have identified ferritic steels capable of meeting the strength requirements of USC plants up to approximately 620 deg. C (1150 deg. F) and nickel-based alloys suitable up to 700 deg. C (1300 deg. F). In this project, the maximum temperature capabilities of these and other available high-temperature alloys are being assessed to provide a basis for materials selection and application under a range of conditions prevailing in the boiler. This report provides a quarterly status report for the period of April to June 30, 2004.
NTIS
Boilers; Power Plants; Construction Materials

20050109889 NASA Marshall Space Flight Center, Huntsville, AL, USA
High Tensile Strength Amalgams for In-Space Repair and Fabrication
Grugel, R. N.; [2005]; 1 pp.; In English; Continuing the Voyage of Discovery: 1st Space Exploration Conference, 2-4 Feb. 2005, Orlando, FL, USA; Copyright; Avail: Other Sources; Abstract Only

Amalgams are defined as an alloy of mercury with one or more other metals. These, along with those based on gallium (also liquid at near room temperature), are widely used in dental practice as a tooth filling material. Amalgams have a number of useful attributes that indude room temperature compounding. corrosion resistance, dimensional stability, and good compressive strength. These properties well serve dental needs but, unfortunately, amalgams have extremely poor tensile

strength, a feature that severely limits their applications. The work presented here demonstrates how, by modifying particle geometry, the tensile strength of amalgams can be increased and thus extending the range of potential applications. This is relevant to, for example, the freeform fabrication of replacement parts that might be necessary during an extended space mission. Advantages, i.e. Figures-of-Merit. include the ability to produce complex parts, minimum crew interaction, high yield - minimum wasted material, reduced gravity compatibility, minimum final finishing, safety, and minimum power consumption. Author

Mercury Amalgams; Space Maintenance; Tensile Strength

20050110388 Northwestern Univ., Evanston, IL USA

Ab-Initio Simulation of a/2\h110\g Screw Dislocations Gamma-TiAl

Woodward, C.; Rao, S. I.; Nov. 2004; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-01-C-5214; Proj-2306; Proj-M02R

Report No.(s): AD-A429899; AFRL-ML-WP-TR-2004-409; No Copyright; Avail: Defense Technical Information Center (DTIC)

The equilibrium core structure of an isolated a/2\h110?111! screw dislocations is calculated using a first-principles pseudopotential-planewave method within the Local Density Approximation of Density Functional Theory. In this work the local dislocation strain field is self-consistently coupled to the long-range elastic field using a flexible boundary condition method. This ab-inition adaptation of the Greens Function Boundary Condition method makes it possible to stimulate the dislocation in a very small periodic cell without compromising the fidelity of the final core configuration. Supercells of 210, 288, and 420 atoms are used to evaluate the local screw and edge displacement of a straight a/2\h110?111! screw dislocations in y-TiAl. The predicted dislocation core is non-planar with significant portions of the dislocation core spread on conjugate ?111! glide planes. By applying a pure (111) shear stress the lattice friction stress is estimated to be approximately 0.006 micro in reasonable agreement with experimental observations. The non-planar character of the dislocation core suggests that the dislocation is sessile, and would readily glide on either of two ?111! slip planes. The dislocation core also produces small but significant edge components that are expected to interact strongly with non-glide (e.g., Escaig) stresses producing significant non-Schmid behavior.

DTIC

Screw Dislocations; Simulation; Titanium Aluminides

20050110448 Massachusetts Inst. of Tech., Cambridge, MA USA

Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP)

Cima, Michael J.; Nov. 2004; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-00-1-0124

Report No.(s): AD-A429993; ARO-41073.1-PH; No Copyright; Avail: Defense Technical Information Center (DTIC)

The BaO-SiO2 material system, which has a 2.4 stronger index changing ability than the Al2O3-SiO2 material system, was developed. Barium acetate was used as the dopant source. The pre-sintering treatment was found to be 900 degrees C for 18 hours in air to convert barium acetate to barium oxide. The sintering condition was found to be 1725 degrees C for 10 minutes in vacuum. A barium oxide-doped GRIN lens with radial parabolic index variation was fabricated. Its effective focal length was measured to be 14.63cm in the x direction and 11.14cm in the y direction. The barium oxide concentration profiles were measured. The theoretical focal lengths were calculated and compared with the effective focal lengths.

DTIC

Acetates; Barium; Barium Oxides; Gradients; Lenses; Printing; Silicon Dioxide; Slurries

20050123561 Media and Process Technology, Inc., Pittsburgh, PA

Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor

Liu, P.K.; Jul. 02, 2004; 28 pp.; In English

Report No.(s): DE2004-826352; No Copyright; Avail: Department of Energy Information Bridge

The porous stainless steel substrate commercially available from Pall offers great potential for large-scale membrane based high temperature gas separations. Our proposed project involves the deposition of the M&P carbon molecular sieve-based hydrogen membrane on AccuSep substrate as a membrane to reactor water-gas-shift reaction. However, the AccuSep substrate was originally designed for liquid phase applications . During the 1st half, this commercial substrate has been modified and improved with regard to its surface topography and end seals. The substrate is now suitable for the deposition of the CMS membrane for hydrogen separation according to the characterization we preformed. In addition,

40(angstrom) Al(sub 2)O(sub 3) membrane layers have been deposited on the improved AccuSep substrate successfully. The SEM, EDX and pore size distribution analysis indicate that the 40(angstrom) membrane is extremely thin, and defect free with a narrow pore size distribution around 40(angstrom) primarily. As the above results suggest, we have made significant progress in preparing a high quality nominal 40(angstrom) (actually 50(angstrom)) layer on the Pall substrate. During the 2nd half of Year 1, we will (1) continue this development work with a focus on eliminating the high pore size peak and (2) begin the CMS layer deposition on the 40(angstrom) deposited AccuSep.
NTIS
Hydrogen Production; Stainless Steels

20050123565 Siempelkamp Giesserei K. G., Krefeld, Germany, Technische Univ., Aachen, Germany
Release of Residues from Melting Norm-Contaminated Steel Scrap. A German Approach
Quade, U.; Thierfeldt, S.; Woerlen, S.; 2003; 12 pp.; In English
Report No.(s): DE2004-826351; No Copyright; Avail: Department of Energy Information Bridge

As many raw materials like crude oil, natural gas, mineral sands, phosphor ores and others are contaminated by radionuclides from the Uranium and/or Thorium decay chain (NORM), also plants for processing these materials became contaminated during operation. When plants are shut down, large quantities of pipes, valves, pumps and other components have to be scrapped. As scrap yards and steel mills are equipped by large detector systems to avoid an input of radioactivity into the steel cycle, decontamination is required before recycling. Siempelkamp is operating a melting plant for processing NORM and/or chemically/ toxically contaminated steel scrap. Beside the decontaminated steel as output, residues like slag and filter dust have to be managed within the range of licensed values. Based on the European Safety Standard the European member states have to implement radiation exposure from work activities with NORM in their Radiation Protection Ordinances (RPO). The German government revised the RPO in July 2001. Part 3 describes exposure limits for workers and for the public. Exposures from residues management have to meet 1 mSv/year. Brenk Systemplanung has performed calculations for assessing the radiation exposure from residues of the Siempelkamp melting plant. These calculations have been based on the input of metal from different origins and include all relevant exposure pathways in a number of scenarios. The calculations have been based on the dose criterion of 1 mSv/y as required by the German RPO. The methods and results will be presented.
NTIS
Radiation Protection; Radioactive Isotopes

20050123582 NASA Glenn Research Center, Cleveland, OH, USA
GRCop-84: A High-Temperature Copper Alloy for High-Heat-Flux Applications
Ellis, David L.; February 2005; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-794-20-77
Report No.(s): NASA/TM-2005-213566; E-15011; No Copyright; Avail: CASI; A03, Hardcopy

GRCop-84 (Cu-8 at.% Cr-4 at.% Nb) is a new high-temperature copper-based alloy. It possesses excellent high-temperature strength, creep resistance and low-cycle fatigue up to 700 C (1292 F) along with low thermal expansion and good conductivity. GRCop-84 can be processed and joined by a variety of methods such as extrusion, rolling, bending, stamping, brazing, friction stir welding, and electron beam welding. Considerable mechanical property data has been generated for as-produced material and following simulated braze cycles. The data shows that the alloy is extremely stable during thermal exposures. This paper reviews the major GRCop-84 mechanical and thermophysical properties and compares them to literature values for a variety of other high-temperature copper-based alloys.
Author
Copper Alloys; Mechanical Properties; Thermophysical Properties; Thermal Expansion; Heat Resistant Alloys; High Temperature

20050123899 NASA Glenn Research Center, Cleveland, OH, USA
Energetics of Oxygen Interstitials in Cr and V
Good, Brian S.; Copland, Evan; [2005]; 6 pp.; In English; 2004 MRS Fall Meeting, 29 Nov. - 3 Dec. 2004, Boston, MA, USA
Contract(s)/Grant(s): 22-066-50-03; Copyright; Avail: CASI; A02, Hardcopy

Dissolved oxygen in group IIIA-VA (Nb, Ti, Zr, Y) based alloys is a fundamental problem, affecting both mechanical properties and oxidation resistance, yet details of the phenomenon are poorly understood. In these alloys, oxygen is more stable dissolved in the metal than as an oxide-compound. In contrast, alloys based on Ni, Fe, Al and Cr exhibit almost no

oxygen solubility. To improve the performance of Nb and Ti based alloys it is necessary to understand the differences in oxygen solubility between these two groups of metals. As a first step we considered the energetics of interstitial oxygen in alpha-V and alpha-Cr. Both of these metals have a BCC structure, yet the oxygen solubility in V is much higher than that in Cr. We obtain total energies, densities of states and population analyses using the CASTEP plane-wave pseudopotential density functional computer code. The differences in the energetics and electronic structures of the two materials, particularly the partial densities of states associated with the interstitial oxygen, are discussed.
Author
Interstitials; Vanadium; Chromium; Oxygen

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20050092369 NASA Marshall Space Flight Center, Huntsville, AL, USA
Lightweight Nonmetallic Thermal Protection Materials Technology
Valentine, Peter G.; Lawrence, Timothy W.; Gubert, Michael K.; Milos, Frank S.; Levine, Stanley R.; Ohlhorst, Craig W.; Koenig, John R.; [2005]; 6 pp.; In English; Forward with a New Age of Exploration, 13-17 Feb. 2005, Albuquerque, NM, USA; Original contains color and black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

To fulfill President George W. Bush's 'Vision for Space Exploration' (2004) - successful human and robotic missions to and from other solar system bodies in order to explore their atmospheres and surfaces - the National Aeronautics and Space Administration (NASA) must reduce the trip time, cost, and vehicle weight so that the payload and scientific experiments' capabilities can be maximized. The new project described in this paper will generate thermal protection system (TPS) product that will enable greater fidelity in mission/vehicle design trade studies, support risk reduction for material selections, assist in the optimization of vehicle weights, and provide materials and processes templates for use in the development of human-rated TPS qualification and certification plans.
Author
Cost Reduction; Payloads; Thermal Protection; Templates

20050092412 Swedish Defence Research Establishment, Linkoeping
Pigments With Potential for Adaptable Optical Properties
Karlsson, E. H.; Nilsson, C.; Hallberg, T.; Kariis, H.; Jun. 2004; In English
Report No.(s): PB2005-101905; FOI-R-1256-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The main objective for the project, Pigments with Potential for Adaptable Optical Properties, is to produce material in which the electromagnetic properties can be controlled thereby enabling the object to adapt its signature to its background. This property is desirable within both the visible wavelength range as well as in the microwave and infrared ranges. Paint consists of pigment and binders. For signature management applications, highly reflective paint in the infrared area of between 3-5 micrograms and 8-12 micrograms but low reflectance in the visible area, is usually desired. The authors have investigated how, through varying pigment particle composition and size, pigment can be designed with the desired reflectance properties. Particles of conducting (silver) as well as semi-conducting (silicon) and isolating (aluminum oxide) materials have been investigated. Particle sizes varied from 0.5 micrograms to 80 micrograms. The powders were studied in a scanning electron microscope and their reflectance measured in both the visible and infrared areas.
NTIS
Electromagnetic Properties; Infrared Radiation; Optical Properties; Powder (Particles); Pigments

20050109808 Advanced Ceramics Research, Inc., Tucson, AZ, USA, National Energy Technology Lab., Pittsburgh, PA
Fibrous Monolith Wear Resistant Components for the Mining Industry. Semi-Annual Report No. 4
Rigali, M. J.; Fulcher, M. L.; Mar. 2003; In English
Report No.(s): DE2004-829541; No Copyright; Avail: National Technical Information Service (NTIS)

During the reporting period, work continued on development of formulations using the materials down-selected from the initially identified contenders for the fibrous monolith wear resistant components. In the previous reporting period, a two-stage binder removal process was developed that resulted in prototype parts free of voids and other internal defects. During the current reporting period, work was performed to characterize the two-stage binder removal process for WC-Co based FM

material systems. Use of this process has resulted in the fabrication of defect free sintered WC-Co FM bodies, with minimal free carbon porosity and densities approaching 100% theoretical. With the elimination of free carbon porosity and other binder removal process related defects, development work focused on optimizing the densification and eliminating defects observed in WC-Co based FM consolidated by pressureless sintering. Shrinkage of the monolithic core and shell materials used in the WC-Co based FM system was measured, and differences in material shrinkage were identified as a potential cause of cell boundary cracking observed in sintered parts. Re-formulation of material blends for this system was begun, with the goal of eliminating mechanical stresses during sintering by matching the volumetric shrinkage of the core and shell materials. Thirty-three 7/8 inch drill bit inserts WC-Co(6%)/WC-Co(16%) FM were hot pressed during the reporting period. Six of these inserts were delivered for field testing by Superior Rock Bit during the upcoming reporting period.
NTIS
Wear Resistance; Mining; Fabrication

20050109868 Edison Welding Inst., Columbus, OH, USA
Inspection of Fusion Joints in Plastic Pipe
Jul. 2004; In English
Report No.(s): DE2004-828896; No Copyright; Avail: National Technical Information Service (NTIS)

The standard method of joining plastic pipe in the field is the butt fusion process. As in any pipeline application, joint quality greatly affects overall operational safety of the system. Currently no simple, reliable, cost effective method of assessing the quality of fusion joints in the field exists. Visual examination and pressure testing are current non-destructive approaches, which do not provide any assurance about the long-term pipeline performance. This project will develop, demonstrate, and validate an in-situ non-destructive inspection method for butt fusion joints in gas distribution plastic pipelines. The inspection system will include a laser based image-recognition system that will automatically generate and interpret digital images of pipe joints and assign them a pass/fail rating, which eliminates operator bias in evaluating joint quality. A Weld Zone Inspection Method (WZIM) is being developed in which local heat is applied to the joint region to relax the residual stresses formed by the original joining operation and reveal the surface condition of the joint. In cases where the joint is not formed under optimal conditions, and the intermolecular forces between contacting surfaces are not strong enough, the relaxation of macromolecules in the surface layer causes the material to pull back, revealing a fusion line. If the joint is sound, the bond line image does not develop. To establish initial feasibility of the approach, welds were performed under standard and nonstandard conditions. These welds were subjected to the WZIM and tensile testing. There appears to be a direct correlation between the WZIM and tensile testing results. Although WZIM appears to be more sensitive than tensile testing can verify, the approach appears valid.
NTIS
Butt Joints; Welded Joints; Fusion; Pipes (Tubes); Plastic Properties

20050110429 Florida Univ., Gainesville, FL USA
Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane
Holfund, Gar; Dec. 2004; 5 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0257
Report No.(s): AD-A429964; AFRL-SR-AR-TR-05-0039; No Copyright; Avail: CASI; A01, Hardcopy

The objectives of this research project have been to characterize the degradation of various types of polymers under simulated space (low-earth orbit (LEO)) conditions and to develop polymers for spacecraft coatings which have improved survivability in LEO. Many polymers have been tested including kapton, polyethylene, fluoromers, polyhedral oligomeric silsequioxane (POSS)-containing copolymers and others. The testing was performed in an ultrahigh vacuum system which contained an atomic oxygen (AO) source and a vacuum ultraviolet (vuv) source. In some studies the polymers were also exposed to energetic electrons and ions. The chemical alterations occurring during the degradation was monitored using X-ray photoelectron spectroscopy (XPS). All polymers exhibit large chemical changes. The POSS-containing polymers are particularly interesting for space applications because they form a thin silica layer which protects the underlying polymer from further degradation.
DTIC
Characterization; Erosion; Oxygen; Oxygen Atoms; Photoelectron Spectroscopy; Polyethylenes; Ultrahigh Vacuum; X Ray Spectroscopy

20050110469 Dayton Univ., OH USA

Research and Development (R&D) on Advanced Nonstructural Materials. Delivery Order 0001: Study of Hydraulic System Component Storage With Operational and Rust-Inhibited Hydraulic Fluids

Gschwender, Lois J.; Snyder Jr, Carl E.; Sharma, Shashi K.; Jenney, Tim; Campo, Angela; Sep. 2004; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-00-D-5021-0001; Proj-4347

Report No.(s): AD-A430018; AFRL-ML-WP-TR-2004-4279; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this program, bearings and pistons were stored in jars containing both operational hydraulic fluids (MIL-PRF-83282, MIL-PRF-87257 and MIL-PRF-5606) and rust inhibited hydraulic fluids containing BSN (MIL-PRF-46170 and MIL-PRF-6083). In addition, hydraulic pumps were filled with MIL-PRF-83282, MIL-PRF-87257 and MIL-PRF-46170. Jars, containing bearings and pistons, as well as hydraulic pumps were stored for up to 3 years in a laboratory environment to determine if operational fluids would protect them from rusting during storage. After each year, the bearings, pistons, and pumps were inspected for corrosion. At the end of 3 years of storage, pumps were endurance tested using fresh operational fluid, MIL-PRF-83282. The bearings, pistons and pumps showed no rusting for the duration of storage with either operational or storage fluids. The pumps stored with the operational fluids MIL-PRF-83282 and MIL-PRF-87257 were in better condition than the pump stored with the rust inhibited fluid. The operational hydraulic fluids MIL-PRF-83282 and MIL-PRF-87257 provided excellent protection against rusting during storage.

DTIC

Hydraulic Equipment; Hydraulic Fluids

20050110471 Air Force Research Lab., Wright-Patterson AFB, OH USA

Military Aerospace Fluids and Lubricants Workshop Proceedings

Snyder, Carl E., Jr.; Gschwender, Lois J.; Sharma, Shashi K.; Nov. 2004; 634 pp.; In English

Report No.(s): AD-A430022; AFRL-ML-WP-TP-2004-413; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Military Aerospace Fluids and Lubricants Workshop was presented by the Materials and Manufacturing Directorate of the Air Force Research Laboratory in order to disseminate information about military lubricant changes and related issues. Major topics included hydraulic fluids: conversion of aircraft from MIL-PRF-5606 to MIL-PRF-87257, system seals, actuator rod tests, T.O. 42B2-3-1 revision status, DoD contamination issues, elimination of storage fluids for hydraulic components, condition monitoring,. Also topics of the workshop were gas turbine engine oils: R&D, test methodology and future trends. Lastly, the topics of the workshop presented were greases: R&D, problem solving and evaluation of MIL-PRF-32014.

DTIC

Conferences; Hydraulic Fluids; Lubricants

20050110504 Washington Univ., Seattle, WA USA

Tunable Optical Polymer Systems

Jenekhe, S. A.; Bard, A. J.; Chen, S. H.; Hammond, P. T.; Rothberg, L. J.; Oct. 2004; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0676

Report No.(s): AD-A430064; ARO-41928.59-CH-MUR; No Copyright; Avail: Defense Technical Information Center (DTIC)

This multidisciplinary university research initiative (MURI) program investigated tunable optical polymer systems suitable for large-area color-switchable coatings and devices, displays, sensors, and other electronic applications. The synthesis and properties of new electrochromic polymers are described. Electrochromic devices incorporating conjugated polymers have been fabricated and found to be durable past 100,000 cycles. Black-red, yellow-red, blue-black color-switchable all-plastic electrochromic devices were demonstrated. Fast responding, bright red light-emitting diodes based on ruthenium (II) complexes were fabricated and investigated. Efficient voltage-tunable multicolor light-emitting diodes based on bipolar blends of polyquinoline and MEH-PPV or poly(octylthiophene) were developed. New quinoline-functionalized dendrimers have been found to be efficient electron transport materials, leading to bright LEDs with high external efficiencies (2.6-6.0%). Blue LEDs with good spectral stability were developed from polyfluorene blends with high glass transition polymers. Red-bluewhite tunable LEDs with a brightness of up to 4000 cd/m2 (3.7 cd/A) and 3.1% external quantum efficiency have been developed from blends of conjugated polymers. Polarized blue LEDs have been developed from ogliofluorene with a dichronic ratio of 15-18.0 and a luminous efficiency of 0.5-5.9 cd/A. Novel chiral-nematic glass forming liquid crystals were synthesized and found to exhibit 100% selective reflection of ultraviolet, visible, and infrared light. High

performance n-channel thin film transistors were developed from ladder polymer semiconductors.
DTIC
Conjugation; Display Devices; Optical Properties

20050110514 Massachusetts Univ., Amherst, MA USA
Morphology and Properties of Model Block and Graft Copolymers
Gido, Samuel P.; Mays, Jimmy W.; Jan. 2005; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0544
Report No.(s): AD-A430079; ARO-42178.1-CH; No Copyright; Avail: Defense Technical Information Center (DTIC)

For this project a number of new polymer materials were synthesized including trifunctional, tetrafunctional and hexafunctional regular graft copolymers. Additionally, a range of poly(cyclohexadiene) (PCHD) homopolymers and block copolymers containing PCHD blocks were prepared. The morphologies of the regular graft copolymers, and PCHD containing block copolymers were determined by TEM and SAXS. Additionally, the morphologies of cyclic block copolymers were studied and compared to their linear analogs. The tensile mechanical properties of the regular multigraft materials were studied and related to molecular architecture. It was found that increasing junction point functionality and increasing number of junction points per molecule increased strength and toughness, and decreased hysterysis. A series of block double graft (BDG) copolymers of unique molecular architecture were studied to relate molecular architecture to morphology and mechanical properties. The mechanical properties of some BDG materials compared favorably to commercial thermoplastic elastomers.
DTIC
Block Copolymers; Copolymers; Grafting; Molecular Structure; Morphology; Polymerization

20050110525 Alabama Univ., Birmingham, AL USA
A Method of Monitoring Explosive Under Cyclic Mechanical Stress
Vyazovkin, Sergey; Nov. 2004; 9 pp.; In English
Contract(s)/Grant(s): W911NF-04-1-0112
Report No.(s): AD-A430094; ARO-45489.1-EG-II; No Copyright; Avail: Defense Technical Information Center (DTIC)

Dynamic mechanical analysis is combined with mass spectrometry to study nitrocellulose under oscillating strain. At a constant temperature (150-160 deg C) and frequency 400-600 Hz nitrocellulose fractures demonstrating a modulus drop and release of products with m/z=30 and 44. At linear heating (2 deg C min-1) and frequency 10-50 Hz similar product are released in two steps, the second of which demonstrates a modulus drop and a temperature increase indicating ignition.
DTIC
Cellulose Nitrate; Mass Spectroscopy; Stress-Strain Relationships

20050110533 Warsaw Univ., Warsaw, Poland
International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004
Florjanczyk, Zbigniew; Krok, Franciszek; Plocharski, Janusz; Aug. 2004; 234 pp.; In English
Contract(s)/Grant(s): FA8655-03-1-5043
Report No.(s): AD-A430107; EOARD-CSP-03-5043; No Copyright; Avail: CASI; A11, Hardcopy

This is the Final Proceedings for the 9th Symposium on Polymer Electrolytes (ISPE 9), 22 August 2004 - 27 August 2004. This is an interdisciplinary conference. Topics include: 1) basic theory, including modeling and simulation techniques; 2) physical and electrochemical methods of characterization; 3) structural studies; 4) investigations of ion transport mechanisms; 5) new polymer electrolytes; 6) existing and expected engineering applications in electrochemical energy storage systems, fuel cells, display systems, multipurpose sensors, and electrochemical devices of potential importance for medicine biology.
DTIC
Conferences; Electrochemistry; Electrolytes; Energy Storage; Ions; Poland

20050110541 Tokyo Medical Univ., Tokyo, Japan
Cell Sheet Engineering with Intelligent Polymer-Grafted Surfaces
Jan. 2002; 22 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430120; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Grafting; Polymerization; Polymers; Surface Properties

20050110548 State Univ. of New York, Oneonta, NY USA

Polymer Waveguides for Quantum Information

Mahanta, Kamala; Jan. 2005; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-03-1-0180; Proj-558B

Report No.(s): AD-A430134; AFRL-IF-RS-TR-2005-4; No Copyright; Avail: Defense Technical Information Center (DTIC)

Electro-optic materials have shown great potential for improving the performance of waveguided communication systems for use in quantum information processing (cryptography, communication, computing, etc.) where the transmission of a single photon or a very small amount of light plays a critical role in establishing the quantum nature of the process. These materials offer significant advantages over inorganic materials such as LiNbO3 or compound semiconductors due to their large EO-coefficients, low dielectric constants with negligible dispersion from DC to optical frequencies and simplicity of processing. EO polymer materials have been engineered to have improved linear and nonlinear properties, thermal stability, and a controlled poling induced optic axis for a better control of the refractive index. The research conducted with this extension grant has enabled the preparation for the design, fabrication and testing of slab waveguides made of EO polymer and covers the initial phase of installation, testing and use of the spin coating system to make a few simple slabs with the anticipation of testing those for coupling and other processes.

DTIC

Electro-Optics; Quantum Theory; Waveguides

20050111486 NASA Marshall Space Flight Center, Huntsville, AL, USA

Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive

Boeder, Paul; Mikatarian, Ron; Koontz, Steve; Albyn, Keith; Finckenor, Miria; [2005]; 3 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 336-33-60; No Copyright; Avail: CASI; A01, Hardcopy

The International Space Station (ISS) solar arrays utilize MD-944 diode tape to protect the underlying diodes in the solar array panel circuit and also provide thermal conditioning and mechanical support. The diode tape consists of silicone pressure sensitive adhesive (Dow Coming QC-7725) with a protective Kapton over-layer. On-orbit, the Kapton over-layer will erode under exposure to atomic oxygen (AO) and the underlying exposed silicone adhesive will ultimately convert, under additional AO exposure, to a glass like silicate. The current operational plan is to retract ISS solar array P6 and leave it stored under load for a long duration (6 months or more) during ISS assembly. With the Kapton over-layer eroded away, the exposed silicone adhesive must not cause the solar array to stick to itself or cause the solar array to fail during redeployment. Previous testing by Lockheed-Martin Space Systems (LMSS) characterized silicone blocking following exposure to low energy atomic oxygen (AO) in an asher facility, but this is believed to be conservative. An additional series of tests was performed by the Environmental Effects Group at MSFC under direction from the ISS Program Office Environments Team. This test series included high energy AO (5 eV), near ultraviolet (NUV) radiation and ionizing radiation, singly and in combination. Additional samples were exposed to thermal energy AO (\h0.1 ev) for comparison to the LMSS tests. Diode tape samples were exposed to each environment constituent individually, put under preload for seven days and then the resulting blocking force was measured using a tensile machine. Additional samples were exposed to AO, NUV and electrons in series and then put under long term (three to ten months) preload to determine the effect of preload duration on the resulting blocking force of the silicone-to-silicone bond. Test results indicate that high energy AO, ultraviolet radiation and electron ionizing radiation exposure all reduce the blocking force for a silicone-to-silicone bond. AO exposure produces the most significant reduction in blocking force.

Author (revised)

Kapton (Trademark); Silicones; Adhesives; Space Environment Simulation; Oxygen Atoms

20050111583 California Polytechnic State Univ., San Luis Obispo, CA, USA

Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings

Censullo, A. C.; Jones, D. R.; Wills, M. T.; Dec. 2004; 172 pp.; In English

Report No.(s): PB2005-102269; No Copyright; Avail: CASI; A08, Hardcopy

The contractor designed a set of experiments to evaluate the effect of volume and type of solids on coverage and hiding for water-based and solvent-based architectural coatings. The experimental design was implemented by formulating thirty water-based and solvent-based coating samples with varying amounts and types of pigments and resins. Thirty unique formulations were prepared, corresponding to coatings commonly used in California. Coating classes included flat, eggshell, semigloss and gloss. Once formulated in agreement with the experimental design, the coatings were applied to well-defined surfaces, and evaluated by a series of standard tests for coverage, film thickness, hiding, and color, as appropriate to the coating

type. A new potential measure for coatings, Hiding VOC, was proposed. This amounts to the grams of VOC associated with the formation of 1.00 square meter of a 'hiding' film, as defined by ASTM Method D2805-96a. A comparison was made between selected solvent-based and water- based coatings, to explore the relative hiding abilities of each. The contractor summarized and interpreted the results of the testing program.
NTIS
Solids; Volatile Organic Compounds; Coatings; Experiment Design; Air Pollution

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*; and *44 Energy Production and Conversion*.

20050109803 Nuclear Regulatory Commission, Washington, DC, USA, Sandia National Labs., Albuquerque, NM
Spent Fuel Transportation Package Performance Study Experimental Design Challenges
Snyder, A. M.; Murphy, A. J.; 2003; 12 pp.; In English
Report No.(s): DE2004-826225; No Copyright; Avail: Department of Energy Information Bridge

Numerous studies of spent nuclear fuel transportation accident risks have been performed since the late seventies that considered shipping container design and performance. Based in part on these studies, NRC has concluded that the level of protection provided by spent nuclear fuel transportation package designs under accident conditions is adequate. Furthermore, actual spent nuclear fuel transport experience showcase a safety record that is exceptional and unparalleled when compared to other hazardous materials transportation shipments. There has never been a known or suspected release of the radioactive contents from an NRC-certified spent nuclear fuel cask as a result of a transportation accident. In 1999 the USA Nuclear Regulatory Commission (NRC) initiated a study, the Package Performance Study, to demonstrate the performance of spent fuel and spent fuel packages during severe transportation accidents. NRC is not studying or testing its current regulations, as the rigorous regulatory accident conditions specified in 10 CFR Part 71 are adequate to ensure safe packaging and use. As part of this study, NRC currently plans on using detailed modeling followed by experimental testing to increase public confidence in the safety of spent nuclear fuel shipments. One of the aspects of this confirmatory research study is the commitment to solicit and consider public comment during the scoping phase and experimental design planning phase of this research.
NTIS
Numerical Analysis; Experiment Design; Hazardous Materials; Nuclear Fuels; Transportation

20050110432 North Carolina State Univ., Raleigh, NC USA
Computational Analysis and Simulation of Toxic Particle Deposition in the Human Respiratory System
Kleinstreuer, Clement; Nov. 2004; 29 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0492
Report No.(s): AD-A429968; AFRL-SR-AR-TR-05-0031; No Copyright; Avail: CASI; A03, Hardcopy

Jet fuel with its performance enhancers is highly toxic and when inhaled may pose a significant health risk. Thus, for a scientific assessment of possible health effects from fuel exposure, it is crucial to know where and at what concentrations fuel aerosols and their vapors deposit in the human respiratory system in light of realistic inlet conditions. In contrast to human testing, and/or experimental deposition studies, computational fluid- particle dynamics (CFPD) simulations offer a non-invasive, less expensive, and effective means of obtaining fuel vapor and droplet transport and deposition data for representative airways. Focusing on JP-8 fuel deposition in a representative human upper airway model, experimentally validated CFPD results are provided for the airflow fields, JP-8 fuel droplets, and-JP-8 fuel vapor under realistic ambient conditions. The 3-year-project conclusions, documented in 14 journal articles and 10 conference papers, are divided into three sections, i.e., fundamentals/discoveries, JP-B fuel impact, and technology transfer.
DTIC
Analysis (Mathematics); Deposition; Jet Engine Fuels; Respiratory System; Simulation; Toxicity

29
SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20050109885 NASA Marshall Space Flight Center, Huntsville, AL, USA
Reproducible Crystal Growth Experiments in Microgravity Science Glovebox at the International Space Station (SUBSA Investigation)
Ostrogorsky, A.; Marin, C.; Volz, M. P.; Bonner, W. A.; [2005]; 1 pp.; In English; 43rd American Inst. of Aeronautics and Astronautics Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

Solidification Using a Baffle in Sealed Ampoules (SUBSA) is the first investigation conducted in the Microgravity Science Glovebox (MSG) Facility at the International Space Station (ISS) Alpha. 8 single crystals of InSb, doped with Te and Zn, were directionally solidified in microgravity. The experiments were conducted in a furnace with a transparent gradient section, and a video camera, sending images to the earth. The real time images (i) helped seeding, (ii) allowed a direct measurement of the solidification rate. The post-flight characterization of the crystals includes: computed x-ray tomography, Secondary Ion Mass Spectroscopy (SIMS), Hall measurements, Atomic Absorption (AA), and 4 point probe analysis. For the first time in microgravity, several crystals having nearly identical initial transients were grown. Reproducible initial transients were obtained with Te-doped InSb. Furthermore, the diffusion controlled end-transient was demonstrated experimentally (SUBSA 02). From the initial transients, the diffusivity of Te and Zn in InSb was determined.
Author
Crystal Growth; International Space Station; Microgravity; Spaceborne Experiments

20050110119 NASA Marshall Space Flight Center, Huntsville, AL, USA
Macromolecular Crystallization in Microgravity
Snell, Edward H.; Helliwell, John R.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAS8-02096; Copyright; Avail: Other Sources; Abstract Only

The key concepts that attracted crystal growers, macromolecular or solid state, to microgravity research is that density difference fluid flows and sedimentation of the growing crystals are greatly reduced. Thus, defects and flaws in the crystals can be reduced, even eliminated, and crystal volume can be increased. Macromolecular crystallography differs from the field of crystalline semiconductors. For the latter, crystals are harnessed for their electrical behaviors. A crystal of a biological macromolecule is used instead for diffraction experiments (X-ray or neutron) to determine the three-dimensional structure of the macromolecule. The better the internal order of the crystal of a biological macromolecule then the more molecular structure detail that can be extracted. This structural information that enables an understanding of how the molecule functions. This knowledge is changing the biological and chemical sciences with major potential in understanding disease pathologies. Macromolecular structural crystallography in general is a remarkable field where physics, biology, chemistry, and mathematics meet to enable insight to the basic fundamentals of life. In this review, we examine the use of microgravity as an environment to grow macromolecular crystals. We describe the crystallization procedures used on the ground, how the resulting crystals are studied and the knowledge obtained from those crystals. We address the features desired in an ordered crystal and the techniques used to evaluate those features in detail. We then introduce the microgravity environment, the techniques to access that environment, and the theory and evidence behind the use of microgravity for crystallization experiments. We describe how ground-based laboratory techniques have been adapted to microgravity flights and look at some of the methods used to analyze the resulting data. Several case studies illustrate the physical crystal quality improvements and the macromolecular structural advances. Finally, limitations and alternatives to microgravity and future directions for this research are covered.
Author (revised)
Microgravity; Macromolecules; Crystal Growth

20050110155 NASA Marshall Space Flight Center, Huntsville, AL, USA
Manufacture of Solar Cells on the Moon
Freundich, Alex; Ignatiev, Alex; Horton, Charles; Duke, Mike; Curren, Peter; Sibille, Laurent; [2005]; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

In support of the space exploration initiative a new architecture for the production of solar cells on the lunar surface is devised. The paper discusses experimental data on the fabrication and properties of lunar glass substrates, evaporated lunar

regolith thin film (antireflect coatings and insulators), and preliminary attempts in the fabrication of thin film (silicon/II-VI) photovoltaic materials on lunar regolith substrates. A conceptual design for a solar powered robotic rover capable of fabricating solar cells directly on the lunar surface is provided. Technical challenges in the development of such a facility and strategies to alleviate perceived difficulties are discussed. Finally, preliminary cost benefit ratio analysis for different in situ solar cell production scenarios (using exclusively in-situ planetary resources or hybrid) are discussed.
Author
Solar Cells; In Situ Resource Utilization; Lunar Bases

20050110184 NASA Marshall Space Flight Center, Huntsville, AL, USA
Observation of an Aligned Gas - Solid 'Eutectic' during Controlled Directional Solidification Aboard the International Space Station - Comparison with Ground-based Studies
Grugel, R. N.; Anilkumar, A.; [2005]; 1 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Direct observation of the controlled melting and solidification of succinonitrile was conducted in the glovebox facility of the International Space Station (ISS). The experimental samples were prepared on ground by filling glass tubes, 1 cm ID and approximately 30 cm in length, with pure succinonitrile (SCN) in an atmosphere of nitrogen at 450 millibar pressure for eventual processing in the Pore Formation and Mobility Investigation (PFMI) apparatus in the glovebox facility (GBX) on board the ISS. Real time visualization during controlled directional melt back of the sample showed nitrogen bubbles emerging from the interface and moving through the liquid up the imposed temperature gradient. Over a period of time these bubbles disappear by dissolving into the melt. Translation is stopped after melting back of about 9 cm of the sample, with an equilibrium solid-liquid interface established. During controlled re-solidification, aligned tubes of gas were seen growing perpendicular to the planar solid/liquid interface, inferring that the nitrogen previously dissolved into the liquid SCN was now coming out at the solid/liquid interface and forming the little studied liquid = solid + gas eutectic-type reaction. The observed structure is evaluated in terms of spacing dimensions, interface undercooling, and mechanisms for spacing adjustments. Finally, the significance of processing in a microgravity environment is ascertained in view of ground-based results.
Author
Spaceborne Experiments; Eutectics; Directional Solidification (Crystals); Liquid-Solid Interfaces

20050110187 NASA Marshall Space Flight Center, Huntsville, AL, USA
Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications
Ray, C. S.; Sen, S.; Reis, S. T.; Kim, C. W.; [2005]; 1 pp.; In English; 1st Space Exploration Conference Continuing the Voyage of Disvoery, 30 Jan. 1 Feb. 2005, Orlando, FL, USA; Copyright; Avail: Other Sources; Abstract Only

In-situ resource processing and utilization on planetary bodies is an important and integral part of NASA's space exploration program. Within this scope and context, our general effort is primarily aimed at developing glass and glass-ceramic type materials using lunar and martian soils, and exploring various applications of these materials for planetary surface operations. Our preliminary work to date have demonstrated that glasses can be successfully prepared from melts of the simulated composition of both lunar and martian soils, and the melts have a viscosity-temperature window appropriate for drawing continuous glass fibers. The glasses are shown to have the potential for immobilizing certain types of nuclear wastes without deteriorating their chemical durability and thermal stability. This has a direct impact on successfully and economically disposing nuclear waste generated from a nuclear power plant on a planetary surface. In addition, these materials display characteristics that can be manipulated using appropriate processing protocols to develop glassy or glass-ceramic magnets. Also discussed in this presentation are other potential applications along with a few selected thermal, chemical, and structural properties as evaluated up to this time for these materials.
Author
Lunar Soil; Glass; Ceramics; Space Environment Simulation; Mars Environment; In Situ Resource Utilization; Space Processing

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20050109798 Kansas Dept. of Transportation, Topeka, KS

Global Positioning System Data Integration and Development of a Three-Dimensional Spatial Model of the Kansas Highway Network

Chang, S. I.; Jun. 2004; In English

Report No.(s): PB2005-103200; No Copyright; Avail: National Technical Information Service (NTIS)

This proposal addresses a number of issues concerning the integration of various data collected on the Kansas Highway System through the development of a spatial (3D) model. Currently, KDOT collects and maintains spatial data on the Kansas highway system from the yearly road condition survey and video log survey. These surveys utilize differentially corrected Global Positioning Systems (GPS) systems cross-referenced to the traditional KDOT linear reference system (LRS) derived from distance measuring instruments (DMI) on board the vehicles. Preliminary development of a spatial model has been performed internally to KDOT resulting in a 2D model (latitude and longitude, but not altitude) for approximately 75% of the state highway system. This project extends the 2D model into a 3D model by including altitude GPS coordinates using a B-spline fitting model. The proposed 3D model shall serve as a cross referencing system between project stationing, project numbers, LRS, and other methods of defining physical locations. It will also serve to enable spatial analysis of the system for such items as sub-standard stopping sight distance, sub-standard horizontal curves, and the correlation of accidents with highway geometry.

NTIS

Global Positioning System; Data Integration; Three Dimensional Models; Highways; Kansas

20050109900 NASA Marshall Space Flight Center, Huntsville, AL, USA

Engineering Lessons Learned and Systems Engineering Applications

Gill, Paul S.; Garcia, Danny; Vaughan, William W.; [2005]; 6 pp.; In English; 43rd American Inst. of Aeronautics and Astronautics Aerospace Sciences Meeting, 8-13 Jan. 2005, Reno, NV, USA; Original contains black and white illustrations; No Copyright; Avail: Other Sources; Abstract Only

Systems Engineering is fundamental to good engineering, which in turn depends on the integration and application of engineering lessons learned and technical standards. Thus, good Systems Engineering also depends on systems engineering lessons learned from within the aerospace industry being documented and applied. About ten percent of the engineering lessons learned documented in the NASA Lessons Learned Information System are directly related to Systems Engineering. A key issue associated with lessons learned datasets is the communication and incorporation of this information into engineering processes. Systems Engineering has been defined (EINIS-632) as 'an interdisciplinary approach encompassing the entire technical effort to evolve and verify an integrated and life-cycle balanced set of system people, product, and process solutions that satisfy customer needs'. Designing reliable space-based systems has always been a goal for NASA, and many painful lessons have been learned along the way. One of the continuing functions of a system engineer is to compile development and operations 'lessons learned' documents and ensure their integration into future systems development activities. They can produce insights and information for risk identification identification and characterization. on a new project. Lessons learned files from previous projects are especially valuable in risk

Derived from text

Systems Engineering; Information Systems

20050109958 Moscow Power Engineering Inst., Moscow, Russia

Radiation Properties of Two Cylindrical Conformal Arrays Isolated by a Space Filter

Okhmatovsky, Vladimir I.; Nikita, Konstantina S.; Uzunoglu, Nikolaos K.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 898-901; In English; See also 20050109927; Copyright; Avail: Other Sources

An integral equations technique together with a Galerkin's procedure are applied to study the radiation characteristics of two cylindrical conformal arrays isolated by a space filter.

Derived from text

Cylindrical Bodies; Arrays; Spatial Filtering; Isolation

20050110058 Queen Mary and Westfield Coll., London, UK

Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method

Vazquez, J.; Parini, C.; deMaagt, P.; Clarricoats, P.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1090-1093; In English; See also 20050109927; Copyright; Avail: Other Sources

Active integrated antennas are reported to show a better performance than some classical devices, reducing losses, improving bandwidth, and making the whole system more compact. At millimetre/submillimetre frequencies the radiating elements are small enough in size (below 1 mm) to be directly constructed upon the semiconductor material, typically in monolithic form. The large amount of free bandwidth and the special propagation properties of millimetre/submillimetre frequency bands, make them suitable for many present and future applications as the new generation of communication links, Wireless LAN, space scientific and earth observation instruments and many others such automotive collision avoidance radars. Derived from text

Antennas; Design Analysis; Receivers; Submillimeter Waves; Finite Difference Time Domain Method; Communication Networks

20050110074 Hughes Space and Communications Co., Los Angeles, CA, USA

Shaped Reflector and Multi-feed Paraboloid: A Comparison

Ramanujam, P.; Law, P. H.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1136-1139; In English; See also 20050109927; Copyright; Avail: Other Sources

The last decade has seen dramatic changes in the evolution of shaped reflector technology. Many implementations of this technology have been used for generating shaped contour beams on many satellites: single offset reflector, dual gridded reflector and dual reflector. Shaped reflectors have replaced multi-feed reflectors as the primary design for single beam applications in many of these satellites due to lower weight, lower feed spillover and lower loss associated with a single feed design. However when multiple beams have to be generated from a single antenna, a multi-feed paraboloid with individual beam-forming networks for each beam is the obvious choice. While the principal advantage of both of these antenna systems mentioned above are well understood, a detailed comparison of the performance characteristics and radiation mechanisms of the two antenna types have not been presented in the literature. This paper presents such a comparison between the two with reference to the following characteristics: a) Directivity performance. b) Feed complexity and losses. c) Aperture Fields. d) Sidelobe performance.

Author

Reflectors; Parabolic Bodies; Antenna Design

20050110079 Alexandria Univ., Egypt

Design of Cylindrical Reflector Antennas with Caustic-located Array Feeding

El-Khamy, Said E.; Elkamchouchi, Yasser H.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1148-1151; In English; See also 20050109927; Copyright; Avail: Other Sources

The caustic of a cylinder is the curve that envelopes the reflected rays from the cylinder surface when it is illuminated by a source at infinity, as shown. The present paper gives a simple method for synthesizing a feed system for cylindrical reflector antennas working in UHF and VHF frequency bands. The antenna radiation characteristics are carefully studied using the method of moments MoM. The cylindrical reflector is represented by a set of parallel grids. The feeding elements are seven half-wavelength dipoles located at the caustic of the cylindrical reflector and phased, so that the cylindrical reflector is illuminated in phase. The radiation characteristics, gain and input impedance for different dimensions of the antenna are considered. Also the effects of changing the frequency and feeding elements locations on the antenna performance are studied.

Author

Antenna Design; Cylindrical Bodies; Reflector Antennas

20050110445 Princeton Univ., NJ USA

The 1-MW Radiatively Driven Hypersonic Wind Tunnel Experiments

Mansfle1d, D. K.; Howard, P. J.; Luff, J. D.; Miles, R. B.; Brown, G. L.; Jan. 2005; 134 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429988; AEDC-TR-05-3; No Copyright; Avail: Defense Technical Information Center (DTIC)

Results and analysis of the RDHWT/MARlAH II 1 MW experiment are reported. The experiment is the addition of approximately MW of energy to a supersonic air flow with an electron bean. The experiment hardware, arrangement and conduct are described. Selected data and analysis are reported. The experiment was subject to transient power fluctuations flat

were traced to the electron beam source rather than to flow instability. Power stability was established at lower power conditions. and these data were used for selected code validations.
DTIC
Electron Beams; Hypersonic Wind Tunnels

20050110527 Defense Science Board, Washington, DC USA
The Defense Science Board 2001 Summer Study on Defense Science and Technology
May 2002; 244 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430098; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Department of Defense is fundamentally transforming its strategy, policies, and forces. This transformation is motivated by a vastly different security environment that has emerged over the last decade. Where once a single monolithic threat-the Soviet Union-dominated the nation's security planning and programming, today's environment comprises a broader, more diffuse set of concerns: terrorism, biological warfare, regional tensions, and an array of other transnational challenges. It is an environment characterized by uncertainty, but more importantly by a rapid pace of change. Transformation of the Department of Defense must be enabled by a transformation of its science and technology enterprise, which is so critical to its superior warfare capabilities. If the Department fails to adapt to the pace of technological change, fails to rapidly integrate new and breakthrough technologies into its operational systems, or fails to sustain a research and development environment that fosters innovation, the USA stands in danger of losing what today is a significant lead in military capability. Assuring that the USA continues to gain access to and develop technology from which to gain military advantage is the subject of this report.
DTIC
Forecasting; Research and Development; Summer; Technologies

20050111459 Wayne State Univ., Detroit, MI USA
Adaptation of Advanced Diesel Engines for Military Requirements Under Severe Environmental Conditions
Henein, Naeim A.; Taraza, Dinu; Chalhoub, Nabil; Oct. 2004; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-02-1-0372
Report No.(s): AD-A429934; ARO-43997.1-EG; No Copyright; Avail: Defense Technical Information Center (DTIC)

The overall goal of this program is to adapt commercially produced heavy duty diesel engines to meet the goals the military engines for maximum power, better fuel economy, and low signature in the field by white or black smoke and compactness for mobility. The commercial advanced heavy-duty diesel engines are produced to meet stringent emission standards, causing penalties in peak power and fuel economy. This project addressed three major thrust areas. The first area is to determine the effect of replacing the commercially available fuel with JP8 fuel. The second area is to examine the different control strategies used in advanced diesel engines to meet the emission goals and their effect on engine performance, fuel economy and exhaust emissions. This requires a basic understanding of the different strategies used in the commercial vehicles to meet the emission standards and to develop new strategies to optimize the fuel economy and maximize the power density without exceeding the low smoke limits allowable in the field. The third area is a fundamental investigation on the lubrication of the main engine bearings. Four codes have been developed in Matlab to calculate the loading of the engine main bearings and, determine the journal orbit and the oil film thickness.
DTIC
Diesel Engines; Military Technology

20050123554 Building and Construction Research TNO, Delft, Netherlands
Implementation of Gas Bubble Loading in 2DCAV
vandenEikhoff, J.; December 02, 2002; 44 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): A0I/KM/117; TNO Proj. 006.28108/01.02
Report No.(s): TD-2002-0074; Rept-2002-CMC-R044; Copyright; Avail: Other Sources

The objective of this study has been to implement an oscillating gas-bubble induced loading based on a Doubly Asymptotic Approximation type of boundary conditions at the Non-Reflecting Boundary. The gas-bubble induced loading has been implemented. The DAA, implementation in CMC s 2DCAV (2 Dimensional CAVitation) has been tested combined with the influence of the gas bubble pressure. Some possible causes of anomalies found are investigated.
Derived from text
Gas Pressure; Bubbles; Loading; Boundary Conditions; Oscillations

20050123713 Fudan Univ., Shanghai, China, Fudan Univ., Shanghai, China

Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging

Jin, Ya-Qiu; Zhang, Nan-Xiong; Chang, Mai; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1796-1799; In English; See also 20050123676

Contract(s)/Grant(s): NSFC-49831006; NSFC-49685005; NSFC-69771007; Copyright; Avail: Other Sources

Advance of satellite-borne microwave remote sensing programs, such as active SAR, ERS scatterometer etc., during recent decades has promoted study of theoretical modeling, data calibration/validation, image analysis, surface classification, and parameter inversion for these programs. In this paper, to simulate fully polarimetric scattering from tree canopy applicable to SAR imaging at C band, the scattering amplitude functions of randomly oriented, non-spherical particles (e.g. leaves with thin thickness, branches with small radius) are derived in the generalized Rayleign-Gans (GRG) approximation. Numerical results show the difference between the GRG and conventional Rayleigh approximations. These functions averaged over randomly spatial orientation are employed to construct the non-diagonal extinction matrix and the Mueller matrix solution. Four Stokes parameters of scattered fields are coupled. It is different from conventional iterative solution of isotropic scattering media. Further, to physically identify polarime_c scattering of the Mueller matrix solution, the coherency matrix and its eigen-analysis are discussed. Information of the eigenvalues and entropy from the Mueller marx measurement is related with polarimetric scattering process and medium randomness, and can be used to investigate directly the influence of different scattering mechanism in complex scenarios on observable parameters. As an application, the eigenvalues and entropy derived from the Mueller matrix measurement of an AirSAR image are demonstrated.

Author

Mathematical Models; Polarimetry; Scattering; Synthetic Aperture Radar; Imaging Techniques; Image Analysis; Simulation

32
COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20050092405 New Mexico State Univ., Las Cruces, NM, USA

Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments

Caulev, Michael, Technical Monitor; Phillip, DeLeon; Horan, Stephen; Borah, Deva; Lyman, Ray; March 2005; 177 pp.; In English

Contract(s)/Grant(s): NAG3-2864

Report No.(s): NMSU-ECE-05-001; No Copyright; Avail: CASI; A09, Hardcopy

The purpose of this research is to investigate the use of commercial, off-the-shelf wireless networking technology in planetary exploration applications involving rovers and sensor webs. The three objectives of this research project are to: 1) simulate the radio frequency environment of proposed landing sites on Mars using actual topographic data, 2) analyze the performance of current wireless networking standards in the simulated radio frequency environment, and 3) propose modifications to the standards for more efficient utilization. In this annual report, we present our results for the second year of research. During this year, the effort has focussed on the second objective of analyzing the performance of the IEEE 802.11a and IEEE 802.1lb wireless networking standards in the simulated radio frequency environment of Mars. The approach builds upon our previous results which deterministically modelled the RF environment at selected sites on Mars using high-resolution topographical data. These results provide critical information regarding antenna coverage patterns, maximum link distances, effects of surface clutter, and multipath effects. Using these previous results, the physical layer of these wireless networking standards has now been simulated and analyzed in the Martian environment. We are looking to extending these results to the and medium access layer next. Our results give us critical information regarding the performance (data rates, packet error rates, link distances, etc.) of IEEE 802.1 la/b wireless networks. This information enables a critical examination of how these wireless networks may be utilized in future Mars missions and how they may be possibly modified for more optimal usage. Author

Mars Environment; Communication Networks; Wireless Communication; Radio Frequencies

20050092408 Research Inst. of National Defence, Stockholm, Sweden

Thoughts Regarding Evaluation of the Human Perspectives in the 'Demonstrators' Work in the Armed Forces Transformation Program and Command and Control Development

Derefeldt, G.; Friman, H.; Jan. 2004; In Swedish

Report No.(s): PB2005-102211; No Copyright; Avail: National Technical Information Service (NTIS)

This report discusses how the evaluation of the human perspectives within the Swedish Armed Forces Transformation Program and Command and Control Development shall be designed in order to balance the technical- and human-centric approaches. One of the difficulties when making measurements at the systems-of-systems level is a common theoretical basis for the evaluation of technical system-of-systems and the evaluation of the human perspectives. In the present report, results and conclusions from a study of documents from the Swedish Armed Forces Headquarters, from the 'demonstrators'' work in the Armed Forces Transformation Program and Command and Control Development, and from the human-factors audit area are discussed. The conclusions are: (a) The Human-centric approach is absent in documents from the Swedish Armed Forces Headquarters; (b) The human-centric approach includes humans and/or groups and organizations; (c) There is an NCW-hypothesis for command and control; (d) There are requirements on effects and abilities that are to be achieved; (e) A synthesis of the human-centric and technical approaches is missing. Using a system approach gives us a theoretical basis for a multidisciplinary approach to bridge the gap between the scientific approaches used in technical disciplines and the approaches used in human factors, cognitive, neural, and social sciences. If we are to succeed in achieving an evaluation method of systems-of-systems we will certainly have to combine these two approaches.
NTIS
Human Factors Engineering; Command and Control

20050092409 Swedish Defence Research Establishment, Linkoeping, Sweden
Retrocommunication
Sjoeqvist, L.; Haellstig, E.; Oehgren, J.; Allard, L.; Mar. 2004; In English
Report No.(s): PB2005-102209; FOI-R-1220-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Novel techniques for free-space optical communication at high data transfer rates are of interest for future military application. Retro communication provides a technique to transfer data from small platforms using an asymmetric data link. Retro communication has been a sub-project within the Swedish Defense Photonics project and this report contains a summary of the main results obtained within the project. The novel technologies were multiple quantum well (MQW) optical modulators for communication and spatial light modulators (SLMs) based on liquid crystal materials for non-mechanical beam steering. Within the project reflective MQW modulators with high contrast and capable of high data rates have been developed. Non-mechanical beam steering techniques were evaluated experimentally and by developing performance models. A retro receiver based on MQW modulators and a transceiver using non-mechanical beam steering were developed and fabricated. In the final phase of the project a retro communication link using MQW modulators and non-mechanical beam steering was demonstrated. Link establishment and tracking of the movable retro receiver during data transfer were shown. The link was in real time capable of transferring audio signals and images captured by a CCD camera.
NTIS
Free-Space Optical Communication; Transmitter Receivers; Audio Signals; Optical Communication

20050092410 Swedish Defence Research Establishment, Linkoeping, Sweden
Demonstration of Adaptive Radio Node
Ahlin, L.; Johansson, P.; Linder, S.; Paeaejaervi, L.; Rantakokko, J.; Mar. 2004; In Swedish
Report No.(s): PB2005-102206; FOI-R-1208-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Adaptive radio nodes are expected to give substantial improvements in future military and civilian radio systems, e.g. improved capacity, higher robustness, and stealth performance. Therefore, we plan a (computer-based) demonstration of adaptive radio nodes. The purpose of the demonstration is to show: (1) possible performance gains with adaptation; (2) feasibility with the chosen technical solutions; and (3) remaining technical challenges. We have chosen to implement a coded MIMO-OFDM-system, where e.g. modulation, coding and MIMO techniques shall adapt to the prevailing channel conditions. The purpose of this document is to give a description of the ideas behind the demonstration, to act as guidance for the implementation of the demonstrator in software, and to give the reader a feeling for what the demonstration will show. The demonstration will be based upon one or several tactical scenarios where the influence from the terrain on the radio performance can be shown. The demonstrator is a first step in building a more advanced simulator that will be developed through a successive development and refinement of the used techniques and adaptive functions.
NTIS
Computerized Simulation; MIMO (Control Systems); Sensory Feedback

20050092443 Federal Communications Commission, Washington, DC
Connecting the Globe: A Regulator's Guide to Building a Global Information Community
2003; 118 pp.; In English
Report No.(s): PB2005-102970; No Copyright; Avail: CASI; A06, Hardcopy

Contents include the following: Foreword; Regulatory Challenges and Opportunities; The U.S. Model; Components of the Regulatory Process and Organization of the FCC; The FCC and the Public Trust; Competition in Telecommunications Services; Universal Service; Spectrum Allocation, Assignment and Enforcement; Regulating Satellite Networks: Principles and Process; The Internet; Glossary; Appendices and Index.
NTIS
Communication Networks; Regulations

20050109786 Associates in Rural Development, Inc., Burlington, VT, USA
Kosovo Media Assessment
Mar. 2004; 64 pp.; In English
Report No.(s): PB2005-103308; No Copyright; Avail: CASI; A04, Hardcopy

The media sector in Kosovo has made remarkable progress in its transition from a state-run to a market-oriented free press. From the post-conflict emergency phase in 1999, substantial levels of donor assistance and a relatively open regulatory environment led to a proliferation of outlets. By 2001, the number of independent electronic broadcasters had reached saturation level but subsequent reductions in donor assistance and a weak advertising market has started a process of market-based consolidation. Donors have made a sizeable investment in the three Kosovo-wide television stations, the public television station RTK, and the private stations TV21 and KTV. RTK has a large operation, budget, and staff. It started receiving a license fee paid through electricity bills in 2004. As a result, all donor assistance to RTK television has ended except for assistance for its minority programming. The U.S. and the Soros Foundation have funded KTV and TV21, and this assistance is ongoing. Donors, including the U.S., made a substantial investment in the terrestrial transmission network, KTTN. They also provided assistance to the newspapers, local broadcast media, a news agency (KosovaLive), and for the creation of media associations. The media in Kosovo is predominantly in the Albanian language, and this Report generally refers to the Albanian media, unless minority media is specifically mentioned. The Serb population in the north relies overwhelmingly on Serbian media for its news and information, and local Serbian language media in the north are also firmly oriented towards Belgrade. In smaller Serb enclaves in other parts of the territory, however, there are indications that local radio stations are acknowledging some common interests with the media in Kosovo.
NTIS
Television Systems; Marketing

20050109927 Institute of Electrical and Electronics Engineers, USA, University of Central Florida, Orlando, FL, USA
IEEE Antennas and Propagation Society International Symposium, Volume 2
[1999]; 746 pp.; In English; IEEE Antennas and Propagation Society International Symposium, 11-16 Jul. 1999, Orlando, FL, USA; See also 20050109928 - 20050110102
Report No.(s): IEEE-Catalog-99CH37010-Vol-2; LC-90-640397; Copyright; Avail: Other Sources

Reports are presented from the IEEE Antennas and Propagation Society International Symposium, Volume 2. Topics covered included microstrip antennas, waveguide devices, biomedical applications, numerical methods, electromagnetics, propagation, rough surface scattering, adaptive and signal processing arrays.
Derived from text
Microstrip Antennas; Antenna Arrays

20050109931 California Univ., Los Angeles, CA, USA
Active Integrated Antennas for New RF Architectures
Deal, W. R.; Qian, Y.; Itoh, T.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 876-879; In English; See also 20050109927
Contract(s)/Grant(s): DAAH04-96-1-0005; Copyright; Avail: Other Sources

Active integrated antennas (AIAs) provide a new paradigm for designing modern microwave and millimeter-wave wireless systems. Benefits of this technique include compactness, reduced losses and weight, low profile and multiple functionality. We describe here three novel AIA architectures that have recently been developed, including a tuned-harmonic class F transmitter front-end, power combining with a dual feed AIA push-pull Power Amplifier (PA) and a novel 2-D retrodirective array.
Author
Antenna Design; Radio Frequencies; Systems Engineering; Systems Integration; Wireless Communication

20050109932 Birmingham Univ., UK

Multi-band Antennas

Lee, E.; Hall, P. S.; Gardner, P.; Kitchener, D.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 912-915; In English; See also 20050109927; Copyright; Avail: Other Sources

Two different types of novel dual band antennas suitable for a data communicator device are reported. The first antenna illustrated here is a dual frequency, dual polarization microstrip patch antenna, capable of generating two distinct frequencies with different polarization characteristics and radiation patterns. This antenna has been intended for coverage of the GSM/lridium's satellite frequencies. The second antenna described here is the modified bent folded monopole antenna having two resonant frequencies, with a frequency separation of 1.9. This antenna could be used in the GSM/DCS1800 frequencies. The limitations of both antennas are also briefly mentioned.

Author

Antenna Radiation Patterns; Microstrip Antennas; Polarization Characteristics

20050109942 Centre d'Electronique de l'Armement, Rennes Armees, France

Complex Natural Resonances Extracted from Radar Signatures Measured in Time Domain with UWB Laboratory System

Kergall, J.; Pouliguen, P.; Legoff, M.; Chevalier, Y.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1346-1349; In English; See also 20050109927; Copyright; Avail: Other Sources

The Centre d'Electronique de l'ARmement (CELAR) has studied and developed an Ultra Wide Band (UWB) time domain 'laboratory' instrumentation. UWB radars allow to emit an instantaneous short pulse including a large frequency spectrum. Two potential applications of these systems, allowed by using mainly the lower frequencies, are the detection and the identification of stealth targets and buried objects (like unexploded ordnances and mines). Good penetration into a lossy ground needs frequencies lower than 300 MHz; it becomes a major difficulty for an efficient using of radar imaging techniques, because of the poor resulting resolution. It is the reason why other identification and classification techniques, like these based on the Singularity Expansion Method (S.E.M.), are extensively analysed and developed since many years.

Author

Ground Penetrating Radar; Radar Signatures; Electromagnetic Pulses; Signal Analysis

20050109944 Nevada Univ., Reno, NV, USA

Optimum Amplitude and Phase Control for an Adaptive Linear Array Using a Genetic Algorithm

FROM; Haupt, Randy L.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1424-1427; In English; See also 20050109927; Copyright; Avail: Other Sources

Phase-only adaptive nulling cannot generate nulls at symmetric locations about the main beam, and it has a slower convergence rate than amplitude and phase adaptive nulling. Phase-only nulling places a null at one angle, and it causes the sidelobe at the symmetric location to go up. The amplitude and phase adaptive nulling with a GA overcomes these problems. The performance of amplitude and phase adaptive nulling with a GA will be compared with that of phase-only adaptive nulling with a GA. In addition, the best bit setup of amplitude and phase adaptive nulling with a GA will be found in terms of convergence speed and null depths when the interference is incident at various locations-single, adjacent, symmetric and non-symmetric about the main beam. The 32 element half wavelength spaced linear array is used and simulated, and the power of symmetric, non-symmetric and adjacent interference are symmetric.

Author

Optimal Control; Amplitudes; Phase Control; Linear Arrays

20050109947 Academy of Sciences (USSR), Novosibirsk, USSR

New Class Microwave Antennas Based on the Elements of the Diffraction Quasioptics: Advantages and Applications

Minin, I. V.; Minin, O. V.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 754-757; In English; See also 20050109927; Copyright; Avail: Other Sources

The concept of optical elements using diffraction is quite an old one; for instance, Fresnel's zone plate dates from about 1830. The elements of the diffraction quasioptics (EDQ) are intended for transformation of incident wave fronts into the required ones. The EDQ operation principle is based on creation of specifically chosen discrete phase delays over the wave front. There are three main types of EDQ (by the principle of disposition with respect to the propagation direction of the electromagnetic wave): transverse (made mainly on a flat surface), longitudinal-transverse (made on an arbitrary curvilinear surface) and longitudinal (representing a system of screens located along the direction of the electromagnetic wave

propagation). The EDQ can operate both in the 'transmission regime' and the 'reflection regime'. According to the application the EDQ can be of amplitude (binary) and phase inversion type. The main physical properties of the EDQ are briefly surveyed in the present work. Different system based on the EDQ are considered as
Derived from text
Wave Fronts; Diffraction; Optics; Microwave Antennas

20050109954 Universidad Politecnica de Madrid, Madrid, Spain
Moment Method Analysis of Parallel Plate Slot Antennas
Castafter, Manuel Sierra; Hirokawa, Jiro; Ando, Makoto; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 850-853; In English; See also 20050109927; Copyright; Avail: Other Sources

The authors propose a Moment Method Analysis for the Analysis of a Parallel Plate Slot Array, excited by a feed waveguide, based on the Flocket's Theorem. The beam tilt of the incident wave, due to the frequency dependence of the excitation wavelength, is considered by using a complex Hertzian Potential and Periodic Boundary Conditions. A phase shift, that depends on the frequency, is included in the Periodic Conditions. This analysis can also be used for beam scanning arrays.
Author
Antenna Design; Boundary Conditions; Method of Moments; Slot Antennas

20050109956 Karlsruhe Univ., Germany
Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface
Loeffler, D.; Wiesbeck, W.; Johannisson, B.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 882-885; In English; See also 20050109927; Copyright; Avail: Other Sources

A conformal aperture coupled phased array was modelled and fabricated. The measured results show the capability of the array to form a directive sector beam as well as an omnidirectional pattern within the measured bandwidth of 19%. As the gain variation is negligible while scanning the direction of the array, it is recommended for 360 degree covering communication systems.
Derived from text
Apertures; Fabrication; Phased Arrays; Microstrip Antennas; Circular Cylinders; Coupled Modes

20050109957 Royal Inst. of Tech., Stockholm, Sweden
Calculating The Mutual Coupling Between Apertures on Convex Cylinders Using a Hybrid UTD-MoM Method
Persson, Patrik; Josefsson, Lars; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 890-893; In English; See also 20050109927; Copyright; Avail: Other Sources

The problem of radiation from sources in the presence: of smooth convex objects is of great interest in the design of antennas on structures, e.g. conformal arrays. Conformal antenna arrays are required whenever an antenna has to conform geometrically to some shaped surface, like that of an aircraft. In the analysis of conformal antennas it is possible to obtain a medal solution to some canonical surfaces, e.g. a circular cylinder or an elliptic cylinder. But for more arbitrarily shaped bodies other methods have to be used.
Author
Computation; Antenna Arrays; Apertures

20050109959 United Arab Emirates Univ., Al-Ain, United Arab Emirates
A New Broad-band, Dual-frequency Coplanar Waveguide Fed Slot-Antenna
Omar, Amjad A.; Antar, Y. M. M.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 904-907; In English; See also 20050109927; Copyright; Avail: Other Sources

This paper describes the design of a new broad-band, dual-frequency coplanar waveguide fed slot-antenna. This antenna operates at about 27 GHz and 40 GHz. It has a return loss that is about 20 dB at each of the two operating frequencies, with a maximum gain of about 4.5dBi. The cross-polarization is about 30 dB less than the co-polarization. Matching the antenna at the two widely separated frequencies is achieved using a special matching network of resonant slot antennas.
Author
Design Analysis; Broadband; Slot Antennas

20050109960 Paderborn Univ., Germany

Low Cost Broadband Microstrip Antenna for Satellite-TV Reception

Bekraoui, Leila; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 916-919; In English; See also 20050109927; Copyright; Avail: Other Sources

A broadband microstrip antenna for DBS (Direct Broadcasting Satellite) reception is presented in the following. The antenna element is an extension of the one of. DBS in Europe requires a linear polarisation, a relative bandwidth of 17.5% (from 10.70 GHz to 12.75 GHz) and a cross-polarisation less than -20 dB. According to these requirements, a dual polarized aperture coupled microstrip antenna was designed in two steps. In a first step, a new disposition of the feeding lines was used. A single patch element permits to obtain a bandwidth of more than 26 % whereas an additional patch element as a parasitic element is currently used in the literature to increase the bandwidth. In a second step, a perforated patch element was used in order to ameliorate the cross-polarisation.

Author

Low Cost; Bandwidth; Microstrip Antennas; Broadcasting

20050109973 Space Systems/Loral, Palo Alto, CA, USA

An Analysis of a Dual Gridded Reflector Antenna

Luh, Howard; Hsu, Rockwell; Lee, Bryan S.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1128-1131; In English; See also 20050109927; Copyright; Avail: Other Sources

A single offset reflector generates linear geometrical optics (GO) cross polarization. Thus its application is limited to a circularly polarized system. When a communication system requires a low linear cross polarization antenna, a dual gridded reflector is often the designer's choice. The dual gridded reflector (Figure 1) consists of a gridded front reflector and a solid rear reflector. The front gridded reflector provides two functions: 1) it is a reflector for the waves whose polarization is parallel to the grid wires, and 2) it is a polarization filter of the rear reflector. The design and analysis of the front gridded reflector is a straight forward manner. Unfortunately, the design and analysis of the rear reflector is not. In the past, due to lack of tools, antenna designers simply design a rear reflector by ignoring the existence of the front gridded reflector and hope for the best. In 1996 Viskum and Sorensen attempted to analyze a dual gridded reflector antenna. Their approaches were: 1) GO analysis except for the far field computation. 2) including the first order front reflector filtering effect. The analysis presented in this paper extends their analysis to include the multiple (up to the third order) interactions between two reflectors. Furthermore, all analyses are based on the near field computation which may be important according to a recent publication of Rahmat-Samii and Imbriale. The software used in the analysis in this paper are POS and GRASP of TICRA.

Author

Antenna Design; Reflector Antennas; Geometrical Optics

20050109974 Da-Yeh Univ., Lungtan, Taiwan

Development of Eight Meters Inverse Cosecant Square Reflector Antenna

Chang, Dau-Chyrh; Cheng, Yi-Chung; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1160-1163; In English; See also 20050109927; Copyright; Avail: Other Sources

An eight meters S-band inverse cosecant square reflector was designed and manufactured. Ray tracing technique and physical optics analyzes the geometry of shaping reflector and field pattern. The test results are quite agreed with the theoretical results.

Author

Fabrication; Reflector Antennas; Physical Optics

20050109978 Ajou Univ., Suwon, Korea, Republic of

An Aperture-coupled Small Microstrip Antenna with Enhanced Bandwidth

Park, Ikmo; Cho, Bum Jun; Mittra, Raj; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1212-1215; In English; See also 20050109927; Copyright; Avail: Other Sources

In recent years there has been considerable interest in the development of small microstrip antennas for personal communication. Common techniques for reducing the size of a microstrip antenna are to employ a substrate with high dielectric constant and/or to incorporate a shorting pin in a microstrip patch. It is well-known, however, that the bandwidth of the microstrip antenna becomes narrower as the size of the antenna becomes smaller. Consequently, it is difficult to achieve an impedance bandwidth of more than 3% for small microstrip antennas. Recently, two techniques that enhance the impedance bandwidth of small antennas to about 10% have been reported in the literature. Kokotoff et al. use an annular ring coupled

to a shorted circular patch to enhance the bandwidth, while Wong and Lin employ a low resistance chip resistor instead of the shorting pin.
Derived from text
Apertures; Microstrip Antennas; Bandwidth

20050109979 City Univ. of Hong Kong, Kowloon, Hong Kong
Wideband L-strip Fed Microstrip Antenna
Mak, C. L.; Luk, K. M.; Lee, K. F.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1216-1219; In English; See also 20050109927; Copyright; Avail: Other Sources

The most remarkable feature of the antenna is that a small step is introduced at the end of the stripline. We then describe this as an L-strip connected to the end of the feed line. No slots on the patch and matching network along the feed line are required to enhance the bandwidth to about 50% for single-patch case. Moreover the non-contact is advantageous to the fabrication of antenna arrays. The principle of operation of this antenna is similar to that of the coaxially-fed L-probe pinch antenna. The whole structure of the L-strip acts as a series L-C remnant element, which is connected in series with the parallel R-L-C resonant element of the patch. The remnant frequency of the former has to be close to that of the TM(sub 01) mode of the patch for wide-band performance. The cross-polarisation may be quite high at some directions. However, this shortcoming can be overcome by an array design.
Derived from text
Broadband; Fabrication; Microstrip Antennas; Antenna Design

20050109980 Nan-Tai Inst. of Technology, Tainan, Taiwan, Province of China
Novel Designs of Broadband Equilateral-triangular Microstrip Antennas
Chen, Horng-Dean; Fang, Shyh-Tirng; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1248-1251; In English; See also 20050109927; Copyright; Avail: Other Sources

Applications of microstrip antennas are limited mainly because of their narrow inherent bandwidth. Recently, there are many reports on solving this problem, such as using electrically thick substrates or stacked multipatch structures. All these designs, however, require a large antenna volume for broadband operation. In this article, new broadband designs of an equilateral-triangular microstrip antenna with a pair of bent slots are proposed and experimentally studied for the case of thin substrate condition.
Author
Broadband; Microstrip Antennas; Antenna Design

20050109986 Waterloo Univ., Ontario, Canada
A Simple Theoretical Model for Polarization Diversity Reception in Wireless Mobile Environments
Shin, E.; Safavi-Nacini, S.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1332-1335; In English; See also 20050109927; Copyright; Avail: Other Sources

Two-branch polarization diversity at the receiving end of a mobile link is investigated when the transmitter emits a linearly polarized signal. In this research, the effect of the elevation angle between the mobile and base station is included in deriving expressions for correlation coefficient between the signals received by the two branches and the average received signal level relative to that of a receiver with a single copolarized antenna.
Author
Mathematical Models; Reception Diversity; Wireless Communication; Mobile Communication Systems; Cross Polarization

20050109988 Institute National des Telecommunications, Evry, France
Wide Band Modeling and Electromagnetic Pulse Propagation through HF Channel
Munir, Arshad; Bouirig, Abdellah; Caratori, Julien; Gimenes, Claude; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1380-1383; In English; See also 20050109927; Copyright; Avail: Other Sources

Complexity associated with modeling of electrical signals at the reception site after reflection from the ionosphere has been a challenging problem. In this paper we present the modeling of the signal by taking into account all the parameters characterizing the HF ionospheric channel including complex response of the receiving antenna. We also discuss the problems involved in modeling wide band signals keeping in view the particular behavior of the ionospheric channel. The simulations based on the analytic formulas for the second and third order derivatives of the signal phase are discussed and the impulse

response of the HF channel, based on these phase derivatives is simulated.
Author
Broadband; Electromagnetic Pulses; High Frequencies; Ionospheric Propagation

20050109991 Air Force Research Lab., Wright-Patterson AFB, OH, USA
Scattering from Dielectric Bodies
Parks, Jeffery M.; Collins, Peter J.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1414-1417; In English; See also 20050109927; Copyright; Avail: Other Sources

The purpose of this study is to develop a database of measured Radar Cross Section (RCS) values for penetrable targets and provide an example of its use for code comparisons. The material used in this research is polyethylene with a relative dielectric constant of approximately 2.3 over the frequency range of interest. The target shapes include a mini-arrow and an ogive.
Author
Radar Cross Sections; Dielectrics; Radar Targets; Radar Scattering

20050109992
A Remote Calibration for DBF Transmitting Array Antennas by Using Synchronous Orthogonal Codes
Oodo, Masayuki; Miura, Ryu; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1428-1431; In English; See also 20050109927; Copyright; Avail: Other Sources

Since the performance of the array antennas is degraded due to the amplitude and phase imbalance between the antenna elements, unknown mutual coupling coefficients, unknown element location and so on, calibration process is indispensable. Moreover fast convergence of the calibration process is required in some systems. This paper focuses upon the calibration of the amplitude and phase imbalance of the adaptive transmitting array antennas and proposes a simple method by using synchronous orthogonal codes. In this method, the calibration coefficients compensating for the imbalance can be obtained simultaneously by the digital signal processing. It is assumed that the direction to the receiving antenna is known and receiving antenna has one element.
Author
Antenna Arrays; Calibrating; Transmitters

20050109993 High Technology Resources, Inc., Atlanta, GA, USA, WorldSpace, Washington, DC, USA
Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment
Najafabadi, Reza M.; Nami, Ziba; Shujaee, Ali; Boto, K.; West, Jerry; Harris, Chris; Mitchel, Brian; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1440-1443; In English; See also 20050109927; Copyright; Avail: Other Sources

Many of the satellite frequency allocations are based on the principle of sharing between terrestrial and space applications. To protect one sharing serVice from another, upper limits have been established by the ITU (International Telecommtmication Union) on the amount ofrfpower that can be present at and interfere with a receiving station. To calculate the interference level at the Fixed Service (FS) receiver due to the broadcastingsatellite service (BSS), antenna gain and side-lobe levels are the major factors to be determined. ITU Recommendation F .699-4 has suggested the maximum allowable gain and the side-lobe levels as a reference for antenna radiation pattern; however, this model overestimate the interference level. In a recent revised ITU model (ITU Recommendation CG9/6 Rev. 2-E), a more realistic reference antenna pattern has been proposed but in some cases it underestimates the interference levels. In this paper, a new model for generalized antenna radiation patterns is proposed using variable boundaries dependent on the antenna parameters.
Author
Mathematical Models; Antenna Radiation Patterns

20050109994 ATR Communication Systems Research Labs., Kyoto, Japan
Performance Estimation of Space-Time Adaptive Processing via Subband Processing in Mobile Communications
Yang, Kehu; Mizuguchi, Yoshihiko; Zhang, Yimin; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1448-1451; In English; See also 20050109927; Copyright; Avail: Other Sources

It is known that the main limitations of space time adaptive processing (STAP) are due to its huge computation burden and the performance degradation because of slow convergence. The developments of subband signal processing enable us to

solve the STAP problem with fast convergence. This paper compares the mean square error between STAP and subband STAP (SSTAP), and makes clear the condition for STAP and SSTAP to be equivalent.
Author
Space-Time Adaptive Processing; Performance Prediction; Mobile Communication Systems

20050110002 Schlumberger Oilfield Services, Houston, TX, USA
Analysis and Design of Magnet and Antenna for NMR Well-logging Tool
Goswami, Jaideva C.; Luong, Bruno; Sezginer, Apo; Oldigs, Richard; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 760-763; In English; See also 20050109927; Copyright; Avail: Other Sources

Nuclear magnetic resonance (NMR) techniques have been in use for many years in chemistry and biochemistry laboratories to analyze the molecular structure of compounds. In this technique the sample is placed inside a coil that produces a time varying field in the presence of a static field generated by an external magnet. The measurement of spin-lattice relaxation time (T1), spin-spin relaxation time (T2), frequency spectrum, and coupling between resonances then provide valuable information about the composition of the sample. In the last few years, NMR measurements have become an important part of oilfield well-logging to identify and quantify oil and gas reservoirs. For such applications, the major problem comes from the fact that the sample (earth formation) is outside the sensor. Furthermore, at a depth of about 5 Km, a typical well-depth, the NMR instrument has to withstand hostile conditions, such as high temperatures (175 C), high pressures (20,000 psi), corrosive fluids, low power, and high shocks. In addition, the instrument must be designed to fit inside a small hole (typically 6 to 12-inches in diameter). The Johnson noise generated by the conductors and magnetoacoustic ringing caused by RF current-carrying conductors in the presence of static magnetic field significantly affect the received signal. These conditions pose a great challenge to designing efficient antenna for NMR instruments. In this paper we analyze the performance of a saddle-point NMR well-logging tool proposed. A perturbation technique in conjunction with the finite element method (FEM) is used to evaluate antenna efficiency. The static magnetic field due to a permanent magnet in the presence of ferrites is evaluated by using nonlinear magnetostatic FEM. Comparisons of the computed and measured results indicate a very good match. The present approach has proved to be quite efficient and accurate in the design of NMR sensor.
Author
Design Analysis; Magnetostatic Fields; Antenna Design; Nuclear Magnetic Resonance; Molecular Structure; Spin-Lattice Relaxation; Time Measurement

20050110007 Hosei Univ., Tokyo, Japan
A Conformal Spiral Array Antenna Radiating an Omnidirectional Circularly-Polarized Wave
Nakayama, K.; Kawano, T.; Nakano, H.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 894-897; In English; See also 20050109927; Copyright; Avail: Other Sources

A conformal spiral antenna above a finite-length conducting cylinder has been numerically analyzed using the method of moments (MoM). In this paper, spiral elements are arrayed above a conducting cylinder. The radiation characteristics of the array are evaluated with emphasis on the radiation patterns. Formation of an omnidirectional radiation pattern is discussed. The mutual coupling among spiral elements is investigated. The radiation patterns calculated by the MoM are compared with those calculated by the pattern multiplication method (PMM). Limitations of the PMM calculation are revealed.
Author
Spiral Antennas; Antenna Arrays; Cylindrical Antennas

20050110008 Birmingham Univ., UK
Triple-band Planar Inverted F Antenna
Song, P.; Hall, P. S.; Ghafouri-Shiraz, H.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 908-911; In English; See also 20050109927; Copyright; Avail: Other Sources

In this paper, we present novel designs for a 3 band planar inverted F antenna (PIFA) operating at 0.9GHz(GSM), 1.89GHz(DECT), and 2.44GHz(WLAN). These bands are selected for the emerging radio on fibre systems such as the passive picocell system, and could also be used for providing connectivity to the fast growing Personal Digital Assistance (PDA) users to wireless telephony and wireless local area network services. The first design is realised with a simple inverted F design using 3 feeds. An isolation of at least 14dB between the feed ports is achieved. The second design, a dual feed 3 band PIFA, is achieved by first embedding an L-shape spur line as a reactive load on one of its radiators resulting in a dual band single feed configuration. The third band is introduced by an addition of another L-shaped inverted F antenna. Isolation of at least 18dB is achieved between the feed ports. Bandwidth and gain of the 3 band antenna on 2 different conductive box housing

will be presented. A 3 band single feed PIFA using an additional L-shape spur line was also realised.
Author
Antenna Design; Bandwidth; Shapes

20050110009 Texas A&M Univ., College Station, TX, USA
A Multi-frequency Microstrip-fed Shorted Square Ring Slot Line Antenna
Tehrani, Hooman; Yung, Tae-Yeoul; Chang, Kai; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 920-923; In English; See also 20050109927; Copyright; Avail: Other Sources

A single-feed three-frequency shorted square ring slot antenna is described. The feed is an open-circuited microstrip line and is electromagnetically coupled to the ring slot antenna at two locations. The radiation pattern of all resonant frequencies is broadside and bi-directional. Impedance bandwidths of 3 to 9 percent and antenna gains on the order of 5 dB are achieved.
Author
Microstrip Transmission Lines; Slot Antennas; Resonant Frequencies; Antenna Radiation Patterns

20050110010 California Univ., Los Angeles, CA, USA
A Uniplanar Quasi-yagi Antenna with Wide Bandwidth and Low Mutual Coupling Characteristics
Qian, Yongxi; Deal, W. R.; Kaneda, Noriaki; Itoh, Tatsuo; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 924-927; In English; See also 20050109927
Contract(s)/Grant(s): N00014-97-1-0508; Copyright; Avail: Other Sources

We report for the first time a planar quasi-Yagi antenna printed on a single layer of high dielectric constant substrate (Duroid, epsilon(sub tau = 0.2) which measures 48 % bandwidth (VSWR less than 2). The antenna radiates an end-fire beam, with a front-to-back ratio greater than 15 dB and cross polarization level below -12 dB across the entire frequency band. A very low mutual coupling level of below -22 dB has been measured for a two-element array with lambda(sub 0)/2 separation.
Author
Yagi Antennas; Bandwidth; Cross Polarization

20050110011 University of Southern Illinois, Carbondale, IL, USA
FDTD Analysis of Mutual Coupling between Microstrip Patch Antennas on Curved Surfaces
Byun, Joonho; Lee, Byungje; Harackiewicz, Frances J.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 886-889; In English; See also 20050109927; Copyright; Avail: Other Sources

The effect of curvature on mutual coupling between microstrip antennas on curved surfaces is studied by using the conformal FDTD method. The method has shown excellent versatility. The method is also applied to antennas mounted on flat and orthogonal substrates for comparison. The results show the strong effect of the different shaped substrates on the mutual coupling.
Author
Curvature; Patch Antennas; Microstrip Antennas

20050110017 Belgrade Univ., Yugoslavia
Efficient and Accurate Inclusion of Radomes into Antenna Analysis
Kolundzija, B.; Tasic, M.; Sarkar, T.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 842-845; In English; See also 20050109927; Copyright; Avail: Other Sources

In the general case a radome enclosing an antenna introduces changes in both, the antenna input admittance and its radiation pattern. When a radome is electrically large its analysis can be performed by using high frequency techniques. For example, physical optics provides good results for radomes ten wavelengths or longer with sources a few wavelengths away. On the other hand a variety of techniques is proposed for electrically small radomes. The Method of Moments (MoM) combined with surface equivalence principle and triangular modeling can be efficiently used for radomes whose maximum linear dimension is comparable with the wavelength. The usage of this method to electrically larger radomes is usually limited by memory and analysis time requirements. The question is how to analyze radomes whose maximum linear dimension is greater than one wavelength and less than ten wavelengths. For example, such case occurs when a vertical array of TV transmitting antennas is situated inside cylindrical or conical radome. The analysis of such radome can be facilitated if the problem is either reduced to 2D-system, or considered as Body of Revolution (BoR). The application of the MoM combined with triangular modeling to general radomes can be broaden if exact formulation based on surface equivalence principle is replaced by approximate formulation, which represents radome as an impedance sheet. However, impedance sheet

approximation is not enough accurate for radomes whose thickness is greater than 3/100 wavelengths. Finally, interactions between antennas and radomes have not been considered much in the past.
Derived from text
Antenna Radiation Patterns; Bodies of Revolution; Physical Optics; Transmission

20050110019 National Univ. of Singapore, Singapore
A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions
Li, Le-Wei; Leong, Mook-Seng; Lee, Sy-Teck; Gan, Yeow-Beng; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 846-849; In English; See also 20050109927; Copyright; Avail: Other Sources

A three-dimensional discrete method, which makes use of the cylindrical dyadic Green's functions (DGF) together with the field equivalence principle, is developed in this paper for characterizing the electromagnetic transmission through a cylindrical antenna radome of arbitrary cross sections. By the use of the dyadic Green's functions for multilayered circular cylinders, this discrete method takes into consideration the curvature effects of the radome shell, which is usually ignored in classical approaches such as the ray-tracing method and the plane wave spectrum analysis technique. First, the discretised field distribution elements on the outer surface of the cylindrical radome shell are obtained from an arbitrarily distributed source. Then, the re-radiation of these elements are analyzed. Various effective radii and oblique transmission coefficients are discussed and their corresponding results further examined. With the developed discrete method, results of radiation power patterns of antennas, boresight errors, and peak-gain attenuations are obtained and compared with some existing results. Although more attention was paid to the elliptical radome shell of various thicknesses with different scanning angles, the discrete method developed in this paper is valid for a very accurate analysis on the electromagnetic transmission through a cylindrical antenna radome shell with arbitrary curved surface.
Author
Three Dimensional Models; Electromagnetic Properties; Green's Functions; Cylindrical Antennas; Antenna Radiation Patterns

20050110021 Nippon Electric Co. Ltd., Tokyo, Japan
Development and Evaluation Test of DBF Equipment for Transmitting
Kuwahara, Yoshihiko; Kakinuma, Hiroyuki; Ogawa, Satoshi; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1432-1435; In English; See also 20050109927; Copyright; Avail: Other Sources

Recently, it is examined to apply the spatial division multiple access (SDMA) to the mobile communication system. In this case, it is necessary to materialize the 'smart' antenna with both transmitting and receiving. So far, various digital beam forming (DBF) techniques for receiving have been discussed. However, it has not discussed too much to examine DBF techniques for transmitting. We have materialized a DBF equipment for transmitting and have evaluated it. It is capable of forming multi-beams and scanning them independently. In this paper, we present about outline of the design and test results.
Author
Multiple Access; Beamforming; Digital Techniques; Transmitters

20050110023 Toshiba Corp., Kawasaki, Japan
An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters
Obayashi, S.; Shoki, H.; Sibata, O.; Kasami, H.; Otaka, S.; Tsurumi, H.; Suzuki, Y.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1436-1439; In English; See also 20050109927; Copyright; Avail: Other Sources

Adaptive arrays for radio base stations are currently being considered as a promising means to enhance subscriber capacity and have been partially applied in some practical fields. On the other hand, a significant increase in transmission speed for radio communications, including wireless local loops, is expected. Digital beam forming is mainly being investigated for its flexibility, but it will be difficult to apply to high speed systems because digital signal processing requires huge computational resources and power consumption. Conventional phased arrays utilize phase shifters through RF or IF signal lines instead. The phase shifters are usually too bulky to meet the miniaturization requirements of the radio unit in the base station. Chua et al. are developing Si monolithic integration of a variable phase shifter for adaptive arrays, but the noise figure as well as the inadequate frequency sensitivity are under investigation. Digital phase shifters are preferred for computer-based control, but signal attenuation becomes larger and the noise figure is degraded as in the conventional type if the number of bits is increased to achieve precise control. We propose an adaptive array steered by local signal phase shifters for high-speed wireless local loops. An adaptive array radio receiver usually requires one or more frequency conversion

sections to achieve acceptable sensitivity performance. The phase shift and the frequency shift of the signal from each antenna element can be accomplished simultaneously at the down-conversion stage by phase-controlled local signals. The configuration can avoid the additional loss or noise in the received signal due to the phase shifter, and commercial quadrature modulator ICs for mobile communications can be utilized for the CW local phase shifter. The adaptive array does not require high speed digital signal processing sections with fast AD converters for all of the array elements. In this paper, we describe the practical configuration of the array as well as pattern measurements in the S-band for a prototype including the essential elements.
Author (revised)
Adaptive Control; Antenna Arrays; Antenna Components; Phase Shift Circuits

20050110024 Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel
Electromagnetic Analysis of an Antenna Buried in a Composite Environment
Pasvolsky, J.; Heyman, E.; Kastner, R.; Boag, A.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 854-857; In English; See also 20050109927; Copyright; Avail: Other Sources

We are interested in the problem of buried antennae. An antenna A is located in a volume D dug in the ground. The ground is assumed to fill the half space z less than 0 in three dimensional coordinate space (x, y, z), and to be homogeneous with a dielectric constant e(sub 1). The volume D is filled with a homogeneous medium e(sub 2). To simplify the calculations, we choose a cylindrical symmetric configuration with a cylindrical hole of radius d and depth H and an axial vertical dipole antenna of length L. Our solution strategy is based on decomposing the problem into simpler subproblems. This method has been used in corresponding two dimensional problems such as apertures in infinite conducting surfaces.
Derived from text
Electromagnetic Fields; Dipole Antennas

20050110026 New South Wales Univ., Sydney, Australia
Computer Simulated and Analytical Results of MSE in Adaptive Integrated Reduced-complexity Receiver for Multipath DS/CDMA Systems
Pharn, V. D.; Vu, T. B.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1452-1455; In English; See also 20050109927; Copyright; Avail: Other Sources

An integrated space-time equalizer is proposed for interference suppression in DS/CDMA receiver. It outperforms the existing time-domain-only counterpart in terms of near-far resistance and capacity in multipath channels. In addition, the use of unequal reduced lengths between array elements can significantly reduce the complexity without greatly sacrificing the performance. A comparison in MSE between simulation and analytical results is also presented.
Author
Code Division Multiple Access; Multipath Transmission; Receivers; Equalizers (Circuits)

20050110027 Alexandria Univ., Egypt
On the Performance of the VESPA Algorithm for Blind Beamforming and Signal Detection of Multi-source Multipath Signals
El-Khamy, Said E.; AbouEl-Soud, Ahmed K.; Kassem, Wafaa I.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1456-1459; In English; See also 20050109927; Copyright; Avail: Other Sources

VESPA algorithm is a blind technique based on higher order statistics (HOS) for beamforming and signal detection using antenna arrays. It achieves blind detection of signals without aperiori information about the array configuration or the direction of arrival (DOA). This blind technique is based on the Estimation of Signal Parameters via Rotational Invariance Technique (ESPRIT) algorithm. This algorithm requires two identical arrays displaced in the space by a certain vector. The covariance matrix of the output of the main array and the cross-covariance matrix of the outputs of the 2-arrays are calculated and after certain processing the steering matrix can be obtained. Each column of the steering matrix (steering vector at a DOA of a signal) is used directly in beamforming to detect the corresponding signal. In practice, it is very hard and expensive to have an identical copy of an array. On the other hand, the ESPRIT algorithm fails in the case of coherent signals. Recently, Dogan and Mendel presented a technique based on HOS that overcome the drawback of the ESPRIT technique. The use of HOS provides a virtual copy of any array and hence the ESPRIT algorithm can be applied to perform blind beamforming without the need of a physical copy of the array. The modified technique is thus called virtual ESPRIT algorithm (VESPA). In this paper, we will clarify the basic ideas of the operation of this technique and show how this technique is very valuable in the case of multi-source signals propagating in multipath media. Extended examples considering uncorrelated, coherent, and

combination of uncorrelated and coherent cases are presented. We also show that the signal detection is done more accurately for arbitrary (even unknown) array configuration, for both cases of coherent and uncorrelated signals, than classical beamforming techniques. It should be noted that these classical techniques completely fail to detect coherent signals. Both linear and circular arrays are considered in the simulation.
Author
Signal Analysis; Beamforming; Signal Detection; Multipath Transmission

20050110040
A New Calibration Method of Adaptive Array for TDD Systems
Nishimori, Kentaro; Cho, Keizo; Takatori, Yasushi; Hori, Toshikazu; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1444-1447; In English; See also 20050109927; Copyright; Avail: Other Sources

Adaptive antennas are especially effective for TDD (Time Division Duplex) mobile communication systems in reducing co-channel interference and enlarging channel capacity because, ideally, the optimum pattern formed in reception mode can be applied to the transmitting pattern. However, since the radiation pattern of the adaptive array is generally formed on a baseband, it is necessary to calibrate the amplitude and phase errors between the branches due to individual differences in the RF devices of the receivers and transmitters. Moreover, since these errors change over time due to temperature variations, real-time calibration is required. Several calibration techniques of adaptive antennas have been proposed, however, since the calibration of transmitters and receivers must be performed separately in such techniques, real-time calibration cannot be realized by these methods. This paper proposes a new calibration method for adaptive base station antennas that is suitable for TDD communication systems; it offers real-time calibration. The effectiveness of the proposed calibration method is also demonstrated using an experimental adaptive array testbed. This paper first shows the distortion in radiation pattern due to the amplitude and phase variations over time. The proposed calibration method is then described. Finally, a comparison of the measured radiation pattern between transmission and reception modes is shown that confirms the effectiveness of the proposed calibration method.
Author
Antenna Arrays; Adaptive Control; Time Division Multiplexing; Calibrating

20050110041 Boeing Information, Space and Defense Systems, Seattle, WA, USA
Wideband Radar Echoes from Cylindrical Rods
Wei, P. S. P.; Reed, A. W.; Knott, E. F.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1418-1421; In English; See also 20050109927; Copyright; Avail: Other Sources

The theory and experiments for wave scattering from metallic cylinders have been well established. Radar measurements of a set of scaled metal cylinders were among the criteria used to evaluate the performance for several outdoor RCS test facilities some 30 years ago. In the Boeing 9-77 indoor compact range, we have collected full polarimetric radar data of simple objects for the purposes of range characterization and calibration. In this paper, we present preliminary results for cylindrical aluminum rods of radius a = 0.25 inch and lengths L of 36 and 72 inches, as functions of tilt angle, azimuth, and frequency. The test objects are supported by fine fishing lines from a ceiling-mounted turntable at the line-of-sight (LOS) orientations of horizontal, 45 deg, and vertical, when held broadside to the radar. A rotation of the turntable changes the azimuth of the object to the radar, except for the vertical case. The measurements are carried out at frequencies from 0.8 to 18 GHz in small steps, for which the electrical circumference ka varied from 0.1 to 2.4. The rods are from a few to several dozens of wavelength lambda in length.
Author
Broadband; Radar Echoes; Rods; Cylindrical Bodies

20050110044 Tsukuba Univ., Japan
A Novel Sleeve Monopole with Broad Bandwidth
Chen, Zhi Ning; Hirasawa, Kazuhiro; Wu, Ke; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1244-1247; In English; See also 20050109927; Copyright; Avail: Other Sources

Owing to simplicity, polarization purity, power capacity, good match, and low cost, to use a coaxially fed monopole in a parallel plate waveguide is an attractive option as an adapter or a feed and has been extensively investigated for years. However, a simple coaxially fed linear monopole particularly offers a feature of narrow impedance bandwidth. So some modified monopoles have been often applied to wireless communication antennas in the past decades. The input impedance performance has been significantly improved by means of the various loading techniques, such as dielectric coatings, attached

dielectric resonator structures, and discended or top-hat structures. Recently, an alternative is a leaky-mode aperture coupled dielectric resonator, which has been successfully used as a feed of a class of omnidirectional antennas suitable for wireless communication systems. In this summary, a novel sleeve monopole type is proposed to further improve the impedance performance of a monopole. This structure simply consists of a second sleeve and a sleeve monopole vertically put between a parallel plate waveguide. Compared to traditional structures used in a parallel plate waveguide, this modified sleeve monopole has a merit of noticeably broad impedance bandwidth and still maintains the feature of simple structure, low cost, and pure polarization.
Derived from text
Bandwidth; Broadband; Monopoles; Sleeves; Antenna Design

20050110046 Reggio Calabria Univ., Reggio Calabria, Rende, Italy
A Broadband Microstrip Antenna for SAR Applications
Amendola, G.; Costanzo, S.; Martire, V.; DiMassa, G.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1240-1243; In English; See also 20050109927; Copyright; Avail: Other Sources

The development of a new configuration of X broadband planar microstrip antenna is presented. As base element is chosen a foamed inverted rectangular patch fed by near-resonant slots. In the feeding line a proper power divisor is introduced. The antenna reach the frequency band of 1 GHz at 9.6 GHz. The proposed antenna is suitable to be used for SAR applications.
Author
Antenna Design; Broadband; Microstrip Antennas; Fabrication; Synthetic Aperture Radar

20050110054 Pennsylvania Univ., Philadelphia, PA, USA
Chaotic Wave Scattering and Synchronization
Wu, Thomas X.; Jaggard, Dwight L.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1388-1391; In English; See also 20050109927; Copyright; Avail: Other Sources

Chaotic electromagnetic waves are candidates for secure communications, target detection, imaging and remote sensing. Although baseband chaotic waves share wideband feature with short pulse electromagnetic waves, these chaotic waves have multiscale characteristics and can be subject to synchronization also. We examine the application of chaotic synchronization to wave scattering in an imperfect channel. We define synchronization mismatch and investigate its dependence on channel characteristics.
Author
Electromagnetic Scattering; Chaos; Synchronism

20050110061 Metawave Communications, Redmond, WA, USA
Applications of Smart Antennas in Cellular Networks
Feuerstein, Martin J.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1096-1099; In English; See also 20050109927; Copyright; Avail: Other Sources

Many cellular telephone networks are currently in the midst of migrating from analog to digital radio air interfaces. This paper examines the network performance of smart antenna architectures designed for current dual-mode AMPS and CDMA cellular networks. The proposed smart antenna approach is implemented as a non-invasive add-on to existing base stations, with the goal of addressing many of the fundamental performance limitations that exist within these networks. Traditionally smart antennas are used to improve capacity by increasing traffic channel carrier-to-interference (C/I) ratios, resulting in tightened frequency reuse for FDMA networks. In this paper, the focus is turned instead to non-traditional methods for phased.array antenna deployments to improve capacity in CDMA networks through traffic load balancing, handoff management and network-wide interference control.
Author
Antennas; Code Division Multiple Access; Digital Systems; Frequency Division Multiple Access; Electromagnetic Interference; Telephones; Radio Communication

20050110066 Ericsson Radio Systems A.B., Stockholm, Sweden
GSM/TDMA Adaptive Antenna Field-Trial Results
Anderson, Soeren; Hagerman, Bo; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1108-1111; In English; See also 20050109927; Copyright; Avail: Other Sources

Adaptive antennas have generated great interest in recent years and at present, several manufacturers and operators are

separately or jointly performing field-tests to gain more detailed knowledge of the potential of the technology. This article summarizes many of the experiences that since 1996 have been collected during field trials carried out for both GSM and TDMA (IS-136) by Ericsson in co-operation with two major network operators, Mannesmann Mobilfunk and AT&T Wireless Services.
Author
Antenna Radiation Patterns; Field Tests; Time Division Multiple Access

20050110067 Technische Hogeschool, Delft, Netherlands
Design of a Focal Plane Dielectric Rod Array for Feeding a Multiple Beams Reflector Antenna
Moumen, A.; Ligthart, L. P.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1152-1155; In English; See also 20050109927; Copyright; Avail: Other Sources

At the Delft University of Technology, different radar systems have been developed. One of the larger systems is the S-band Delft Atmospheric Research Radar (DARR), which is used for atmospheric profiling. DARR is a permanent system constructed in an urbanized coastal area. As atmospheric conditions depend on the geographical situation, measurement done at different locations could give extra information on the atmosphere. Therefor, At IRCTR a new transportable atmospheric radar system (TARA), having a sophisticated antenna system, is under construction. The antenna system of TARA has multiple beams pointing at different directions (i.e. 0 deg.,15 deg. in both horizontal and vertical-plane) and switched electronically. This is achieved by means of a parabolic reflector fed by a small phases array located in the focal region.
Derived from text
Design Analysis; Focal Plane Devices; Rods; Arrays; Reflector Antennas

20050110069
A Reflector Antenna with High Gain and Wide Angle Beam Steering Capabilities
Capone, R.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1156-1159; In English; See also 20050109927; Copyright; Avail: Other Sources

A reflector antenna configuration is presented that allows beam steering in a wide conical coverage by a two-axes reflector rotation about the focus, while keeping fixed the feed. This approach is able to limit gain loss by high utilization of reflector surface and high reduction of phase errors on the aperture plane. A parametric study has been carried out as function of the antenna geometrical parameters and illumination function.
Author
Reflector Antennas; Antenna Design; High Gain; Angles (Geometry)

20050110071 Matsushita Electric Industrial Co. Ltd., Kadoma, Japan
An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz
Ogawa, Koichi; Matsuyoshi, Toshimitsu; Monma, Kenji; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1122-1125; In English; See also 20050109927; Copyright; Avail: Other Sources

With the expansion of cellular telephone services, there has been an interest in and much research directed towards antenna gain enhancement in ordinary use situations. In order to reduce multipath fadings in a land mobile communication environment, diversity reception techniques are employed for portable telephone terminals because high diversity gain can be achieved while at the same equipment can be further miniaturized. A very compact diversity antenna configuration for portable telephones comprising a retractable whip antenna and built-in planar inverted F antenna (PIFA) has been developed. In order to obtain high diversity the correlation between diversity branches must be small while maintaining a high effective gain in the communication environment. To this end, correlation coefficients and effective gains have been analyzed in free space in relation to antenna structures under various radio wave propagation environments. However, few theoretical analyses evaluating these relationships which include electromagnetic interaction by the existence of the antenna, the handheld unit and the human operator have been reported. For desiring a diversity antenna with a small correlation coefficient and a high effective gain, analysis of these characteristics under practical use conditions is essential. The purpose of this work is to make a wire-grid analysis of a diversity antenna comprising a whip antenna and a built-in PIFA, to include the electromagnetic effects of a human operator and to evaluate diversity performance with regards to the head-to-radio separation under various incident radio wave environments. Investigations are also made on the power absorbed in a head, a hand and a shoulder, on the power less due to impedance mismatch, and on the dissipated power in a non-excited element when the head-to-radio

reparation is changed. From the results, a mechanism for changing radiation efficiency is explained.
Derived from text
Antenna Arrays; Miniaturization; Wave Propagation; Electromagnetic Interactions; Antenna Components; Antenna Design

20050110073 Space Systems/Loral, Palo Alto, CA, USA
A Confocal Reflector System
Luh, Howard; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1132-1135; In English; See also 20050109927; Copyright; Avail: Other Sources

The confocal paraboloidal reflector system which changes the input and output beam diameters is often considered as a phased array magnifier. However, the test results shows that the antenna performance is less desirable. Recently, due to the realization of the implementation of active phased array in space, for example, S band phased array of Global Star satellites, has revived interest in a con.focal system. The confocal system is particularly attractive to low frequency system such as S band system, where the radiating aperture may become quite large. With the use of the confocal system, one can use a smaller stationary active phased array feed instead of a large deployed full size active phased array. This paper describes an improved confocal system.
Author
Reflectors; Conical Bodies; Magnification; Antenna Arrays

20050110075 University of Southern California, Los Angeles, CA, USA
A Design Procedure for Classical Offset Dragonian Antennas with Circular Apertures
Chang, S.; Prata, A., Jr.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1140-1143; In English; See also 20050109927; Copyright; Avail: Other Sources

Numerous antenna applications (e.g., remote sensing, radar, and communication) require compact antennas capable of providing high gain over a wide field of view. Although high performance over a moderate field of view can be achieved with conventional classical offset dual-reflector geometries, some applications require performances unattainable with these antennas. For such cases, the classical offset Dragonian antenna might provide the required improved performance. The classical Dragonian antenna employs a paraboloidal main reflector illuminated by a concave hyperboloidal subreflector, and its performance has been confirmed. The relatively large offset distance and focal length of the main reflector, and the avoidance of caustics between the two reflector surfaces (a consequence of the concave subreflector), yield relatively flat reflectors with wide field of view capability. Furthermore, the Dragonian antenna can be designed to be efficiently illuminated by an electrically small feed. Although Dragonian antennas have been around for more than two decades, to the authors' best knowledge an electrical design methodology is not yet available for them. In this paper a convenient step-by-step design procedure for electrically optimized (i.e., zero geometrical-optics cross polarization and minimum spillover) classical offset Dragonian antennas with a circular aperture is presented. The procedure starts from readily available mechanical
Author
Design Analysis; Apertures; Antenna Arrays; Circular Plates

20050110077 DaimlerChrysler Aerospace A.G., Munich, Germany, Dornier Satellitensysteme G.m.b.H., Munich, Germany
EIRP and Power Efficiency of Reconfigurable Active Transmit Antennas
Kraft, Ulrich R.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1144-1147; In English; See also 20050109927; Copyright; Avail: Other Sources

Reconfigurable, active transmit antennas are attractive for a variety of applications in the military and aerospace sector, since they offer antenna pattern flexibility via reconfigurable amplitude/phase control and permit high EIRP-figures with a set of amplifiers operating at fairly low power levels. Such antennas can be realized as direct radiating arrays, single-reflector multi-feed types or array-fed double-reflector antennas (magnified arrays) and comprise - in all cases - a radiator section, a set of power amplifiers (PAs) and a low-power BFN. Looking from the systems perspective, one basic need for the handling of such antennas within the systems analysis and design is an antenna model which can be used for a wide variety of antenna types and provides easily usable tools for the prediction of the most relevant system figures. Whereas such a description for the gain and G/T of active receive antennas has been proposed earlier, the current contribution provides a corresponding model for the EIRP and power efficiency of active transmit antennas where the antenna gain is almost meaningless.
Author
Antenna Radiation Patterns; Transmission Efficiency; Reflector Antennas

20050110083 Southeast Univ., Nanjing, China

A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications

Xiaoxing, Yin; Xinyu, Zai; Wei, Hong; Xiaowei, Zhu; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1384-1387; In English; See also 20050109927; Copyright; Avail: Other Sources

To meet the growing demand for high-capacity mobile communication services, micro-cell and pico-cell are now introduced. Wave propagation prediction in urban micro- and pico-cells is becoming a very important work in design of a mobile communication system. In urban environments with many high buildings, the antenna height at base station is usually below the level of building roofs, and the wave diffraction at the top of buildings can be ignored. These buildings can be modeled as conducting cylinders coated with lossy media, and wave propagation prediction in the cell can be achieved by solving a two-dimensional scattering problem of multi-cylinder. The Frequency Domain Finite Difference (FDFD) method combined with Measured Equation of Invariance (MEI) can dramatically save CPU time and memory. To avoid outgoing wave in the scattering field of multi-cylinder, iterative MEI method (IT-MEI) has been developed. Not solving the scattering field on all cylinders at the same time, IT-MEI solves the scattering field on one cylinder at one time, and the inference from all other cylinders is taken into account in the form of incline wave onto the cylinder. The computational work of IT-MEI includes three parts, generating matrix equation (calculating MEI and FD coefficients and filling in the matrix), solving the matrix equation on each cylinder and calculating the scattering field of the cylinder on others. By rearranging the order of nodes, FAST-MEI has reduced the computing effort for solving the matrix equation from O(N(sup 2)) to O(N), where N is the number of the mesh nodes around each cylinder. But the computing time for both generating the matrix equation and calculating multiple scattering by multi-cylinders are still proportional to O(N(sup 2)). In this paper we present a novel fast iterative algorithm (FAST-MEI+FMM) based on the combination of FAST-MEI and the fast multipole method (FMM) for wave propagation prediction in urban micro-cells. By using FMM in both calculating the MEI coefficients and the multiple scattering by multi-cylinders, the computing time is then down to O(N(sup 1.5) log N).

Author (revised)

Cities; Mobile Communication Systems; Wave Diffraction; Wave Propagation; Finite Difference Theory; Invariance

20050110086 Michigan Univ., Ann Arbor, MI, USA

A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies

Ellis, Thomas J.; Raskin, Jean-Pierre; Rebeiz, Gabriel M.; Kathehi, Linda P.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1220-1223; In English; See also 20050109927; Copyright; Avail: Other Sources

This paper presents a CPW-fed aperture-coupled micromachined microstrip antenna operating at 94 GHz. The design consists of two stacked silicon substrates: 1) the 200 micron silicon substrate, which carries the microstrip antenna, is micromachined to improve the radiation performance of the antenna, and 2) the bottom 100 micron silicon substrate, which carries the feed CPW line. The performances of this new antenna are compared to the ones obtained with a microstrip-fed aperture-coupled micromachined microstrip antenna designed by some of the authors published previously in the literature. It is demonstrated that a wider bandwidth and a less sensitive input impedance versus the fabrication process accuracy are obtained with the new design presented in this paper. The measured return loss is -27 dB at 94 GHz with a 10-dB bandwidth greater than 30%. The CPW-fed aperture-coupled micromachined microstrip antenna is an efficient solution to vertical integration of antenna arrays at millimeter-wave frequencies.

Author

Fabrication; Microstrip Antennas; Millimeter Waves; Frequencies; Broadband

20050110087 Universidad Politecnica de Madrid, Madrid, Spain

Design of Two-layer Printed Reflect Arrays for Bandwidth Enhancement

Encinar, Jose A.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1164-1167; In English; See also 20050109927

Contract(s)/Grant(s): CICyT-TIC95-0137-C02-01; Copyright; Avail: Other Sources

A reflect array consists of a planar array of microstrip patches on a grounded substrate with a certain tuning to produce a progressive phase shift when illuminated by a primary source. The progressive phase shift of the reflected field can be achieved by varying the resonant length of the patches. This technique allows a simpler manufacture and produces lower cross-polarization levels than the stubs of different length attached to the radiating patches. Reflect arrays are easier to manufacture than reflector antennas and present less distortion and cross-polarization at the cost of a narrower bandwidth. Since narrow bandwidth is the most restricting limitation of reflect arrays, in this paper we propose a double layer reflect array, using patches of variable size, to increase the bandwidth and to reduce the sensitivity to manufacture tolerances. A reflect array

using stacked microstrip patches of variable length was designed for dual frequency operation. In that work, the design was performed in only one dimension and for linear polarization. In the present work, the same techniques are used for the analysis and design of the multilayer reflectarray, but the objective is to increase bandwidth. A two-dimensional double-layer reflectarray is designed for dual polariza6on, and the radiation patterns are presented. The results are compared with those of a single layer reflectarray.
Author
Design Analysis; Antenna Radiation Patterns; Boundary Layers; Reflector Antennas

20050110088 Army Communications-Electronics Command, Fort Monmouth, NJ, USA
Bandwidth Enhancement of Microstrip Antenna with Leaky-wave Excitation
Nalbandian, Vahakn; Lee, Choon Sae; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1224-1227; In English; See also 20050109927; Copyright; Avail: Other Sources

One of the most detrimental aspects of microstrip antennas despite their many advantages is narrow bandwidth. Even though numerous successful results have been reported, a bandwidth more than 20% is difficult to achieve. In this paper a new technique is introduced to increase the bandwidth of a microstrip antenna drastically using a leaky-wave concept.
Author
Bandwidth; Excitation; Microstrip Antennas; Dielectrics

20050110090 Helsinki Univ. of Technology, Helsinki, Finland
Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna
Hienonen, Sami; Lehto, Arto; Raeisaenen, Antti V.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1228-1231; In English; See also 20050109927; Copyright; Avail: Other Sources

Aperture-coupling has proven to be a reliable and a robust feeding technique ofmicrostrip antennas. The lack of galvanic contacts makes it a preferable way to realize the feeding of large printed antenna arrays. Moreover, it is suitable for wide-bandwidth dual-polarization designs. These designs, however, utilize two stacked microstrip patches and thus, are more expensive to produce than single-patch designs. In addition, most designs are not suitable for integration of active circuits. This paper presents a simple broadband dual-polarized microstrip antenna with only three layers. The input impedance bandwidth (VSWR less than 2) of 25% is achieved with double resonance technique, in which the resonant frequencies of the patch and the coupling slot are tuned near to each other. Proper positioning of the coupling slots and the use of a thin, medium permittivity substrate results high isolation (greater than 40 dB) between the ports and thus acceptable cross polarization (better than -20 dB). The geometry, return loss, and the isolation of a single antenna element and the radiation pattern of a four-element linear array are presented. These antennas were designed for the European DBS-band 10.70-12.75 GHz.
Derived from text
Apertures; Broadband; Cross Polarization; Microstrip Antennas; Antenna Couplers; Antenna Design

20050110091 Lockheed Martin Corp., Palmdale, CA, USA
Archimedean Spiral-mode Microstrip Antenna with Improved Axial Ratio
Acree, Michael A.; Prata, Aluizio, Jr.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1232-1235; In English; See also 20050109927; Copyright; Avail: Other Sources

Spiral antennas are widely used in applications such as radar warning, direction finding, and advanced electronic surveillance systems. They are suitable for conformal mounting onto aircraft skins targeted for low radar cross section whenever circularly-polarized low to medium antenna gain (0-10dBi) is required over a wide bandwidth (2-18 GHz). For such applications, the system designer may select between the conventional cavity-loaded spiral (CLS) and the recently invented spiral-mode microstrip (SMM) antenna. Although the CLS is capable of a fairly low axial ratio over three octaves (typically less than 2 dB), the SMM antenna is capable of maintaining a 3 dB gain advantage with some axial ratio degradation. It is then desirable to have a spiral antenna whose axial ratio performance is similar to the CLS without the gain loss. To satisfy such requirements, a spiral antenna placed above a circular cavity with a conical bottom, filled with a low-loss substrate, is proposed in here (as opposed to the fiat cavity bottom of the standard SMM antenna). This conical geometry provides a varying electrical spacing between the microstrip conductor and the cavity bottom as the radiation zone diameter varies with frequency-a feature here used to improve the antenna electrical characteristics.
Derived from text
Microstrip Antennas; Spiral Antennas; Axial Modes

20050110093 EMAG Technologies, Inc., Ann Arbor, MI, USA

Polarimetric Backscatter Characterization of Road Surface Faults at Millimeter-wave Frequencies

Li, Eric S.; Sarabandi, Kamal; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1300-1303; In English; See also 20050109927; Copyright; Avail: Other Sources

To design a reliable obstacle detection radar sensor for automated highway system applications, thorough knowledge of backscatter response of various road surface conditions is required. Recently analytical models capable of predicting various road surfaces under different environmental conditions were developed. In this paper, the polarimetric backscatter behavior of typical road surface faults, such as surface cracks and potholes, is considered. Although cracks do not pose any safety threat, the study of their backscatter response is important as far as the false alarm rate caused by cracks is concerned. Two theoretical models are developed to predict the backscatter response of cracks perpendicular to the antenna boresight. The first model simulates a crack by two impedance wedges next to each other. The method developed by Maliuzhinets is used to calculate the total field in the presence of impedance wedge at normal incidence condition. A non-uniform expression for impedance wedge diffraction is chosen to represent the diffraction coefficient. The diffracted fields from two adjacent wedges are then added coherently. At MMW frequencies the radii of curvature of asphalt or concrete crack edges become comparable with the wavelength and the wedge model may become invalid. For this situation a second model for curved edges based on scattering from impedance cylinders is developed. The validity of the theoretical model verified by the experimental results. The simulation results of the second model exhibit better agreement with the measured data at 94 GHz than do those of the first model. Also the experimental backscatter behavior of potholes with different depths over a wide range incidence angles is presented.

Derived from text

Backscattering; Millimeter Waves; Roads; Frequencies; Mathematical Models; Surface Cracks; Polarimetry

20050110096 Clemson Univ., SC, USA

The Sleeve-cage Monopole and Sleeve Helix for Wideband Operation

Rogers, Shawn D.; Butler, Chalmers M.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1308-1311; In English; See also 20050109927

Contract(s)/Grant(s): DAAH04-95-1-0247; DAAG55-98-1-0009; Copyright; Avail: Other Sources

Recent advances in modem mobile communication systems, especially those which employ spread-speca'um techniques such as frequency hopping, require antennas which have omnidirectional radiation characteristics, are of low profile, and can be operated over a very wide frequency range. The simple whip and the helical antenna operating in its normal mode appear to be attracfive for this application because they naturally have omnidirectional characteristics and are mechanically simple. However, these structures are inherently narrow band and fall short of needs in this regard. Hence, additional investigations must be undertaken to develop methods to meet the wide bandwidth requirement of the communication systems. We have recently shown from numerical calculations that the bandwidth of a normal mode helix can be increased by the addition of close-by wire parasites. A genetic algorithm and a fast integral equation solution technique are employed to determine the optimum distance and height of these parasites. These parameters were determined experimentally when the driven element was a straight wire dipole. In a recent paper a central parasitic straight cylinder was added inside a driven single wire helix to obtain dual frequency operation. We have found that even greater bandwidth, over that of a single driven wire, can be realized when the parasites are placed around 'cage' monopoles having several parallel wires. Similar observations are made about a multifilament versus a single filament helix. We modeled and measured the properties of a so-called cage monopole.

Derived from text

Broadband; Helical Antennas; Monopoles; Sleeves

20050110097 Raytheon Systems Co., Rancho Cucamonga, CA, USA

Rigorous Analysis of Practical Reflector Antennas

Brown, Kenneth W.; Prata, Aluizio, Jr.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1312-1315; In English; See also 20050109927; Copyright; Avail: Other Sources

Perhaps the most ubiquitous numerical tool used in the analysis of reflector antennas is the physical optics technique. Although this approximate technique typically predicts the radiation patterns of reflector antennas with excellent accuracy, there are numerous situations where rigorous analysis methods are desirable. The rigorous analysis of reflector antennas using the method of moments has been accomplished in the past. However, the majority of the work has been limited to electrically small reflectors, or antennas with axial-symmetry. In this work a technique for rigorously analyzing relatively large practical reflector antennas, with as many as 100,000 surface current elements, is presented. This tool is based on an iterative integral equation solver and can rigorously handle offset multireflector antennas in their entirety (including all reflectors, surfaces,

struts, feed, and feed support hardware). To demonstrate the tool's performance, computed radiation patterns are compared with measured and physical optics generated radiation patterns.
Author
Reflector Antennas; Antenna Radiation Patterns; Method of Moments

20050110098 Ohio State Univ., Columbus, OH, USA
Electromagnetic Energy around Hertzian Dipoles
Schantz, Hans Gregory; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1320-1323; In English; See also 20050109927; Copyright; Avail: Other Sources

There is great interest in the fundamental question of how an antenna radiates and where is the source of its radiation. Most examinations have focused on tracing radiation back to 'radiation centers' on an antenna. The aim of this present paper is to show how to determine where static and reactive energy are convened into radiation in the fields around an antenna. The origin of radiation is well understood on a qualitative basis. To answer the question more precisely however, I present a new technique for analyzing how electromagnetic energy behaves, the method of 'causal surfaces.' First, I will present the Hertzian dipole fields in the time domain, and consider their flux of energy. I will show how to determine the 'causal surfaces' around such a dipole. These are the surfaces on which the normal Poynting vector goes to zero so that there is no net flow of energy through the surface. For a Hertzian dipole, these surfaces are always spherical, and therefore relatively simple to analyze. I will use this technique in a few special cases: an exponentially decaying Hertzian dipole and a damped harmonic Hertzian dipole, to explore instances in which none of the radiated energy is emitted directly from the dipole itself. Rather, it comes from the original energy in the fields of the pre-existing dipole moment. I will further apply the technique of causal surfaces to a harmonic oscillating Hertzian dipole to determine the source of its radiated energy. I will show that, on average, the power radiated from such a dipole is converted from reactive or static energy at a distance of 0.17 lambda away from the dipole itself. Finally I will consider the utility of the technique of causal surfaces in understanding real antennas.
Author
Dipole Antennas; Antenna Radiation Patterns

20050111454 Naval Postgraduate School, Monterey, CA USA
SJFHQ Simulation
Schacher, Gordon; Dailey, James; Looney, John; Saylor, Steven; Jensen, Jack; Nov. 2004; 86 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429798; NPS-IS-04-001; No Copyright; Avail: Defense Technical Information Center (DTIC)

A four level architecture has been developed for SJFHQ processes. This architecture has been used to develop a simulation of SJFHQ operations. Correct simulation performance has been verified and initial results produced. The results focus on personal work tasking and multi-tasking effects.
DTIC
Command and Control; Architecture (Computers)

20050111457 Naval Postgraduate School, Monterey, CA USA
Wireless Network Security: Design Considerations for an Enterprise Network
Wee, Oh K.; Dec. 2004; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429868; No Copyright; Avail: Defense Technical Information Center (DTIC)

Since its introduction in 1999, the Institute of Electrical and Electronics Engineers (IEEE) 802.11 Wireless Local Area Network (WLAN) has become the de-facto standard for wireless networking, providing convenient and low cost connectivity. Increasingly, enterprises are extending their networks with 802. 11-based WLANs to provide mobility and information-on-the-move for its employees. However, the introduction of WLANs into enterprise networks has raised major concerns about security. A poorly implemented WLAN introduces weaknesses in the enterprise network which can be exploited by attackers, resulting in severe consequences for the enterprise. This thesis was sponsored by the DoD to study the problem of designing a secure wireless architecture for an enterprise network. The specific requirements for the enterprise network were based extensively on DoD and the intelligence community's security guidelines and policies. This thesis provides an indepth analysis into the 802.11 standard and measures how far the standard goes in meeting the specific requirements of the enterprise network. This thesis presents a layered-defense architecture to provide a scalable design for secure wireless networks. A

prototype system utilizing XML to control the flow of classified information in wireless networks is also presented.
DTIC
Radiotelephones; Information Transfer; Parallel Processing (Computers); Security

20050111494 Newcastle-upon-Tyne Univ., Newcastle
Distributed Enactment of Composite Web Services
Woodman, S. J.; Palmer, D. J.; Shrivastava, S. K.; Wheater, S. M.; Jun. 2004; 22 pp.; In English
Report No.(s): PB2005-103581; CS-TR-848; Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
World Wide Web; Internets; Information Systems

20050111505 Newcastle-upon-Tyne Univ., Newcastle
Design and Evaluation of a QoS-Adaptive System for Reliable Multicasting
Di Ferdinando, A.; Ezhilchelvan, P.; Mitrani, I.; Mar. 2004; 34 pp.; In English
Report No.(s): PB2005-103573; CS-TR-833; Copyright; Avail: National Technical Information Service (NTIS)
This document presents and studies a QoS-adaptive system for reliably multicasting messages to all intended destinations, despite possible crashes of the sender and other processes, and communication failures. This is a part of our on-going work on building a QoS-adaptive group communication system to support application service provision- ing (ASP) where it is typical to purchase network level services, subject to some service level agreements (SLA), from an Internet Service Provider (ISP). The reliable multicast protocol studied here is designed for QoS metrics such as absolute and relative latency distributions, and the probability of successful delivery, to be negotiated prior to multicast provisioning. Moreover, the protocol adapts its parameters dynamically in order to minimize the message traffic required to achieve the negotiated QoS metrics. The performance of the protocol is analyzed mathematically under simplifying assumptions. The accuracy of the approximations is evaluated by simulations.
NTIS
Reliability; Probability Theory

20050111509 Newcastle-upon-Tyne Univ., Newcastle
From Crash Tolerance to Authenticated Byzantine Tolerance: A Structured Approach, the Cost and Benefits
Mpoeleng, D.; Ezhilchelvan, P. D.; Speirs, N. A.; Jan. 2004; 16 pp.; In English
Report No.(s): PB2005-103566; CS-TR-824; Copyright; Avail: National Technical Information Service (NTIS)
Many fault-tolerant group communication middleware systems have been implemented assuming crash failure semantics. While this assumption is not unreasonable, it becomes hard to justify when applications are required to meet high reliability requirements and are built using commercial off the shelf (COTS) components. This paper presents a structured approach to extend a crash-tolerant middleware system into an authenticated Byzantine tolerant one with small modifications to the original system. The proposed approach is based on state machine replication (SMR) and is motivated by the composability features of standard distributed object technologies such as CORBA. SMR is used to assure signal-onfailure (fail-signal) semantics at a level where existing crash-tolerant services can be seamlessly deployed. The resulting system can provide total ordering that has no liveness requirement for termination. We demonstrate the effectiveness of our approach by porting a crash-tolerant CORBA group communication service - the NewTOP system. We also measure the performance of the resulting system.
NTIS
Communication Networks; Fault Tolerance; Applications Programs (Computers)

20050111512 Newcastle-upon-Tyne Univ., Newcastle
Component Middleware to Support Non-repudiable Service Interactions
Cook, N.; Shrivastava, S.; Robinson, P.; 2004; 14 pp.; In English
Report No.(s): PB2005-103564; Copyright; Avail: National Technical Information Service (NTIS)
The wide variety of services and resources available over the Internet presents new opportunities to create value added, inter-organisational Composite Services (CSs) from multiple existing services. To preserve their autonomy and privacy, each organisation needs to regulate access both to their services and to shared information within the CS. Key mechanisms to facilitate such regulated interactions are the collection and verification of non-repudiable evidence of the actions of the parties to the CS. The paper describes how component-based middleware can be enhanced to support non-repudiable service

invocation and information sharing. A generic implementation, based on a J2EE application server, is presented.
NTIS
Internets; Computer Programs; Support Systems; Applications Programs (Computers)

20050111515 Westat Research, Inc., Rockville, MD, USA
Internet Access in US Public Schools and Classrooms: 1994-2003
Parsad, B.; Jones, J.; Greene, B.; Feb. 2005; 94 pp.; In English
Report No.(s): PB2005-103395; NCES 2005-015; No Copyright; Avail: CASI; A05, Hardcopy

The National Center for Education Statistics (NCES) has employed its Fast Response Survey System (FRSS) to track access to information technology in schools and classrooms since 1994. Each year, NCES has conducted a new nationally representative survey of public schools to gauge the progress made in computer and Internet availability, based on measures such as student-to-computer ratio and the percentage of schools and classrooms with Internet connections. As computers and the Internet became increasingly available in schools, the FRSS surveys were modified to address new and continuing issues, such as the use of new types of Internet connections to enhance connectivity. Recent FRSS surveys on Internet access have been expanded to address other emerging issues. The 2002 survey, for instance, included items on the use of technologies or procedures to prevent student access to inappropriate material on the Internet, the availability of computers outside of regular school hours, and the availability of teacher professional development on technology use in the classroom.
NTIS
Computer Networks; Education; Technology Utilization

20050111535 Newcastle-upon-Tyne Univ., Newcastle
Design and Evaluation of an Efficient Reliable Manycast Protocol for Ad-hoc Networks
Vollset, E.; Ezhilchelvan, P.; 2004; 18 pp.; In English
Report No.(s): PB2005-103625; CS-TR-838; Copyright; Avail: National Technical Information Service (NTIS)

The protocol presented here guarantees that at least a specified number, k, of destinations receive a given message. The guarantees are deterministic and the failure probability is zero. Such a strong delivery assurance provides a more powerful primitive than protocols which attempt to minimize failure probability, and is useful for meeting many user-level requirements. Simulations under a wide range of settings confirm that the overhead is low even when k is high, and that the protocol is scalable. These desirable performance results are due to many design features, in particular, the decentralized delivery management whereby any node - manycast initiator or destination- can take responsibility in a cost-effective manner for achieving the specified delivery ratio. The goal of attaining total reliability is comprehensively addressed: the design considers even the rare, but not impossible, scenarios of the network behaving as an adversary.
NTIS
Communication Networks; Protocol (Computers); Cost Effectiveness; User Requirements

20050123553 Physics and Electronics Lab. TNO, The Hague, Netherlands
Array Configurations and Wideband Radiators Suitable for Shared Apertures
Keizer, W. P. M. N.; November 2002; 43 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): A00/KM/WCS; TNO Proj. 015.29411
Report No.(s): FEL-02-A245; TD-2001-0344; Copyright; Avail: Other Sources

In two recent reports, TNO-FEL has published the results from the first phase of the Netherlands Integrated Topside Design Program (ITD). The ITD program is related to the design of future warships. In this report the following general ITD objectives were formulated: 1. Improved sensor performance. 2. Reduced signature. 3. Reduced EM1 effects. 4. Improved survivability The ITD program is focused on the integration of four functions - radar, communications, navigation and electronic warfare - into a set of common intelligent low signature apertures that can perform these functions simultaneously and satisfying the above requirements. This report addresses various approaches to meet the ITD objectives. The focus will be on antennas since these devices are a key factor to satisfy the ITD objectives.
Derived from text
Radar Navigation; Performance Prediction; Sensors; Surveillance; Communication Equipment

20050123676 Institute of Electrical and Electronics Engineers, USA, University of Central Florida, Orlando, FL, USA
IEEE Antennas and Propagation Society International Symposium, Volume 3
[1999]; 713 pp.; In English; IEEE Antennas and Propagation Society International Symposium, 11-16 Jul. 1999, Orlando, FL, USA; See also 20050123677 - 20050123850
Report No.(s): IEEE-Catalog-99CH37010-Vol-3; LC-90-640397; Copyright; Avail: Other Sources

Reports are presented from the IEEE Antennas and Propagation Society International Symposium, volume 3.Topics included propagation, microstrip antennas and arrays, photonic bandgap materials, numerical methods, ground reflector antennas, transmission properties of materials, an inexpensive distance measuring system for location of robotic vehicles, a multistate markov model for satellite propagation, and channel simulation on LEO satellites.
Derived from text
Microstrip Antennas; Antenna Arrays; Reflector Antennas

20050123680 California Univ., Los Angeles, CA, USA
A Novel Phase Conjugator for Retrodirective Array Application
Miyamoto, Ryan Y.; Qian, Yong-Xi; Itoh, Tatsuo; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1674-1677; In English; See also 20050123676
Contract(s)/Grant(s): DAAH04-96-1-0005; Copyright; Avail: Other Sources

A novel phase conjugator for retrodirective array has been developed. Each element employs a balanced FET mixer, which provides effective isolation between RF and IF signals with identical frequencies to realize phase conjugation. Taking advantage of FETs, a compact circuit has been designed, which allows the array spacing to be small, while the performance was comparable.
Author
Phase Conjugation; Antenna Arrays

20050123682 Kyungpook National Univ., Taegu, Korea, Republic of
Surface Wave Scattering by Finite Periodic Structure of Arbitrary Profile in a Ground Plane: TE case
Lee, Cheol Hoon; Cho, Ung Hee; Cho, Young Ki; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1758-1761; In English; See also 20050123676; Copyright; Avail: Other Sources

So far lots of research works concerning periodic loading problems in various waveguides have been done for such applications as a mode launcher or a dielectric image line array antenna and a grating coupler. Most studies, however, are based on approximate methods as in or restricted to some particular geometries such as notch and sinusoidal shapes. In this article, we deal with surface wave scattering by finite periodic structure of arbitrary profile in a ground plane covered by a dielectric slab. In order to check the validity of the present result (such as the maximum beam angles of leaky wave) for the finite periodic case, the analysis method for the infinite periodic case is also considered. The analysis method is based on the combined FEM/MOM procedure in case of finite periodic case and full MOM procedure in case of infinite periodic case.
Author
Antenna Arrays; Finite Element Method; Sine Waves; Wave Scattering; Waveguides

20050123683 Nebraska Univ., Lincoln, NE, USA
ISAR Turntable Experiments Using a Coherent Ultrawideband Random Noise Radar
Bell, Daryl C.; Narayanan, Ram M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1768-1771; In English; See also 20050123676
Contract(s)/Grant(s): N00014-1-97-1061; Copyright; Avail: Other Sources

The Environmental Remote Sensing Laboratory at the University of Nebraska-Lincoln has developed and tested an ultrawideband random noise radar operating in the 1 - 2 GHz frequency range. Through a unique heterodyne correlation process, this radar preserves the phase of received waveforms thus allowing one to use it as a coherent receiver. This system has been used in various applications, such as detection of buried objects, Doppler estimation, and interferometry. The system has been successfully extended to inverse synthetic aperture radar (ISAR) applications.
Author
Synthetic Aperture Radar; Random Noise; Coherent Radar; Remote Sensing

20050123684 Northrop Grumman Corp., Melbourne, FL, USA
An Optimal Algorithm for Radar Imaging
Milman, Andrew S.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1772-1775; In English; See also 20050123676; Copyright; Avail: Other Sources

We can use a certain set of orthogonal functions to describe the response of any radar to the different spatial frequencies

in a scene being imaged. We can then derive an algorithm that produces the best image resolution possible and explore the relationship between signal-to-noise ratio and resolution.
Author
Radar Imagery; Algorithms; Orthogonal Functions; Imaging Techniques

20050123685 Universitat Politecnica de Catalunya, Barcelona, Spain
Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms
Navarro, M.; Gonzalez, J. M.; Puente, C.; Romeu, J.; Aguasca, A.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1566-1569; In English; See also 20050123676
Contract(s)/Grant(s): FEDER-2FD-97-135; Copyright; Avail: Other Sources

Experimental verification of the Fractal Sierpinski Antenna surface current distribution is presented. Measured data from an infrared camera agree with numerical data showing a self-similar behavior in the current density distribution over the fractal antenna surface. This result gives a better insight on the multiband behavior of the fractal-shape antenna.
Author
Experimentation; Data Acquisition; Current Distribution; Temperature Measuring Instruments

20050123689 National Center for High-Performance Computing, Taipei, Taiwan, Province of China
Scattering of Plane Waves by Two-Dimensional Periodic Impedance Surface
Hwang, R. B.; Peng, S. T.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1900-1903; In English; See also 20050123676; Copyright; Avail: Other Sources

We have modeled a two-dimensional periodic structure by a two-dimensional impedance surface. The scattering of waves by such an impedance surface is rigorously formulated as a three-dimensional boundary-value problem, including the coupling between the TE and TM polarized waves. Numerical examples are given to illustrate physical phenomena associated with the structure.
Author
Plane Waves; Electromagnetic Scattering; Impedance

20050123692 Trieste Univ., Italy
Null Control for Linear Arrays by Phase-only or Amplitude-only Modification of the Excitations
Vescovo, Roberto; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2040-2047; In English; See also 20050123676; Copyright; Avail: Other Sources

We consider two synthesis problems for linear arrays, which consist in placing nulls in the array factor by modifying only the phase or only the amplitude, respectively, of the excitations. The problems are solved iteratively using the method of successive projections, and numerical results are shown.
Author
Linear Arrays; Control Theory; Iteration

20050123694 Paderborn Univ., Germany
Significant RX Antenna Diversity Gain in 30 GHz Broadband Radio Channels Subject to Fading
Karthaus, U.; Noe, R.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2078-2081; In English; See also 20050123676; Copyright; Avail: Other Sources

Transmission in the lower mm wave range along traffic roads suffers from fading, even if the line of sight is not obstructed, and from intersymbol interference (ISI) due to multipath propagation. We have measured up to 11 dB gain when employing RX antenna space diversity. ISI on the other hand is reduced only little.
Author
Antenna Gain; Radio Frequencies; Reception Diversity; Broadband; Signal Fading

20050123696 Catholic Univ., Rio de Janeiro, Brazil
A Shaped Relector Antenna for Mobile Communications
Bergmann, J. R.; Hasselmann, F. J. V.; Branco, M. G. C.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2155-2157; In English; See also 20050123676; Copyright; Avail: Other Sources

The characterisitics of a shaped reflector antenna with omnidirectional radiation pattern are presented with a view towards its possible application in radio base stations for cellular communications at microwave frequencies and above. The present

design is an alternative to configurations reported elsewhere, involving nodal stations with up to four antennas for quadrant sectors coverage or dual reflector arrangements for omnidirectional coverage. It comprises a single circularly symmetrical shaped reflector surface fed by an axial horn and synthesized for a cosecant squared secondary antenna pattern in the vertical plane while complying with omnidirectional specifications in the azimuthal plane. Numerical results for a Physical Optics (PO) reflector surface synthesis considering a rigorous feed model highlight the main features of the proposed design.
Author
Mobile Communication Systems; Reflector Antennas; Antenna Design; Microwave Antennas

20050123697 Michigan Univ., Ann Arbor, MI, USA
Effect of Canopy-Air Interface Roughness on HF-VHF Wave Propagation in Forest
Sarabandi, Kamal; Koh, Il-Suek; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1482-1485; In English; See also 20050123676; Copyright; Avail: Other Sources

The problem of wave propagation in forest is revisited. In particular, the effect of the non-planar interface between the air and the canopy on lateral waves is examined. An analytical formulation is obtained for the mean field when both the transmitter and receiver are within the foliage. This formulation is based on distorted Born approximation and is shown that compared to a planar interface, the field of a dipole in a canopy with rough interface is significantly reduced.
Author
Wave Propagation; Very High Frequencies; High Frequencies; Surface Roughness; Forests; Transmitter Receivers

20050123699 Wuhan Radar Academy, Wuhan, China
Performance Improvement of Estimation Direction-of-arrival via Array Geometry Arrangement
Chen, Hui; Wang, Yong-Liang; Wan, Shan-Hu; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1600-1603; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper, a simple method of the direction-of-arrival (DOA) estimate for the unequal linear array, which uses the spatial smoothing MUSIC technique. In the case of the same sensor number, this method which adopts appropriate army geometry arrangement can improve the reso'lvability of DOA estimation more obviously than the uniform linear array. It also overcomes the weakness of the ambiguity of DOA estimation and improves the poor property of de--correlation in the conventional unequal linear array.
Author
Performance Prediction; Linear Arrays

20050123704 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Ka-Band Beam Steering Reflectarray Study
McSpadden, James O.; Fan, Lu; Chang, Kai; Huang, John; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1662-1665; In English; See also 20050123676; Copyright; Avail: Other Sources

A one-meter diameter, 32 GHz active microstrip reflectarray capable of electronic beam steering has been studied. The 15_500 element array consists of rnicrostrip patch antennas, microstrip phase shifters, and dc bias lines. Specifically, the study focused on the solid-state devices and dc bias layouts for scanning the beam linearly 45 from boresight using 2-bit phase shifters. Three configurations are recommended for the reflectarray with integrated 2-bit phase shifters where the total substrate and cladding mass varies from 8 kg to 14 kg. Additionally, dc power requirements for p-i-n diodes in 1-bit, 2-bit and 3-bit phase shifting circuits are approximately 19 W, 19 W, and 39 W, respectively. The dc power requirement for phase shifters using passive MESFETs is much less than 1 W.
Author
Antenna Arrays; Reflector Antennas; Microstrip Antennas

20050123705 National Chiao Tung Univ., Hsinchu, Taiwan, Province of China
Analysis and Design of a Planar Two-Dimensional Retrodirective Array Reflector
Tseng, Wen-Jen; Chung, Shyh-Jong; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1678-1681; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper, a 3 x 4 planar Van Atta array reflector is analyzed and realized. Unlike those in the previous investigations, this reflector possesses a twodimensional retrodirectivity, which means that it can produce broad reflected-field beamwidth both in E-plane and H-plane of the antenna array. To understand the scattering characteristics of the retrodirective reflector, the method of moments and the physical optics (PO) together with the method of equivalent currents (MEC) are used to

analyze and design the reflector. Numerical and measured results are presented, which show good agreement with each other. Author

Antenna Arrays; Reflectors

20050123709 California Univ., Los Angeles, CA, USA

A Fractal Based FSS with Dual Band Characteristics

Romeu, Jordi; Rahmat-Samii, Yahya; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1734-1737; In English; See also 20050123676

Contract(s)/Grant(s): CICyT-FEDER-2FD97-0135; DAAH04-96-1-0389; Copyright; Avail: Other Sources

In recent years, the design of multiband Frequency Selective Surfaces (FSS) has attracted much attention. Different approaches can be found in the literature. Some involve the design of multilayer FSS, others the perturbation of the elements or the spacing between elements. In any case, it is clear that by arraying dual-band elements it is possible to obtain a dual band FSS. On the other hand, the multiband properties of antennas designed using fractal shapes have been recently demonstrated. It appears a natural choice to explore the feasibility of a dual-band FSS based on fractal elements. In this paper a preliminary design of a FSS based on the Sierpinski gasket dipole is presented. The FSS is designed by periodically arraying a two iteration Sierpinski dipole. A fundamental constrain of this approach is the band limitation imposed by the excitation of grating lobes. It is for this reason that the design of a dual band FSS has been addressed, instead of a more general multiband design. The performance of the Sierpinski FSS is compared with a design based on the bow-tie element.

Author

Selective Surfaces; Frequencies; Design Analysis; Arrays

20050123710 Nebraska Univ., Lincoln, NE, USA

Ultrawide-band Noise Synthetic Aperture Radar: Theory and Experiment

Garmatyuk, Dmitriy; Narayanan, Ram M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1764-1767; In English; See also 20050123676

Contract(s)/Grant(s): N00014-1-97-1061; Copyright; Avail: Other Sources

The basic concept of forming synthetic aperture radar (SAR) images by processing received signals in noisy environment allows us to extract useful information from temporal, frequency and spatial separation patterns. Moving targets provide the basis for Doppler estimation, thus allowing us to build a target time history and develop a temporal separation pattern. Multifrequency radars are useful for target detection/identification based on wave-number matching technique (coupling between spatial wavelength of radar signal and target body and features), thus creating a frequency separation pattern. Spatial separation is commonly achieved by various methods of SAR post-processing (such as bandwidth extrapolation for increasing slant-range resolution, or various superresolution methods. In this paper, we will discuss the potential to obtain quality SAR imagery using a coherent ultrawide-band noise radar developed at the University of Nebraska.

Author

Synthetic Aperture Radar; Signal Processing; Radar Imagery; Extrapolation; Bandwidth

20050123711 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Bistatic Scattering Characterization of a Complex Object

Eigel, Robert L., Jr.; Terzuoli, Andrew J., Jr.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1784-1787; In English; See also 20050123676; Copyright; Avail: Other Sources

Although much of the radar development over the past fifty years has been focused in the monostatic domain, a bistatic detection approach offers several key benefits. Without proper understanding of the bistatic scattering mechanisms, utilization of these benefits may not be fully realized. This paper addresses some phenomenological aspects of bistatic scattering from a complex object with an emphasis on specular, shadowing, dihedral, and cavity effects. Both ray tracing and scattering center approaches are used to describe the bistatic mechanisms. An appraisal of the effectiveness and utility of the bistatic equivalence theorems and several commercial scattering prediction codes are also accomplished. Finally some rules of thumb are proposed to help guide the reader in evaluating the bistatic scattering of complex shapes in general.

Author

Bistatic Reflectivity; Lateral Stability; Ray Tracing; Scattering

20050123712 Academy of Sciences of the Ukraine, Kharkov, Ukraine

Probe Pulse Shape Estimation in Synthetic Aperture Method

Kovalenko, V.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1792-1795; In English; See also 20050123676

Contract(s)/Grant(s): STCU Proj. 366; Copyright; Avail: Other Sources

Issues of a Synthetic Aperture Method (SAM) application to subsurface scanning data are discussed in the suggested paper. SAM is known to be one of the most powerful technique of the electromagnetic sounding data processing. Initially created for remote sensing data procession it is now used also in the subsurface investigations. The SAM has been proposed for the subsurface scanning data processing by Osumi and Ueno. The advantages of the SAM include universality of its algorithm and high resolution capability that it can produce. Images of non-dissipative and low-absorbing media can be efficiently treated with this technique. At once, applicability of the SAM to processing of the data that had been collected on media having non-negligible conductivity is rather limited. It is necessary to note, that such a conductivity is proper to all moist soils. Thus, the SAM needs a modification that would permit to take into account a distortion of the sounding impulse in a conducting medium.

Author

Algorithms; Synthetic Apertures; Data Processing; Impulses

20050123714 California Univ., Los Angeles, CA, USA

ARISE: A Challenging 25-m Space Antenna Design

Rahmat-Samii, Yahya; Hoferer, Robert A.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1524-1527; In English; See also 20050123676

Contract(s)/Grant(s): JPL9-60591; Copyright; Avail: Other Sources

ARISE (Advanced Radio Interferometry between Space and Earth). Future scientific and communications missions are conceptualizing using very large reflector antennas in space. The antenna dimensions are targeted from lOm to 25m beyond. Frequencies coveting L-band through W-band are being considered. these challenging missions, one may refer to ARISE (Advanced Radio Interferometry between Space and Earth), which is projected to utilize a 25-m dual Gregorian optics operating from 8 GHz to 86 Gl-lz . An artist's renditions Gregorian antenna concept is shown . The objective of this mission is to create a space-based VLBI system (integrated with ground based antennas) for high resolution mapping of black holes. Successful realization of ARISE necessitates development of several technologies . The most crucial technology is that of the deployable 25-m reflector that must work at frequencies as high as 43 and 86 GHz. The current baseline selection for ARISE is an inflatable antenna, under development for several other applications in communications and remote sensing.

Author

Antenna Design; Reflector Antennas

20050123715 EMS Technologies Canada Ltd., Ste-Anne-de-Bellvue, Quebec, Canada

Design Concepts for the Radarsat-2 SAR Antenna

Uber, J.; Mennitto, J.; McLaren, D.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1532-1535; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper the Radarsat-2 SAR antenna design concepts are presented. Mechanical design issues as well as trade-off analysis are addressed first. Furthermore, the antenna RF design concept evolving from extensive Wade-off studies is described.

Author

Antenna Design; Radarsat

20050123717 Dublin Inst. of Technology, Dublin, Ireland

Planar Trapezoidal and Pentagonal Monopoles with Impedance Bandwidths in Excess of 10:1

Evans, J. A.; Ammann, M. J.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1558-1561; In English; See also 20050123676; Copyright; Avail: Other Sources

A planar disc monopole antenna has been developed for the Japanese TV band (90-770 MHz) in 1991. A model for determining the input impedance of a circular disc monopole has been proposed in 1993. In 1998, a simple formula for predicting the frequency corresponding to the lower edge of the bandwidth was proposed. The planar monopole may be

realised by replacing the cylindrical element of a conventional monopole with a planar element.
Author
Planar Structures; Trapezoids; Monopole Antennas; Impedance; Bandwidth

20050123727 California Univ., Los Angeles, CA, USA
Microstrip Line Fed Slot Antenna with PBG Superstrate
Zhang, Lijun; Alexopoulos, Nicolaos G.; Yablonovitch, Eli; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1924-1927; In English; See also 20050123676; Copyright; Avail: Other Sources

The effect of using a superstrate PBG material on a microstrip line fed slot antenna is investigated. The PBG material is composed of periodic metallic blocks inside a host dielectric material with high material permittivity, and exhibits a complete bandgap at the design frequency of the slot antenna. Simulation results show that by adding the PBG layer as a superstrate, radiation in the E-plane near the endfire direction is suppressed, while radiation in the H-plane is enhanced.
Author
Slot Antennas; Antenna Radiation Patterns

20050123732 Stubenrauch (Carl F.), Boulder, CO, USA
Far-field Antenna Patterns Determined from Infrared Holograms
Stubenrauch, Carl F.; Norgard, John D.; Will, John E.; MacReynolds, Katie; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1996-1999; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper, we describe a technique based on optical holography which allows determination of the amplitude and phase of an unknown antenna on a near-field plane from amplitude-only measurements. We measure the interference pattern between the fields radiated by the antenna under test (AUT) and a known reference field. The reference field is produced by a standard gain horn radiating at an angle to the AUT and positioned so that the peak of the radiation occurs approximately at the same place as the peak from the AUT. The fields are detected by a resistive screen which absorbs some of the incident energy and heats as a function of the electric field intensity distribution. We use an infrared camera to record the temperature disa'ibution caused by the interference of microwave energy radiated by the reference and the AUT. Data are processed using an enhanced algorithm based on conventional holography for recovery of the complex near field. The new algorithm allows elimination of the spurious images commonly present in optical hologram readouts using illumination of the hologram with the reference wave.
Derived from text
Antenna Radiation Patterns; Far Fields; Holography

20050123733 Hong Kong Polytechnic, Kowloon, Hong Kong
An Anisotropic Perfectly Matched Layer (APML) Absorber for Mesh Truncation in the Context of a Multiresolution Time Domain Scheme
Cao, Qunscheng; Chen, Yinchao; Mittra, Raj; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2010-2013; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper, we have applied an anisotropic perfectly matched layer (APML) type of absorber for mesh truncation in the context of a three-dimensional multiresolution time domain (MRTD) scheme. We have developed a generalized APML update algorithm to handle the faces, edges and comers of the APML regions in the MRTD formulation that retains the philosophy of the leapfrog algorithm of the conventional Finite Difference Time Domain (FDTD) method. We have validated the algorithm by analyzing the performance of an open microstrip line, and have shown that the APML does an excellent job of absorbing the electromagnetic waves when implemented in the MRTD algorithm.
Author
Finite Difference Time Domain Method; Microstrip Antennas; Electromagnetic Radiation

20050123734 Georgia Inst. of Tech., Atlanta, GA, USA
Array Pattern Synthesis with High Radiation Efficiency for Transmission Antenna Arrays
Zhou, P. Y.; Ingram, M. A.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2040-2043; In English; See also 20050123676; Copyright; Avail: Other Sources

This paper presents a new pattern synthesis algorithm with high radiation efficiency for the transmission antenna array. The synthesis algorithm uses adaptive array theory. By incorporating a quadratic constraint, the desired pattern characteristics,

such as low sidelobe level, with high radiation efficiency can be achieved. With sidelobe level fixed, a different value of Lagrangian multiplier corresponds to a different radiation efficiency.
Author
Antenna Arrays; Efficiency; Electromagnetic Wave Transmission; Antenna Radiation Patterns

20050123735 Laval Univ., Sainte-Foye, Quebec, Canada
Omnidirectional-dual Polarized Antenna for Wireless Indoor Applications at Millimeter Waves
Hettak, K.; Delisle, G.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2054-2057; In English; See also 20050123676; Copyright; Avail: Other Sources

This paper introduces a new way of building omnidirectional dual polarized antenna with a CPW feed line on two layers for the EHF band around a center frequency of 38 GHz. The antenna structure developed combines the advantages of CPW (Coplanar Waveguide) with the advantages of cross-slots coupled back to back patch antenna. The proposed antenna configurations are able to demonstrate broad bandwidth characteristics, compactness, dual polarization capability with single feed line, and have been proven to work well in the mm-waves region. Finally, the design is straightforward to implement in MMIC in order to reduce the development cost, planning its use as building block for the fast emerging LAN wireless LAN and indoor systems.
Derived from text
Omnidirectional Antennas; Millimeter Waves; Polarized Electromagnetic Radiation; Patch Antennas

20050123736 Hochschule der Bundeswehr, Munich, Germany
Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems
Lindenmeier, H.; Hopf, J.; Reiter, L.; Kronberger, R.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2058-2061; In English; See also 20050123676; Copyright; Avail: Other Sources

A criterion for the diversity effectiveness of a multi-antenna arrangement on a car is derived. This number of equivalent decorrelated antennas being effective is evaluated by turntable antenna measurements as a basis for computer simulated virtual drives in a Rayleigh wave propagation scenario. The comparison of a variety of antenna arrangements shows that even compact antenna systems on a car window provide high diversity effectiveness.
Author
Antenna Design; Design Optimization; Automobiles; Reception Diversity; Signal Reception

20050123737
An Analysis and Design Tool for Evaluation of Integrated Antenna Diversity Systems in Portable Wireless Devices
Itazoqui-Pastor, P.; Swanson, E.; Short, C.; Bernhard, J. T.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2062-2065; In English; See also 20050123676
Contract(s)/Grant(s): NSF CDA-96-01602; Copyright; Avail: Other Sources

This work describes a design and analysis tool that evaluates real-world diversity system performance by accounting for the effects of chassis integration on antenna characteristics. The method allows qualitative comparisons of antenna systems and is both numerically efficient and highly versatile. Theoretical, simulated, and measured antenna characteristics with a variety of diversity processing schemes can be incorporated in the analysis. Results using measured antenna characteristics are presented.
Author
Antenna Design; Design Analysis; Systems Integration; Wireless Communication

20050123738 Technical Univ. of Lisbon, Portugal
Microstrip Patch Antenna for GSM 1800 Handsets
Barreiros, Jacinto; Cameirao, Pedro; Peixeiro, Custodio; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2074-2077; In English; See also 20050123676; Copyright; Avail: Other Sources

A low cost miniaturized microstrip patch antenna is presented. It consists of a planar inverted-F antenna (PIFA) having two rectangular stacked patches with sorting pins and an air gap. It has been designed, fabricated and tested to be used in a GSM 1800 handset.
Author
Microstrip Antennas; Patch Antennas; Miniature Electronic Equipment; Antenna Design

20050123739 Mitsubishi Electric Corp., Kamakura, Japan

Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems

Takahashi, Toru; Konishi, Yoshihiko; Makino, Shigeru; Kabashima, Shigenori; Ozaki, Tsuyoshi; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2096-2099; In English; See also 20050123676; Copyright; Avail: Other Sources

The quasi-GEO satellite communication system with large deployable APAA (Active Phased Array Antenna) can realize smaller-size and lower-power terminals for regional communication services. A super lightweight planar satellite antenna is indispensable to this system. However, a conventional lightweight planar microstrip array antenna with honeycombed substrates is too heavy to realize this system. In this paper, a novel planar antenna employing a stretched structure and meshed material is proposed in order to reduce the weight drastically and experimental results in S-band are described. As a result, the developed planar array antenna has a weight of 300g/sq m, one third as conventional one, and has R.F. performances that are in good agreement with designed ones and its validity is confirmed.

Author

Planar Structures; Antenna Arrays; Satellite Antennas; Phased Arrays

20050123740 Communications Research Lab., Koganei, Japan

Millimeter-wave Photodetection and Direct Integration with Microstrip Slot Antenna Array

Li, K.; Ge, J. X.; Matsui, T.; Izutsu, M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2114-2117; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper, we present experimental results on millimeter-wave photodetection for fiber-radio system. The experiment shows about 5dBm millimeter-wave output from the photodetector at 38GHz and 60GHz, respectively, which is close to the required power for direct fed of the indoor millimeter-wave radiation system. To efficiently radiate the obtained millimeter-wave power, a microstrip slot antenna array directly integrated with the photodetector are designed, fabricated on a glass substrate at 38GHz and 60GHz. The simulation results for the antenna are also presented.

Author

Microstrip Antennas; Slot Antennas; Antenna Arrays; Photometers

20050123741 Tokyo Inst. of Tech., Tokyo, Japan

Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas

Akiyama, A.; Hirokawa, J.; Ando, M.; Takeda, E.; Arai, Y.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2122-2125; In English; See also 20050123676; Copyright; Avail: Other Sources

The radial line slot antenna (RLSA) is one of single-layer waveguide antennas which is proposed for DBS reception in 12GHz band. The radial line assures small transmission loss. The excellent efficiency of more than 80% is realized over a wide range of the antenna diameter (16-60cm) in 12GHz band. High efficiency is expected even in millimeter wave band, since the transmission loss is still sufficiently small in principle. We have proposed a millimeter wave RLSA consisting of a thick dielectric substrate for wireless LAN system. However, due to insufficient manufactural accuracy, desirable operation has not been confirmed. This paper presents small-aperture conical-beam radial line slot antennas for 60GHz band using a modified coaxial feeder. The reasonable operations are observed for the first time.

Author

Slot Antennas; Waveguide Antennas; Beams (Radiation); Antenna Radiation Patterns

20050123742 Universidad Politecnica de Madrid, Spain

Antennas Feasibility Study for a LMDS Communication System

deHaro, Leandro; Pino, Antonio G.; Besada, Jose L.; Arias, A. marcos; Rubinos, J. Oscar; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2162-2165; In English; See also 20050123676

Contract(s)/Grant(s): Proj. TIC97-1129-C04; Copyright; Avail: Other Sources

Some antennas solutions are presented for new LMDS systems at 42 GHz. For terminal antennas multiflare horns with dielectric lens and shaped gregorian splash reflectors are presented. For base stations omnidirectional single and dual shaped reflector solutions are described. Although the specifications are tentative, they are representative enough to the obtained results may be characteristics.

Author

Feasibility; Antenna Design; Communication Equipment

20050123743 Helsinki Univ. of Technology, Helsinki, Finland

On the Planarity Errors of the Hologram of the CATR

Ala-Laurinaho, Juha; Hirvonen, Taavi; Raisanen, Antti V.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2166-2169; In English; See also 20050123676; Copyright; Avail: Other Sources

hologram is a transmission type of a device, thus the required surface accuracy of the hologram is not so stringent, and the manufacturing of the hologram is much less expensive than that of the reflector. In the present work, the effect of the planarity errors of the hologram on the quiet-zone field are simulated, and simulation results are compared with a simple theoretical path length approximation.

Author

Holography; Antennas; Errors

20050123744 Tor Vergata Univ., Rome, Italy

Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth

Schiavon, G.; Ferrazzoli, P.; Guerriero, L.; Jorgensen, R.; Badessi, S.; deMaagt, P.; Fenech, H.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2174-2177; In English; See also 20050123676; Copyright; Avail: Other Sources

This paper describes the recent results of a study aimed at accurately determining the antenna noise temperature used to calculate uplink G/T for satellite-borne receivers. The antenna noise temperature is calculated from a brightness temperature database of the Earth which, for each surface pixel (1 deg x 1 deg), includes the effects of season, observation angle and frequency. Good correlation has been found by comparison with In-Orbit Test (IOT) measurements.

Author

Satellite Antennas; Noise Temperature; Receivers

20050123747 National Taipei Univ. of Technology, Taipei, Taiwan, Province of China

Multi-state Markov Model for Satellite Propagation Channels

Lin, Hsin-Piao; Yang, Chieh; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1486-1489; In English; See also 20050123676

Contract(s)/Grant(s): NNSC-88-2213-E-027-019; Copyright; Avail: Other Sources

In order to predict the service performance required for both land mobile satellite system (LMSS) and satellite personal communication services (S-PCS), channel simulation and modeling are necessary. Numbers of models have been proposed to characterize multipath fading and shadowing in LMSS channel. Among various approaches, statistical models have the advantage of allowing easy predictions of performance and comparison of systems under different condition of modulation, coding and multiple access. A statistics based model is less complicated than a geometric model and more phenomenological than an empirical regression model. In a typical satellite-earth propagation path, while the mobile unite is in motion, the field strength of the received signal level changes with respect to time and space according to the changing morphology of the environment. It has been shown that the switching between different attenuation levels can be represented as Marker stochastic process using the assumption that the channel properties are quasi-stationary in small period of time. Propagation channels can be considered as operating in one of a finite number of possible channel states. in previous work, environmental images were processed to derive Markov matrices and state transition matrices, and conventional three-state propagation channel simulation algorithm was used to obtain a statistical representation of the communication channel. However, images take times and memory spaces for processing. For more accuracy and easier prediction, increasing the number of states and adopting less complicated propagation channel model are presented in this paper. In the following, we give a description of our multi-state Markov propagation channel model, and we compared the simulation results with measured data in several typical mobile user environments.

Author

Mathematical Models; Land Mobile Satellite Service; Satellite Communication

20050123749 National Chung Hsing Univ., Taichung, Taiwan, Province of China

Channel Simulation of Leo Satellites

Kiang, Jean-Fu; Chen, Yung-Chang; Shi, Le-Gen; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1494-1497; In English; See also 20050123676; Copyright; Avail: Other Sources

Using low-earth-orbit(LEO) satellites for communication became popular in recent years. The main advantage of using LEO satellites as compared with the geosynchronous-earth-orbit (GEO) satellites lies in that the LEO ones are closer to the

earth, hence requiring less power. However, LEO satellites have certain disadvantages. Firstly,their link time with any fixed ground station is on the order of minutes in each pass. Secondly, a quick-response tracking antenna is needed at the ground station to track the satellite. Ka-band has been explored for satellite communication to serve wide band applications. However, the main attenuation in the Ka-band is stronger than in the lower bands, and significantly affects the communication quality. ROCSAT-1 is the first LEO satellite planned by the National Space Program Office (NSPO) of Taiwan, the Republic of China, to conduct scientific experiments. In the Ka-band communication experiment, a video clip is first converted into a bit stream, transmitted to the satellite at a rate ranging from 3.3 Mbps to 5.6 Mbps, then sent back to the ground station by the satellite transponder. The carrier frequency of the uplink is 28.25 GHz, while that of the downlink is 1845 GHz.
Derived from text
Low Earth Orbits; Satellite Communication; Carrier Frequencies; Satellite Transmission; Downlinking; Uplinking

20050123750 Utah State Univ., Logan, UT, USA
An Inexpensive Distance Measuring System for Location of Robotic Vehicles
Kamdar, Nilesh; Furse, Cynthia; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1498-1501; In English; See also 20050123676; Copyright; Avail: Other Sources

An distance-measuring system based on a swept frequency reflectometer radar system was built and tested for application to navigation of robotic vehicles in a sealed room where GPS signals are not available. The final system would cost approximately $25. The system was simulated using HP/EEsof (Libra) software and tested using inexpensive commercial components. Several signal processing methods were compared for deriving distance from the data acquired from the system. Log periodic antennas (LPA) were used to test the system, and inexpensive LPA and Yagi-Uda microstrip patch arrays were built and tested for use in this application.
Author
Distance Measuring Equipment; Log Periodic Antennas; Low Cost; Position (Location); Robotics

20050123751 Commerce Dept., Boulder, CO, USA
Reflection and Transmission Properties of Reinforced Concrete Walls
Dalke, Roger; Holloway, Christopher L.; McKenna, Paul; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1502-1505; In English; See also 20050123676; Copyright; Avail: Other Sources

The proliferation of communication systems used in and around man-made structures has resulted in a growing need to determine the reflection and transmission properties of various commonly used building materials at radio frequencies typically used in businesses and residential environments. This paper gives examples of calculated reflection and transmission coefficients for a reinforced concrete wall over a frequency range of 100-6000 MHz. The reflection and transmission coefficients were calculated using a finite-difference time domain solution of Maxwell's equations. In general, the results show that the reinforced concrete structures severely attenuate signals with wavelengths that are much larger than the re-bar lattice, and the transmitted signal has a complex structure with resonances and nulls that strongly depend upon the geometry of the reinforcing structure and the concrete wall thickness.
Author
Concrete Structures; Frequency Ranges; Reflectance; Finite Difference Time Domain Method; Radio Frequencies; Maxwell Equation

20050123752 Allgon System, Taby, Sweden
Downlink Propagation Measurements in the GSM 900 and 1800 MHz Bands
Ahlberg, Mikael; Lindmark, Bjorn; Simons, Jesper; Beckman, Claes; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1506-1509; In English; See also 20050123676; Copyright; Avail: Other Sources

During the last 10 years, the world has seen an exponential growth of wireless telephony. In e.g. the Nordic countries the penetration of mobile telephony has reached almost 50 % of the population. In Sweden, the three GSM operators have all nearly reached their network capacity limit in the 900 MHz band and the need for more spectrum has become urgent. In 1995 ETSI, the European Telecommunications Standardization Institute, approved a specification concerning joint GSM operations in both the old GSM 900 (880-960 MHz) and a new GSM 1800 (1710- 1880 MHz) band. During the spring of 1996 frequencies in this new band were also awarded to all three Swedish operators and the deployment of GSM 1800 systems has recently begun. A major problem during the deployment of a cellular radio network is to find suitable sites. Another is the high cost for installation of antennas, feeder cables and base stations. One can therefore expect operators with existing GSM 900 networks to be keen to use their old sites for their new GSM 1800 base stations wherever possible. In an urban or suburban

environment the cost of installation of feeder cables and antennas, as well as an overall need to reduce the number of antennas, makes antennas operating on both bands an attractive solution.
Derived from text
Telecommunication; Wireless Communication; Downlinking

20050123753 Moncton Univ., Canada
Adaptive Arrays for Wideband Interference Suppression in Wireless Communications
Hefnawi, Mostafa; Delissle, Gilles Y.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1588-1591; In English; See also 20050123676; Copyright; Avail: Other Sources

Adaptive antenna array systems have recently played a central role in removing narrowband multiple-access interference (MAI) in wireless communications. However, due to the actual need for increasing channel capacity, the required bandwidth is becoming wider and can bring significant deteriorations of the narrowband adaptive systems. These performance degradations are mainly caused by the fact that the interelement phase shift becomes a function of the frequency while the adaptation weights are kept independent of frequency. To compensate the effect of the inter-element phase variations, a new approach called the interpolated constant modulus algorithm (ICMA) is introduced. The system is based on an interpolation technique used in conjunction with the constant modulus algorithm (CMA). Results, both analytical and experimental, showing the performance of the system with and without compensation are given and discussed on the basis of the gain-array patterns.
Author
Adaptation; Wireless Communication; Antenna Arrays; Bandwidth

20050123756 Universidad Politecnica de Madrid, Madrid, Spain
Minimization of Mutual Coupling Effects in Eigenstructure Algorithms Based on Modal Analysis
Martin-Cuerdo, R.; Segovia-Vargas, D.; Sierra-Perez, M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1608-1611; In English; See also 20050123676; Copyright; Avail: Other Sources

The problem of mutual coupling effects between antennae in an adaptive array has not been extensively treated. A general classification of the contributions in this area can be made according to the way of minimizing the effect of mutual coupling. In this way, there are methods that modify eigenstructure (ES) algorithms(both DOA and beam forming) in order to model and eliminate coupling matrix. These methods are exclusively related to array processing techniques. There are also methods that don,t modify the corresponding ES algorithms (for instance MUSIC). These ones seek to correct the actual antenna voltages for the mutual coupling and then process these corrected voltages to determine the angle of arrival. It can be said that these algorithms need two tasks: the first one is related to the electromagnetic problem to fred out the coupling matrix while the second one is the application of the non modify ES algorithm. The method presented in this paper belongs to the second group.
Derived from text
Miniaturization; Coupling; Algorithms; Antenna Arrays

20050123760 Prodelin Corp., Conover, NC, USA
Design and Development of Co-Polarized Ku-band Ground Terminal System for Very Small Aperture Terminal (VSAT) Application
Moheb, H.; Robinson, C.; Kijesky, J.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2158-2161; In English; See also 20050123676; Copyright; Avail: Other Sources

Recent advances in the communication satellite industry have made it possible to utilize smaller antennas in two-way communications networks, commonly known as VSAT (very small aperture terminal) networks. These typically range in aperture size from 60cm to 4.5m. It is now possible to build a system with antennas having significantly less gain than the conventional 3.8m reflector antenna satisfying the 2 deg satellite spacing. On the other hand, the future satellite communication industry is leaning toward wider bandwidth to accommodate expanded services at lower cost. The conventional Ku-band (10.95-14.5 GHz) VSAT communication terminal operates in orthogonal polarization configuration to minimize the cross talk and to provide additional isolation between the transmit and the receive port. However, there are several communications satellite services (Nahuelsat, PanAmSat, Eutelsat, Thaicomsat) available that operate at the same polarization, i.e., co-polarized (HH, VV), even though associated signal cross talk could be encountered. To eliminate the cross talk, a co-polarized adapter is typically used between the orthomode transducer (OMT) and the corrugated feed horn. The co-polarized adapter comprises a 90 degrees electrical or mechanical twist and a waveguide filter to provide 90 degrees

rotation in either Tx or Rx band to provide two orthogonal signals at the horn interface. In a simpler alternative approach, a single-piece co-polarized diplexer, connected between the feed horn, the high power transmitter, and the receive LNB, is used to frequency select the uplink and the downlink signals. The diplexer is designed to split the two Rx/Tx bands into two separate ports having the same polarization. This paper describes the development of a co-polarized Ku-band Rx/Tx system. Due to stringent electrical requirements, waveguide technology was selected over the microstrip and/or stripline design approaches. The developed system consists of corrugated conical horn, co-polarized waveguide junction with embedded low- and pass-band filters, and a diamond shape reflector.
Author (revised)
Satellite Communication; Superhigh Frequencies; Waveguides; Ground Stations

20050123762 Lawrence Livermore National Lab., Livermore, CA, USA
A Parametric Approach to Radar Processing of Reentry Vehicle Signatures
Candy, James V.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1628; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper we investigate the development of parametric techniques to extract dynamical information about a reentry vehicle (RV) from noisy radar cross-section (RCS) measurement data. We develop a simplified signal processing model of the entire measurement process based on the underlying physics and radar system operations. Signal processing techniques are developed to extract the desired RV dynamical parameters. This suite of techniques includes: trajectory motion compensation, environmental transfer function estimation and its inverse, instantaneous spectrogram estimation using parametric autoregressive moving average (ARMA) models and recursive-in-time algorithms, demodulation, and event detection schemes based on the prediction errors and instantaneous ARMA coefficients. The overall processing is applied to both synthesized and raw flight data demonstrating its effectiveness.
Author
Reentry Vehicles; Radar Measurement; Radar Cross Sections; Signal Processing; Extraction

20050123768 Yung-Ta Inst. of Tech. and Commerce, Pingtung, Taiwan
Single-feed Dual-frequency Microstrip Antenna with Two Patches
Pan, Shan-Cheng; Hsu, Wen-Hsiu; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1644-1647; In English; See also 20050123676; Copyright; Avail: Other Sources

A variety of dual-frequency microstrip antennas have been reported. However, it is noted that these dual-frequency designs usually support limited tunable frequency ratios for the two operating frequencies. To provide a very flexible frequency-ratio for a single-feed dual-frequency microstrip antenna, the design with two circular patches has been shown. Such a design, however, uses a relatively complicated matching network between the two patches. In this article, we present a new structure of using an inset-microstrip line to simplify the matching network, which makes the present proposed design simpler and easier to be constructed. The proposed design method applied to two rectangular patches has been successfully implemented. The obtained frequency ratio the two operating frequencies can be flexible, and good dual frequency performances are also observed.
Author
Microstrip Antennas; Antenna Design

20050123769 National Kaohsiung Inst. of Tech., Kaohsiung, Taiwan, Province of China
Reactively Loaded Microstrip Antenna for Dual-frequency Operation
Chen, Hua-Ming; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1648-1651; In English; See also 20050123676; Copyright; Avail: Other Sources

Novel dual-frequency operation of a single-feed rectangular microstrip antenna with an embedded reactive loading is presented. The reactive loading is provided by a structure of two cascaded microstrip-line sections embedded within a rectangular slot cut in the patch. By selecting suitable dimensions of the microstrip-line sections and the rectangular slot, the proposed antenna can perform a dual-frequency operation, with a low frequency ratio of about 1.04 to 1.15 between the two operating frequencies. And, the two operation frequencies are of the same polarization planes and similar broadside radiation patterns.
Author
Microstrip Transmission Lines; Antenna Radiation Patterns

20050123770 National Sun Yat-Sen Univ., Kaohsiung, China

Compact Dual-frequency Operation of Rectangular Microstrip Antennas

Yang, Kai-Ping; Wong, Kin-Lu; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1652-1655; In English; See also 20050123676; Copyright; Avail: Other Sources

Owing to the miniaturization requirements of personal mobile communications equipment, compact designs of microstrip antennas recently receive much attention. Several compact dual-frequency designs of rectangular microstrip antennas have also been reported. In these compact dual-frequency designs, different slots such as a cross-slot or a pair of bent-slots are embedded in the rectangular microstrip patch to lower the resonant frequencies of the first two resonant modes of TM0_ and TMl0 for compact dual-frequency operation. It was demonstrated that by using a cross-slot of 0.634 times the patch width, both the first two resonant frequencies are lowered by about 11% as compared to those of a simple rectangular patch without a cross-slot. That is, for a fixed dualfrequency operation, an antenna size reduction of about 21% can be obtained. However, there is a limitation for the compact dual-frequency design using a cross-slot. When a larger slot length of the cross-slot is to be used, the 50- 2 feed position for achieving good impedance matching of both the two resonant modes can no longer be located inside the patch. Such a problem can be alleviated using the designs reported in. In this article, we propose two other promising designs to achieve compact dual-frequency operations. The proposed designs include inserting four narrow slots at each patch edge of a rectangular patch and embedding four T-shaped slots in a rectangular patch. It is found that by using the present proposed designs, the first two resonant frequencies of the rectangular patch antenna can be reduced further, with good impedance matching conditions, and a much reduced antenna size for a fixed dual-frequency operation can be obtained.
Author

Microstrip Antennas; Mobile Communication Systems

20050123771 National Kaohsiung Inst. of Marine Technology, Koahsiung, Taiwan, Province of China

Dual-frequency Operation of Single-feed Triangular Microstrip Antennas

Lu, Jui-Han; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1656-1659; In English; See also 20050123676; Copyright; Avail: Other Sources

The dual-frequency design of a single-feed rectangular microstrip antenna with a pair of narrow slots placed close to its radiating edges has recently been reported. The two operating frequencies, having similar radiation characteristics and same polarization planes, are the resonant frequencies of the TM10 and TM30 modes. And, the frequency ratio of the two operating frequencies is generally within the range of 1.6 - 2.0. This frequency-ratio restriction imposes a limitation for such a dual frequency design in some applications where lower frequency ratio is required. In this article, we propose that, by applying a similar but different slot-loading arrangement to an equilateral-triangular microstrip antenna, dual-frequency operation with an extended frequency-ratio range, as compared to that of a slot-loaded rectangular microstrip antenna can be obtained. This proposed dual-frequency design is achieved by loading two pairs of narrow slots in the triangular patch, with one pair of the slots embedded close to the side edges of the patch and the other pair inserted at the bottom edge of the patch. The two operating frequencies in this case are associated to the resonant modes of TM10 and TM20. And, it is found that, due to the slots embedded close to the side edges, the radiation pattern of the TM20 mode, which usually exhibits a slight dip in the broadside direction , is removed and become similar to that of the TMt0 mode. As for inserting the pair of slots at the bottom edge of the patch, various frequency ratios of the two operating frequencies can be obtained by varying the length and position of the inserted slots.
Author

Microstrip Antennas; Antenna Radiation Patterns

20050123772 Manitoba Univ., Winnipeg, Manitoba, Canada

Microstrip Patches for a Reflectarray

Sze, K. Y.; Shafai, L.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1666-1669; In English; See also 20050123676; Copyright; Avail: Other Sources

Microstrip patch element geometry is indeed an important factor in the design of a microstrip reflectarray. In essence, each of these perfectly conductive elements creates minuscule correction to the reflection phase of the scattered field so that a phase-coherent main beam is constructed. The geometrical dimensions of these elements must therefore be carefully designed as such.
Author

Microstrip Antennas; Antenna Arrays

20050123774 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Inflatable Microstrip Reflectarray Antennas at X and Ka-band Frequencies

Huang, John; Feria, Alfonso; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1670-1673; In English; See also 20050123676; Copyright; Avail: Other Sources

Inflatable antenna technology is being developed by JPL/NASA to enable the capabilities of low mass, high packaging efficiency, and low-cost deployment for future spacecraft high-gain and large aperture antennas. One of the technologies being considered is the inflatable microstrip reflectarray. A conventional inflatable parabolic reflector antenna will offer similar advantages with the added capability of wide electrical bandwidth. However, it suffers from the difficulty of maintaining its required large, thin, and curved-parabolic surface in the space environment. Since the microstrip reflectarray has the 'natural' flat reflecting surface, it is much easier to maintain the required surface tolerance using an inflatable structure. This is the primary reason, despite its narrow bandwidth characteristic, that the inflatable microstrip reflectarray is being studied. This article discusses an already-developed one-meter X-band inflatable microstrip reflectarray and a three-meter Ka-band inflatable microstrip reflectarray which is currently under development. Both antennas' RF structures are designed at JPL and their mechanical inflatable structures are designed and manufactured at ILC Dover, Inc.

Author

Microstrip Antennas; Inflatable Structures; Antenna Arrays

20050123775 Technical Univ. of Denmark, Lyngby, Denmark

A 2.5-D Diffraction Tomography Inversion Scheme for Ground Penetrating Radar

Johansen, Peter M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2132-2135; In English; See also 20050123676; Copyright; Avail: Other Sources

A new 2.5-D inversion scheme is derived for ground penetrating radar (GPR) that applies to a monostatic fixed-offset measurement configuration. The inversion scheme, which is based upon the first Born approximation and the pseudo-inverse operator, takes rigorously into account the planar air-soil interface, the loss in the soil, and the characteristics of the antennas.

Author

Ground Penetrating Radar; Diffraction; Tomography

20050123780 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA

Accurate Model of Arbitrary Wire Antennas in Free Space, Above or Inside Lossy Ground

Cui, T. J.; Chew, W. C.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1696-1699; In English; See also 20050123676; Copyright; Avail: Other Sources

The investigation of wire antennas in the free space, above or inside the lossy ground is a very old but important topic. For wires in free space, comprehensive study has been made by using approximate methods and numerical methods since the beginning of this century. For wire antennas above or inside the lossy ground, they were intensively investigated in 1960s, 1970s and early 1980s, after the pioneering work of Sommerfeld in 1909. In the above studies, the method of moments plays an important role in modeling arbitrary wire antennas, yielding some efficient codes, for example, the numerical electromagnetics code (NEC). In the above methods, however, there are three limitations. First, in most methods the current is assumed to flow on the axis of the wire and testing is performed on the surface or vice versa. Second, the delta gap and magnetic frill are adopted for the source model but the delta gap is popularly used. In the frill model, a circumferentially directed magnetic current density that exists over an annular aperture with inner radius a and outer radius b has been assumed, requiring an additional parameter b. Finally, the input admittance of the wire, simply defined as the ratio of the current and voltage at the driving point is not variational.

Derived from text

Wire; Antenna Components; Numerical Analysis; Aerospace Environments

20050123781 Media Lario S.r.l., Bosisio Parini, Italy

Nickel Sandwich Technology for High Precision Reflector Antennas

Valsecchi, G.; Franchini, C.; Prieto, Raphael Garcia; van'tKlooster, Kees; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2170-2173; In English; See also 20050123676; Copyright; Avail: Other Sources

Ultra high accuracy was achieved by Media Lano in the realization of large grazing incidence mirrors for the XMM telescope by electroformed Nickel technology. The development of this technique also to the manufacturing of reflector antennas operating at centimeter and millimeter wavelength, has been carried out, achieving surface accuracy of the order of

the microns. The electroforming Ni technology, due to the high repeatability of the process which allows for the mass production with reduced recurring costs, is therefore to be considered as a cost effective approach for the realization of reflector panels for large ground station antennas.
Author
Reflector Antennas; Nickel; Sandwich Structures; Electroforming; Grazing Incidence

20050123783 Institut National Polytechnique, Toulouse, France
A New Approach for Microstrip Active Antennas Using Modal FFT-algorithm
Ngongo, R. S.; Baudrand, H.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1700-1703; In English; See also 20050123676; Copyright; Avail: Other Sources

A full-wave Fast Wave Concept Iterative technique is developed to analyze single and stacked microstrip active antennas with arbitrary shape. The wave concept is developed to express the boundary conditions on the radiating surfaces in term of the waves, which are solved using the iterative technique. With the help of modal FFT-algorithm an efficient code is developed which allows a rapid and accurate characterization of arbitrary shaped embedded in single and multilayered dielectric without the trial functions usually used in the conventional integral method. The time saving factor is about 20 compared to the conventional numerical integral methods. Field distribution and input admittance are derived.
Author
Boundary Conditions; Electrical Impedance; Microstrip Antennas; Numerical Analysis

20050123788 Saint Petersburg Technical Univ., Russia
Beamforming by Magnetostatic Wave Microstrip Antennas
Rezvanov, A. G.; Zagriadski, S. V.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2100-2103; In English; See also 20050123676; Copyright; Avail: Other Sources

The paper reports a new phenomenon of space synchronism of electromagnetic waves propagating in a transmission line and magnetostatic waves excited in a ferrite layer (film). This synchronism results in the extremely narrow (less 1 deg) radiation pattern of magnetostatic wave antennas and in the unidirectional propagation of wave beams at certain frequencies. Calculations were performed for microstrip antenna in the frequency band of surface magnetostatic waves. Application of the effect is suggested for tunable microwave multichannel filters and for space filtering of magnetostatic waves.
Author
Beamforming; Magnetostatics; Microstrip Antennas

20050123789 Manitoba Univ., Winnipeg, Manitoba, Canada
Wideband Single Layer Microstrip Array at 28 GHz
Clenet, M.; Shafai, L.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2106-2109; In English; See also 20050123676; Copyright; Avail: Other Sources

Microstrip antennas are now used for 2 decades in many applications from 1 GHz to 100 GHz because of their thin profile, light weight, low cost and capability to be integrated in active devices. They remain a good candidate for LMCS/LMDS applications, in array configuration to achieve the required high gain. However, due to the resonant nature of the antenna element, microstrip arrays operate only over a narrow bandwidth. The technique widely used to improve the bandwidth is to add another resonator, as a parasitic patch, on the same layer than the main resonator of slightly above it. As the latter, i.e., the stacked technique, exhibits inherent problems at EHF frequencies due to fabrication process (air gap between layers, misalignment of resonators, ...), the proximity coupling on the same layer is preferred. The aim of the present work was then to investigate the impedance and gain bandwidth properties of a single layer microsmp array realized with wide bandwidth radiating elements.
Author
Microstrip Antennas; Antenna Arrays; Broadband; Parasitic Elements (Antennas)

20050123790 Massachusetts Univ., Amherst, MA, USA
Scattering by Resistively Loaded, Multilayer Frequency Selective Surfaces over Two-octave Bandwidth
Zink, Katherine; Wunsch, Gregory J.; Schaubert, Daniel H.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1738-1741; In English; See also 20050123676; Copyright; Avail: Other Sources

The motivation behind examining the multilayer Frequency Selective Surface (FSS) structures presented here is to design a surface from which reflected waves maintain a constant amplitude and phase over a wide band of operation. Thin,

conformable structures of less than 6.5 cm thickness are shown to operate with moderate losses over a 4:1 frequency band centered at 1 GHz. A computer model developed to analyze the response of non-commensurate multilayer FSS structures was used in the optimization and parametric studies of a two-layer FSS structure at broadside, the results of which are presented in this summary.
Author
Scattering; Selective Surfaces; Frequencies; Bandwidth

20050123793 NASA Lewis Research Center, Cleveland, OH, USA
A Millimeter-wave Cavity-backed Suspended Substrate Stripline Antenna
Simons, Rainee N.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2110-2113; In English; See also 20050123676; Copyright; Avail: Other Sources

Future generation satellite communication systems in near-Earth orbit will operate at frequencies in the higher mm-wave frequency hands. These satellite systems require low-profile, high gain, light weight and low cost antennas for communications to and from Earth as well as for inter-satellite links (ISL). At higher mm-wave frequencies, the conductor loss of conventional microstrip line is high and consequently the feed network loss of patch antenna arrays is also high. The high loss lowers the array efficiency and in addition lowers the G/T ratio in a receiving array. Recently a radial line slot antenna array has been demonstrated to have high gain and efficiency at 60 GHz. In this paper, the design, fabrication and characterization of a V-Band (50-75 GHz) 4 x 4 planar array of cavity backed circular aperture antennas with suspended substrate stripline (SSS) corporate feed is presented.
Author
Antenna Arrays; Millimeter Waves; Microwave Antennas; Antenna Design; Dipole Antennas

20050123794 Communications Research Lab., Koganei, Japan
Development of a Tri-plate Ring-Slot Antenna for mm-Wave Frequency Band
Lim, Kyutae; Matsui, Toshiaki; Nam, Sangmin; Kim, Kiho; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2118-2121; In English; See also 20050123676; Copyright; Avail: Other Sources

Recently, the ring-slot antenna (RSA) has been studied actively as one of the prominent candidates for mm-wave planar antennas. The RSA has several advantages over the conventional microstrip patch antennas such as the larger bandwidth and flexibility of polarization control Tong et al. presented analytical solution for a ring-slot radiator formed on a dielectric layer of infinite thickness. Raman and Rebeiz have studied on the RSA with a CPW feed. CPW feed has an advantage that the radiator and feed are located on the same plane. However, it has disadvantages that the power radiated from a slot propagates both directions and that the realization of a multiple feeding scheme is quite difficult since it needs a lot of air-bridges to suppress the unwanted slot-modes at the discontinuity of CPW. In this paper, the tri-plate RSA is developed designed, fabricated and measured at mm-wave band. The coupled stripline is adopted for a feed of RSA. Using coupled feeding a multiple feeding can be realized easily with compare to CPW feed. A ground plane is located beneath of the slot layer with the distance of a quarter wavelength, which is to prevent backward radiation and to increase radiation efficiency. Theoretical properties of the ring-slot element are obtained by the full-wave analysis with Hankel transformation. Layout design of the antenna is performed using commercial software to consider the effect of a feeding circuit. The method of a fabrication and a measurement of a planar antenna for ram-wave frequency band are stall the issue to be solved. The antenna is fabricated on the quartz substrate by using the double sided lift-off process to increase the accuracy of manufacturing. To measure the return loss and radiation pattern of the antenna, a waveguide to stripline transition is developed. As an example, the measured radiation pattern of the 2nd mode ring-slot antenna with 4-port feeds for the circular polarization at 60 GHz is presented and compared with the calculated one.
Author
Microwave Antennas; Millimeter Waves; Slot Antennas; Antenna Design

20050123795 Chan Technologies, Inc., Kirkland, Quebec, Canada
Computation of Radar Cross Section of Waveguide Arrays
Chan, K. K.; Chadwick, K.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1746-1749; In English; See also 20050123676; Copyright; Avail: Other Sources

A review of the open literature shows that not much information has been published on the radar cross section (RCS) of waveguide arrays. In this paper, an accurate method for the computation of the RCS of ac_e waveguide arrays is presented. It combines the plane wave angular spectrum method used by Stalzer et. al. to find the active element radiation pattern of an

infinite phased array and the ganeraliz_ scattering matrix (GSM) approach [21 to periodic waveguide array analysis. The active scatter pattern of an element in an infinite array is obtained in teams of the reflection coefficients of the free space Floquet modes found by the GSM procedure. This active scatter pattern is employed in the computation of the RCS of a finite array by assuming that it is identical for all elements of the array and ignoring edge effects in the process. The accuracy of this model has been validated by the good agreement observed between predictions and published test results of arrays of various sizes. Author

Computation; Radar Cross Sections; Waveguides; Phased Arrays

20050123797 L'Garde, Inc., Tustin, CA, USA

On Inflatable Antenna State of the Art Precision

Palisoc, Arthur; Cassapakis, Constatine; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1528-1531; In English; See also 20050123676; Copyright; Avail: Other Sources

It has been the experience of these authors that the following parameters significantly affect the surface accuracy of an inflatable segmented reflector: (a) Materials properties uniformity, as small variations in thickness behave as variations in membrane material modulus. (b) Gore (film segment) cutting accuracy. (c) Gore seaming accuracy, (d) On-orbit effects (ACS loading, thermal, creating fatigue, etc.), (e)supports structure stability, among others. Given all these parameters that an inflatable antenna designer and manufacturer needs to take into account; and given in addition the fact that : (a) membrane materials are non-linear and orthotropic; (b) the mission and systems requirements imposed by 1 spacecraft manufacturer and integrator must also be taken, into account, it becomes obvious that the development of big specialized codes for this class of structures is necessary. It is with the help of such codes that we can assess in a highly effective way the sensitivity of surface accuracy to all of these parameters, so that we can make some predictions about the ultimate accuracy achievable with inflatable apertures.

Derived from text

Antenna Design; Inflatable Structures; Reflectors

20050123798 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands

ESA's Ground Breaking Synthetic Aperture Radar: The ENVISAT-1 ASAR Active Antenna

Torres, R.; Buck, C.; Guijarro, J.; Suchail, J.-L.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1536-1539; In English; See also 20050123676; Copyright; Avail: Other Sources

The Advanced Synthetic Aperture Radar (ASAR) is a major instrument on board ENVISAT-I, the next Earth Observation mission of the European Space Agency. It will represent a sensor of paramount importance for the remote sensing community because of its enhanced flexibility with respect to the existing SAR in the AM1 on board ERS-I and ERS-2. The unique combination of different spatial resolutions, incidence angles, swath width sizes and polarisation diversity will offer an increased number of operational modes tailored for a large set of scientific and operational applications. Among the innovative design features of this radar it can be pointed out the use of an active antenna concept far tailoring the transmit and receive elevation beams to different mode geometry, a digital generation waveform technique for obtaining variable time-bandwidth products and a Block Adaptive Quantization compression scheme. In this paper, the ASAR antenna is described and the development status is presented.

Author

Antenna Design; Synthetic Aperture Radar

20050123799 Comision Nacional de Investigacion del Espacio, Madrid, Spain

Large 2-D Thinned Array for the Microwave Imaging Radiometer with Synthetic Aperture (MIRAS)

AndresdeMatey, Juan Miguel; Palacios, Helena; Vassallo, Juan; Marti-Canales, Javier; Martin-Neira, Manuel; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1540-1543; In English; See also 20050123676; Copyright; Avail: Other Sources

The development and performance of the large two-dimensional thinned array antenna for the ESA Microwave Imaging Radiometer with Aperture Synthesis (MIRAS) is here presented. The radiating elements are distributed along three arms that form a Y-shape when deployed in space. Interferometry in two orthogonal linear polarisations is performed by coherent reception at element level in order to produce aperture synthesis, thus avoiding a larger antenna area. The overall instrument performance is enhanced by sequentially rotating or mirroring the radiating elements as in array design techniques. This work

is being performed under a Demonstrator Pilot Project of the European Space Agency for the provision of one arm's segment and radiators.
Author
Antenna Arrays; Interferometry

20050123800 Massachusetts Univ., Amherst, MA, USA
Design Features of the Large Millimeter Telescope (LMT)
Baars, Jacob W. M.; Kaercher, Hans J.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1544-1547; In English; See also 20050123676; Copyright; Avail: Other Sources

We direct our attention to developments in the area of reflector antennas. In particular we shall present the characteristics of a new facility for mm-wavelength radio astronomy: the Large Millimeter Telescope (LMT), a 50 m diameter reflector antenna with a good performance down to 1 mm wavelength. This project is a collaborative effort of the Department of Astronomy at the University of Massachusetts at Amherst and the Mexican Instituto National de Astrofisica, Optica y Electronica (INAOE) in Tonantzintla, Puebla. Because millimeter observations are strongly impeded by atmospheric water vapor in the line of sight, ram-telescopes must be placed at high mountain sites with a dry atmosphere. The LMT will be located on Cerro la Negra in central Mexico at an altitude of 4600 m. The antenna is currently in the Critical Design phase at MAN Technologic, Germany. In this paper we summarize the salient features of the LMT design with particular reference to the special methods required to realize the stringent specifications for operation at 1 mm wavelength.
Author
Reflector Antennas; Antenna Design

20050123801 EMAG Technologies, Inc., Ann Arbor, MI, USA
Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms
Sabet, Kazem F.; Jones, Dennis P.; Cheng, Jui-Ching; Katehi, Linda P. B.; Sarabandi, Kamal; Harvey, James F.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2084-2087; In English; See also 20050123676; Copyright; Avail: Other Sources

This paper presents a novel technique for pattern synthesis of printed antenna arrays, which takes into account the effect of coupling among the radiating elements of the array. To this end, macromodels of the coupling among neighboring elements are generated using full-wave simulation data. The array analysis is then based on such coupling macromodels combined with full-wave radiation models of the individual radiating elements. The array synthesis is performed using a newly developed efficient optimization scheme based on an accelerated hybrid evolutionary genetic algorithm (GA). Numerical results are presented to illustrate the advantages of the proposed technique over conventional pattern synthesis methods.
Author
Antenna Arrays; Antenna Design; Design Optimization; Antenna Components; Electromagnetic Coupling

20050123802 Communications Satellite Corp., Clarksburg, MD, USA
Distributed Aperture Design for Low Profile Earth Station Antennas
Zaghioul, A. I.; Kilic, O.; Sun, L. Q.; Lieberman, M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2088-2091; In English; See also 20050123676; Copyright; Avail: Other Sources

The objective of this paper is to develop a distributed aperture antenna, which has the same performance as a single large aperture antenna, but has lower profile. The distributed aperture will have a simpler mechanical design, lower cost, lower power electronics, graceful performance degradation and overall higher reliability. This paper presents a design that forms an antenna aperture from distributed smaller apertures connected with precisely phased transmission lines.
Author
Apertures; Antenna Design; Antenna Arrays

20050123803 Bremen Univ., Germany
Fast Spectral Domain Analysis of Large Finite Microstrip Patch Arrays
Enneking, Arthur; Arndt, Fritz; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2092-2095; In English; See also 20050123676; Copyright; Avail: Other Sources

The scattering and radiation from large finite arrays of microstrip patches is analyzed by an improved spectral-domain moment method. Based on the electric field integral equation (EFIE) and using rooftop expansion and testing functions in a uniform discretization scheme, the elements of the resulting equation system are represented by inverse Fourier integrals. In

the new approach, the application of the two-dimensional sampling function leads to equivalent finite integral expressions which are efficiently evaluated using Filon type quadrature rules in combination with the FFT algorithm. This reduces the number of sample points in the spectral domain drastically. The final discrete equation system is solved iteratively using the BCG-FFT algorithm. This results in a fast and accurate computation code well appropriate for the application on a PC. Several numerical examples for arrays up to N=32x16 patches are presented demonstrating the versatility of this technique.
Author
Spectrum Analysis; Microstrip Antennas; Antenna Arrays; Patch Antennas

20050123804 Universidad de Santiago de Compostela, Compostela, Spain
Recalculating Linear Array Antennas to Compensate for Failed Elements While Maintaining Fixed Nulls
Lozano, M. V.; Rodriquez, J. A.; Ares, F.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2048-2051; In English; See also 20050123676; Copyright; Avail: Other Sources

Given the failure of one or more elements of an array antenna designed to produce a radiation pattern including nulls in arbitrarily fixed directions, a pattern with the desired side lobe level and nulls can often be recovered by modifying the excitations of the non-defective elements. The modified excitations can be calculated by simulated annealing using an appropriate cost function.
Author
Linear Arrays; Antenna Components; Optimization; Antenna Radiation Patterns

20050123805 Birmingham Univ., UK
Advance Path Measurement for Automotive Radar
Tsang, S. H.; Hoare, E. G.; Hall, P. S.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1776-1779; In English; See also 20050123676; Copyright; Avail: Other Sources

There are too many accidents and people killed on the roads in the world every year. In the UK alone there ate 240,000 road traffic accidents, 5,000 of which are fatal and 64.000 producing serious injuries [1]. Apart from the human tragedy, there is a high cost associated with traffic jams, emergency services, and properly damage as a direct consequence of road accidents. There is therefore a very high incentive to attempt to reduce the incidence of accidents by the use of techniques such as Collision Avoidance (CA) or Collision Warning (CW) systems, In considering the migration of sensors systems from Intelligent Cruise Control (AICC), or Adaptive Cruise Control (ACC), to CW and CA applications, a number of road scenarios need to be considered. There is a stringent requirement to establish the correlation between target vehicle position and road path ahead of the host vehicle. Target vehicles in the host vehicle path are considered a potential threat whereas target vehicles not in path are not an immediate potential threat. This situation is compounded by curved paths. Road trajectory prediction is one of the main issues that needs to be addressed to solve this requirement. Currently. solutions favour the use of data from sources such as yaw-rate sensors or wheel speed however in the context of path prediction this data is historical and performance will be improved by the provision of real time data gathered ahead of the vehicle. This can be provided by a radar sensor with suitable signal processing. With such processing, an image of the traffic scene covered by the radar sensor may be developed. This opens up the possibility of using image processing techniques to enable the radar data to be processed to produce a predicted path. In this paper, a method of predicting road trajectory ahead of the host vehicle based on image processing techniques applied to millimeter wave radar returns is presented.
Author
Adaptive Control; Warning Systems; Traffic Control; Image Processing; Radar Detection

20050123806 Florida Univ., Gainesville, FL, USA
Integrated Dipole Antennas on Silicon Substrates for Intra-chip Communication
Kim, Kihong; Kenneth, K. O.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1582-1585; In English; See also 20050123676
Contract(s)/Grant(s): SRC-96-IJ-453; Copyright; Avail: Other Sources

To study the feasibility of integrating the antennas in integrated circuits, short linear, meander, and zigzag dipole antennas were implemented on silicon wafers using processing steps compatible with the silicon IC technology. The axial length of the antennas is 2 mm and the width of the metal lines is 10 microns. From phase delay measurements, it is shown that EM waves predominantly travel through the silicon substrate. Transmission gain (received power/available transmitted power) dependence on distance is greater than expected. Meander dipole antennas have 3-5 dB higher gains than the other antennas.

Input impedances of these antennas can be modeled well using lumped elements. This paper demonstrated that wireless communication within silicon ICs is possible.
Author
Dipole Antennas; Integrated Circuits; Chips; Wireless Communication

20050123807 Texas Univ., Austin, TX, USA
Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform
Deng, Hai; Ling, Hao; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1780-1783; In English; See also 20050123676
Contract(s)/Grant(s): N00014-98-1-0615; Copyright; Avail: Other Sources

Synthetic Aperture Radar (SAR) images of ground targets generally consist of target features and clutters from background scattering. In automatic target recognition (ATR) applications, it is desirable to remove the clutter from the target image before ATR processing. The standard way to suppress clutter is to apply an appropriate threshold level to the whole SAR image. However, this approach assumes that the target signal-to-clutter ratio (SCR) is large enough. Otherwise this direct threshold approach results in either target feature loss or remnant clutter residue. In this work, we set out to develop a decluttering algorithm to automatically extract the target image from a SAR image by maximizing the SCR using the adaptive wavelet packet transform (AWPT). The wavelet packet basis is a generalization of the conventional wavelet basis and has been applied for image compression and moment matrix sparsification. Our approach is to transform the SAR image to a new domain using the wavelet packet basis. Since a typical target image usually consists of point scatterers and more diffused region features, the multi-scaled wavelet basis is well suited to focus the target image. Clutter image, on the other hand, is statistically uncorrelated from pixel to pixel, and the transformed clutter image under the same set of bases remains unfocused. Therefore, we expect that the SCR can be increased by transforming the original image by an appropriately chosen set of wavelet packet basis. The cost function of our AWPT algorithm is chosen to describe how well the target signal is focused in the transform domain. An efficient basis search algorithm is implemented to find the best wavelet packet basis. Our algorithm is tested using the MSTAR SAR data set and results show that an improved SCR can be achieved using the AWPT algorithm.
Derived from text
Clutter; Synthetic Aperture Radar; Target Recognition; Radar Imagery; Image Processing; Scattering; Extraction

20050123808 Aerospace Corp., El Segundo, CA, USA
Elemental Probes for Planar Near-field Antenna Measurements
Rousseau, Paul R.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1802-1805; In English; See also 20050123676
Contract(s)/Grant(s): F04701-93-C-0094; Copyright; Avail: Other Sources

With planar near-field antenna measurements, a small probe is used to measure the radiating electromagnetic fields in the near field of the antenna under test (AUT). The measured near-field data is transformed into fax-zone antenna patterns using Fourier transforms. Practical probes are not perfectly isotropic, so some form of probe pattern compensation must be used to obtain accurate results. The best probe pattern compensation is implemented using actual calibrated measured probe patterns. However, measured probe patterns may not be available and one must use an appropriate theoretical model to approximate the probe patterns. Some commercial near-field software programs contain a 'no probe compensation' option, but it is important to understand which theoretical elemental probe model is _sumed for this option.
Derived from text
Electromagnetic Fields; Field Tests; Antenna Radiation Patterns; Electromagnetic Measurement

20050123809 Israel Aircraft Industries Ltd., Ben-Gurion Airport, Israel
A Fast Multilevel Domain Decomposition Algorithm for Radar Imaging
Boag, Amir; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1788-1791; In English; See also 20050123676; Copyright; Avail: Other Sources

A novel algorithm for radar imaging is presented. The method comprises two steps. First, a decomposition of the radar data domain into sub-domains and computation of pertinent low resolution images. Second, interpolation, phase-correction and aggregation of the low-resolution images into the final high resolution one. A multilevel domain decomposition algorithm

is formulated. The computational cost of the proposed algorithm is comparable to that of the FFT-based techniques while it appears to be considerably more flexible than the latter.
Author
Algorithms; Domains; Decomposition; Imaging Techniques; Radar Imagery

20050123811 California Univ., Davis, CA, USA
Optimization of Linear Array Antenna Performance
Branner, G. R.; Kumar, B. Preetham; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2036-2039; In English; See also 20050123676; Copyright; Avail: Other Sources

It is well understood that linear antenna arrays having variable inter-element spacing are of interest because of the potential of producing superior performance while possessing fewer elements than equivalent equally spaced structures. By utilizing array inter-element spacings as independent variables, it becomes feasible to approximate a prescribed pattern response more closely than with a uniform array due to the additional degrees of freedom afforded. A discussion of methods of synthesis of such nonuniform arrays may be found in reference, where a new analytical technique has been introduced. One approach, which offers considerable promise for smaller nonuniform arrays, employs computer oriented synthesis as a basis for determination of element locations and excitation vectors. A perusal of recent literature reveals that there has been very little reported on this approach. This paper presents a technique for optimum pattern synthesis of linear uniformly excited arrays by employing nonuniform element spacings which are determined by a nonlinear weighted least squares optimization process. The technique is illustrated for, but not constrained to linear symmetric arrays.
Author
Linear Arrays; Optimization; Antenna Radiation Patterns

20050123813 Institute of Space and Astronautical Science, Sagamihara, Japan
Large Deployable Antennas: Concepts and Realization
Takano, Tadashi; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1512-1515; In English; See also 20050123676; Copyright; Avail: Other Sources

Large deployable antennas for space use are strongly required in several missions. This paper introduces such missions together with requirements and concepts of antennas. As an example, the procedure to study and realize a radloastrouom]cal antenna is presented.
Author
Large Space Structures; Deployment; Antennas

20050123814 National Space Development Agency, Japan
The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII
Meguro, Akira; Tsujihata, Akio; Hamamoto, Naokazu; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1520-1523; In English; See also 20050123676; Copyright; Avail: Other Sources

The Engineering Test Satellite VIII (ETS-VIII) will conduct orbital experiments on the large deployable antennas, as well as the active-phased-array feeder, and the on-board processor, which are all required to realize mobile satellite communications/broadcasting with hand-held terminals. The ETS-VIII will be launched by an H-IIA launch vehicle from NASDA's Tanegashima Space Center in 2002. In these experiments, the 13 m aperture cable-mesh/truss antenna reflectors are employed for transmission and receiving antennas. Many structural concepts, engineering models has been presented and demonstrated for a long period by several organization. Typical structural concepts are graphite-mesh, cable-mesh/rib, cable-mesh/mast, cable-mesh/taruss and inflatable structure. They have many advantages and disadvantages. Therefore, we must choose the appropriate structural concept considering given mission requirements. Considering surface accuracy, thermal stability and deployment reliability, we believe that the cable-mesh/truss structure is the most feasible for our mission requirement. Disadvantages of the cable-mesh/truss structure to be solved may be weight and cost.
Author
Apertures; Antennas; Reflectors; Structural Design; Thermal Stability; Large Space Structures

20050123815 Pan American Univ., Edinburg, TX, USA
Broadband, Robust, Low-profile Monopole Incorporating Top Loading, Dielectric Loading, and a Distributed Capacitive Feed Mechanism
McLean, James; Foltz, Heinrich; Crook, Gentry; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1562-1565; In English; See also 20050123676
Contract(s)/Grant(s): DABT63-97-C0041; Copyright; Avail: Other Sources

Background Top-loaded monopoles have been shown to possess intrinsically low radiation Q and thus form a class of inherently broadband, electrically-small radiators. Over the frequency range in which they are electrically-small, these antennas provide performance superior to that of bowtie or biconical radiators of similar electrical size. However, when proportionally large-diameter top-loading elements ('tophats') are used, as required for effective operation (that is, to obtain a nearly constant current distribution on the stem), the top loading makes them somewhat mechanically unwieldy as large mechanical moments about the feed exist. It is therefore desirable to support the tophat with some sort of robust dielectric as shown. The dielectric loading generally lowers the fundamental resonance frequency of the antenna and can, in some cases, enhance radiation as well as provide mechanical support. This type of monopole has been recently investigated by several researchers.
Derived from text
Broadband; Robustness (Mathematics); Antenna Arrays

20050123816 Antenna Giken Co. Ltd., Omiya, Japan
Characteristics of Digital Terrestrial Broadcasting Antennas
Ojiro, Y.; Litsuka, Y.; Kogiso, S.; Kawakami, H.; Sato, G.; Sumihiro, S.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1570-1573; In English; See also 20050123676; Copyright; Avail: Other Sources

The characteristics of the batwing radiator, which is the heart of the superturnstile antenna system for VHF-TV broadcasting, are broad bandwidth. We investigate the modified batwing antenna for UHF used as the digital terrestrial broadcasting. In this paper, the characteristics of the 2-element modified batwing antenna with the infinite reflector and with the wire screen for finite reflector are calculated by NEC-Win Pro. These antennas are connected with each element by a parallel feed line and fed at the center of this line. We estimate these antennas from 470MHz to 770MHz of the UHF-TV broadcasting band in Japan. Broad-band properties and the power gain of about 11dBi are obtained in these frequencies.
Author
Antenna Design; Broadcasting; Television Systems

20050123818 International Business Machines Corp., Yorktown Heights, NY, USA
A Multi-Branch Monopole Antenna for Dual-Band Cellular Applications
Liu, Dui-Xian; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1578-1581; In English; See also 20050123676; Copyright; Avail: Other Sources

Advances in wireless communication technology are currently developing very rapidly. Cellular phones are used worldwide now. In Europe, many cellular networks operating at 900 MHz (GSM) have reached the network capacity. Some newer European networks are designed to operate at 1800 MHz (DCS). As the result, the demand of cellular phones capable to operate at both frequencies (bands) is increasing. A cellular phone operating at both frequencies requires the antenna to work at both bands. Dual band antenna system with one feed point was proposed. The antenna uses two helical elements, and three monopoles. In this paper, a monopole antenna with two branches, still having one feed point, is proposed for the dual-band cellular applications.
Author
Antenna Design; Monopole Antennas; Wireless Communication

20050123819 Wroclaw Univ., Poland
Planar Handset Antennas with Electronically Steerable Parameters
Kabacik, Pawel; Kucharski, Andrzej; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2070-2073; In English; See also 20050123676; Copyright; Avail: Other Sources

The primary objective of developments in wireless communications systems is to increase the density of subscribers simultaneously served by the system. Another major objective is to provide services where high rates of data transmission are needed. This can be achieved by extending the multiple access scheme and by improving channel modulation and coding. There are two major approaches to the multiple access scheme problem - the Code Division Multiple Access (CDMA) and the Spatial Division Multiple Access (SDMA). Their implementation calls for the use of smart antennas not only at the base station site, but also at the terminals, where antennas of an improved design are recommended. However, the functioning of smart antennas is still far from being well defined, and in this context a variety of concepts has been examined. This paper presents some results of our investigations into terminal antennas with improved properties of their radiation patterns. We focused on two properties - the optimized shape of the radiation pattern and the scanning of the main beam. These properties are needed to suppress interference. Furthermore, owing to the achieved antenna directivity it is feasible to suppress the

scattered waves and to decrease intersymbol interference, which is a prerequisite to achieve a high data transmission rate. Unfortunately, each terminal antenna design must comply with the tough miniaturization requirements.
Author
Portable Equipment; Steerable Antennas; Antenna Radiation Patterns; Planar Structures

20050123820 Southwest Research Inst., San Antonio, TX, USA
Development of a Conductive-polymer, Composite, Direction-finding Antenna
Solberg, Ruell F., Jr.; Siemsen, Patrick J.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1966-1969; In English; See also 20050123676; Copyright; Avail: Other Sources

Traditionally, antennas have been fabricated from metals because of the required high electrical conductivity. Now, polymer materials with sufficiently high electrical conductivities have been developed and are commercially available. Inherent advantages of replacing metals with composites which utilize these polymers, include reduced radar cross sections (RCS), excellent corrosion resistance, and the ability to tailor specific electromagnetic properties. The application of conductive-polymer composites to direction-finding (DF) antennas is described. Normalized radar reflectivity as a function of frequency for three different conductivity values of materials is shown. Note that lower conductivity values shift the curves to the left and vice versa. For low RCS, a relatively low sensitivity is desired. How the conductivity of the material for a half-wavelength dipole antenna affects its sensitivity is shown. A conductivity range of about 10 to 100 Siemens per meter (S/m) was selected so that sensitivity was not sacrificed significantly and yet the RCS was reduced.
Derived from text
Conductivity; Direction Finding; Polymers; Dipole Antennas; Fabrication

20050123830 Southeast Univ., Nanjing, China
S-Parameter Extraction of 3-D Microwave Structures by Using 3D-FDFD Method in Conjunction with Asymptotic Waveform Evaluation Technique
Liang, Jian; Hong, Wei; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1856-1859; In English; See also 20050123676; Copyright; Avail: Other Sources

The 3-D FDFD (Frequency Domain Finite Difference) has been a very useful tool for the simulation of 3-D microwave structures such as multilayered patch antennas, MMIC. In 3-D FDFD, the Maxwell's equations in frequency domain is discretized in space and the so-called absorbing boundary conditions (ABCs) is employed to truncate an infinite problem space to a finite computation domain, which becomes a matrix equation problem. The generation and solution procedure of the matrix are the two major factors affecting the computational efficiency. Like using many other frequency-domain numerical methods, in order to obtain the S- parameters of a MMICs over a wide band of frequencies by using FDFD, the matrix equation has to been solved at many sampling frequencies over the band of interest. If the S-parameters is highly frequency dependent one needs to do the calculations at f'mer frequency increments to get an accurate frequency response. This can be computationally time-consuming. The asymptotic waveform evaluation (AWE) technique was originally applied to the analyze of the VLSI circuits. Recently, AWE was also applied to the RCS calculation and microwave circuits analysis combined with finite-element. In this paper, we extend the AWE to the calculation of S-parameters using FDFD method.
Author
Microwave Circuits; Patch Antennas

20050123832 Air Force Research Lab., Kirkland AFB, NM, USA
Beamforming in Time-Domain Arrays
Tyo, J. S.; Buchenauer, C. J.; Schoenberg, J. S. H.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2014-2017; In English; See also 20050123676; Copyright; Avail: Other Sources

The Air Force Research Laboratory has developed a number of impulse radiating antennas (IRAs) for use in various ultra-wideband (UWB) and UWB high-power microwave (HPM) applications. Many of these antennas are designed to behave as differentiating antennas excited by a fast-rising step waveform, thereby resulting in a large-amplitude, narrow pulse in the far-field. In order to achieve this differentiating behavior, a focused aperture antenna is employed (hence the need for the reflector or lens). Furthermore, in order to maintain the differentiating nature of the antenna for long times (equivalently, in order to obtain good low-frequency performance) a combination of a physically large aperture and appropriate terminations at the end of the feed structure is needed. A new class of IRAs - the array IRA - has been proposed and examined in a number of studies. The principle benefit that is realizable with an array IRA is the potential for electronic beamsteering. Secondly, array IRAs will allow for far-field power combination from solid-state sources that are currently under development. In addition to

these primary benefits, array IRAs provide a reduction in volume and the related mass of the antennas. It is important to note, however, that these benefits come at the cost of the added complexity associated with the precise timing of the array elements that is necessary for beamforming and far-field power combination.
Author (revised)
Beamforming; Time Domain Analysis; Antenna Arrays

20050123833 Wang Electro-Opto Corp., Marietta, GA, USA
Low-power Low-profile Multifunction Helmet-mounted Smart Array Antenna
Tillery, J. K.; Thompson, G. T.; Wang, J. J. H.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1554-1557; In English; See also 20050123676
Contract(s)/Grant(s): DAAB07-97-C-D007; Copyright; Avail: Other Sources

The development of a smart low-profile helmet-mounted antenna with pattern-diversity has been previously reported by the authors. This smart antenna array virtually ensures stable reception despite problems such as the continually varying skeletal position associated with the movements of the individual, as well as propagation interferences, even for locations which are 'dead spots' for conventional antennas However, with the extremely limited space and battery power available on the helmet, it is necessary that the antenna be multifunction and the power consumption be minimal. In this paper, we present a design for an advanced smart helmet-mounted antenna which employs low-power CMOS control devices and innovative antenna technology for size reduction (patents pending). This smart array uses pattern diversity to mitigate the effects of multipath fading and the soldier's changing skeletal orientation. In the past, smart antenna techniques have generally been applied to base-station antennas only. By taking advantage of a unique low-cost, low-power, pattern diversity switching mechanism, as well as the recent rapid decline in component and device costs and size, we believe we have made one of the first practical portable smart antenna systems.
Author
Antenna Arrays; Antenna Design

20050123834 Michigan Univ., Ann Arbor, MI, USA
A Novel Design of an Ultra-Fast Wideband Polarimetric Radar
Nashashibi, A.; Sarabandi, K.; Frantzis, P.; DeRoo, R. D.; Ulaby, F. T.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1992-1995; In English; See also 20050123676; Copyright; Avail: Other Sources

Accurate high resolution measurements of both clutter and man-made targets at millimeter-wave frequencies have become an essential requirement for the development of optimal target detection and tracking algorithms. Towards this end, an ultra-fast wideband polarimetric instrumentation radar was developed by The University of Michigan for millimeter-wave frequencies applications. With this new design, the scattering matrix of a target can be measured over a bandwidth of 840 MHz in less that 32 microsec, hence, one foot resolution fully polarimetric radar images can easily be generated using this system. The design is directly applicable to microwave instrumentation radars.
Author
Broadband; Polarimetry; Radar Imagery; Systems Engineering

20050123835 Nevada Univ., Reno, NV, USA
Adaptive Nulling with Spherical Arrays Using a Genetic Algorithm
Chung, You Chung; Haupt,Randy L.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2000-2003; In English; See also 20050123676; Copyright; Avail: Other Sources

Spherical arrays are arrays that conform to the surface of a sphere. One approach to a spherical array layout is to mold a planar array to the surface of a sphere (spherical-planar array). Another approach is to create circular arrays about the spherical surface (spherical-circular array). This paper presents an approach to adaptive nulling with either type of spherical array using a genetic algorithm. Amplitude and phase adaptive nulling with a genetic algorithm generates deeper and faster nulls than phase-only nulling. A genetic algorithm is used to place a null at the sidelobe of two types of spherical arrays. The 16x16 element, 256 elements, rectangular grid half wavelength spaced spherical planar array, and the spherical circular array with same number of elements as spherical-planar array are simulated and compared.
Derived from text
Genetic Algorithms; Adaptive Control; Antenna Arrays; Spheres

20050123836 Florence Univ., Italy

A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems

Bolli, P.; Naldini, A.; Pelosi, G.; Pochini, C.; Selleri, S.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2018-2021; In English; See also 20050123676; Copyright; Avail: Other Sources

Passive intermodulation (PIM) is a phenomenon which often arises at junctions between different materials. This may be a major issue in tightly packed antenna farms as those typically present on communication satellites. Here an heuristic non-linear extension to the Time Domain Physical Optics is proposed, to take into account electromagnetic scattering at intermodulated frequencies when such a junction is illuminated by two impinging electromagnetic fields at different frequencies.

Author

Physical Optics; Intermodulation; Antenna Arrays; Electromagnetic Scattering; Satellite Antennas

20050123837 California Univ., Los Angeles, CA, USA

The Field Transmitted into a PBG Crystal due to an Electric Line Source

Merrill, William M.; Kyriazidou, Chryssoula; Contopanagoe, Harry F.; Alexopoulos, Nicolaos G.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1908-1911; In English; See also 20050123676; Copyright; Avail: Other Sources

During the past few years interest in periodic composite structures has been increasing as a result of their unique filtering properties. Particular attention has been focused on metallo-dielectric and dielectric-dielectric composites exhibiting photonic (propagation) bandgaps (PBGs) in both numerical and experimental studies. PBG crystals prohibit propagation in certain directions (ranging from a single direction to the creation of complete band-gaps) for certain frequency ranges. As the name implies photonic baud gap crystals axe being widely explored for optical filtering and reflection applications. However as the PBG unit cell size is increased filtering and antenna pattern shaping applications have been demonstrated at frequencies down to the lower microwave spectrum.In this paper the transmitted field due to a electric line source suspended over a PBG crystal half-space is presented. This result is a generalization of the plane wave response provided by the transfer matrix approach and results from using a Fourier representation to present the line source as a spectrum of plane waves.

Author

Antenna Radiation Patterns; Electric Fields

20050123839 California Univ., Irvine, CA, USA

Physical Realization of Magnetic Walls Using Finite-thickness 3D Printed Arrays

Contopanagos, Harry; Kyriazidou, Chryssoula; Merrill, William; Alexopoulos, Nicolaos G.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1916-1919; In English; See also 20050123676; Copyright; Avail: Other Sources

Perfect Magnetic Conductors (PMC) have been useful in electromagnetics for many years as subsidiary hypothetical surfaces in conjunction with formal dualities between electric and magnetic currents and vector potentials.This in turn helped formulating equivalence theorems and solving many scattering problems involving either a single scatterer in a solvable background (aperture in wave guiding structures)or many scatterers in highly symmetrical distributions.Physically,however,natural materials used in microwave engineering had been macroscopically classified as (low-loss) dielectrics and (im)perfect electric conductors. Natural dispersive characteristics of these materials are rarely considered in microwave engineering, because they occur at far greater frequencies; For low-loss dielectrics natural dispersion develops in the quasi-optical regime, whereas imperfect conductors are only described through their (microwave) skin depth, which is a low-frequency approximation of their full dispersive characteristics, and does not describe such optical properties as their ultraviolet transparency. Hence, natural electromagnetic media in the microwave never behaved as (im)perfect magnetic conductors, and the concept remained a theoretical tool only. In this paper we will show that artificial metalo-dieleetric crystals, composed of printed elements in a 3D array do exhibit magnetic conductor behavior, provided the size of the elements is a good fraction of the wavelength. In essence, we can think of the printed elements as artificial atoms scaled up to microwave frequencies. The resulting medium is analogous to a natural metal at plasma frequencies (ultraviolet regime) where the latter also behaves like a magnetic conductor.

Author

Electric Conductors; Waveguides; Electromagnetism

20050123840 Defence Evaluation Research Agency, Malvern, UK

Fundamental Limit on the Performance of Radar Absorbing Materials

Brewitt-Taylor, C. R.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1938-1941; In English; See also 20050123676; Copyright; Avail: Other Sources

Standard designs of radar absorbing material on a conducting backplane become inconveniently thick for the absorption of longer wavelength radiation. Attempts to reduce the thickness of the absorber, for example increasing the dielectric constant of the materials often results in a decrease of the bandwidth of good absorption, proportional to the thickness reduction achieved. A possible method of overcoming this problem is the use of artificial materials with frequency-dependent constitutive parameters: e.g. the embedding of loaded antenna elements, and the present author's previous work on helix-loaded chiral materials. We have performed broadband numerical optimizations of various absorbers involving frequency-dependent materials, including Salisbury (circuit analogue) screens, single-layer dielectric and chiral absorbers, and multi-layer dielectric absorbers. A Lorentz resonant form for the frequency-dependence was used. Using several resonances allows the shape of the absorption-frequency curve to be adjusted, but does not allow the area enclosed to be increased without limit. Wallace performed similar computations for resonant magnetic materials: he also raises the possibility that there is a fundamental limitation arising from the Kramers-Kronig relations. Consider a single-layer absorber with frequency-dependent dielectric constant epsilon(f). An ideal frequency variation can be found by computing at each frequency what value of epsilon(f) gives zero reflection for a fixed layer thickness. The real part is roughly proportional to 1/f(exp 2), and the imaginary part to 1/f. layer, and attenuation through the layer. But since any real material is causal (it cannot react to an electromagnetic pulse before the pulse arrives), the real and imaginary parts of its dielectric constant are connected by the Kramers-Kronig relations. We cannot independently specify the real and imaginary parts, as we have done in our ideal frequency variation, and the ideal frequency variation may be unrealisable.

Author (revised)

Radar Absorbers; Electromagnetic Absorption; Bandwidth

20050123842 Kharkov State Univ., Ukraine

Numerical Calculation of the Volterra Integral Equation for a Time-varying Medium

Yemelyanov, K. M.; Nerukh, A. G.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2026-2029; In English; See also 20050123676; Copyright; Avail: Other Sources

Problems for time varying parameters are of interest for the purposes of investigation of electromagnetic waves propagation in the ionosphere, for remote sensing of unstable objects by short electromagnetic pulses, signal propagation in optic line etc. The solution to the nonstationary electromagnetic problem may be obtained by various methods based on either Integral Transform Techniques or treating Maxwell equations in Time Domain, In this paper numerical solution to the nonstationary electromagnetic problem by various methods is analyzed.

Author

Electromagnetic Wave Transmission; Volterra Equations; Plane Waves; Electromagnetic Fields

20050123843 California Univ., Davis, CA, USA, California Univ., Davis, CA, USA

Design of Low Sidelobe Circular Ring Arrays by Element Radius Optimization

Kumar, B. Preetham; Branner, G. R.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2032-2035; In English; See also 20050123676; Copyright; Avail: Other Sources

There is a special class of antenna arrays, called 'minimum redundancy arrays', that seeks the optimal array geometry, with a limited number of antenna array elements. Optimization techniques include analytical techniques, computational methods such as linear/non-linear optimization and genetic algorithms. In this paper, the authors expand the scope of their earlier synthesis method to design planar circular arrays with concentric rings of circular apertures.

Author

Antenna Arrays; Antenna Design; Design Optimization; Apertures

20050123847 California Univ., Los Angeles, CA, USA

PBG-Assisted Gain Enhancement of Patch Antennas on High-dielectric Constant Substrate

Yang, F. R.; Coccioli, R.; Qian, Y.; Itoh, T.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1920-1923; In English; See also 20050123676

Contract(s)/Grant(s): DAAH04-96-1-0389; DAAH04-96-1-0005; Copyright; Avail: Other Sources

The recently developed Uniplanar Compact PBG (UC-PBG) substrate is successfully used to reduce surface wave losses

of a patch antenna on a high dielectric constant substrate. The surface wave dispersion diagram of the UC-PBG substrate has been numerically computed and found to have a complete bandgap in the range of frequency 10.9-13.5GHz. This feature is exploited to enhance both bandwidth and broadside gain of a patch antenna working at the frequency 11.5GHz in the forbidden bandgap. Measured results show a 2.8dB higher radiation in the broadside direction than that of a standard patch antenna built on the same high-permittivity grounded dielectric slab.
Author
Patch Antennas; Antenna Gain; Dielectrics; Surface Waves

20050123848 HRL Labs., LLC, Malibu, CA, USA
External Substrate Perforation Applied to Patch Antennas for Mitigating Surface Wave Effects
Colburn, J. S.; Rahmat-Samii, Y.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1928-1931; In English; See also 20050123676
Contract(s)/Grant(s): DAAH04-96-1-0389; Copyright; Avail: Other Sources

Patch antennas are useful in a very broad range of applications due to their simplicity, in both operation and fabrication, conformability and integrability with planar circuitry. The problem is that patch antennas don't perform well on high dielectric constant substrates used in compact micro/millimeter-wave circuit fabrication. This makes the integration of a patch antenna on the same substrate as the input/output circuitry difficult. Thus, there is considerable interest in overcoming the undesirable features of thick and high dielectric constant substrates for patch antennas without sacrificing any of the desired features, namely, small element size and bandwidth. To this end, substrate perforation exterior to a patch antenna is suggested. The idea is to lower the effective dielectric constant of the substrate surrounding the patch while not affecting the substrate under the antenna. This concept was studied using the FDTD technique. The change in the effective dielectric constant surrounding the patch antenna has been observed to help mitigate the ill effects of patch antennas on thick, high dielectric constant surfaces.
Author
Patch Antennas; Permittivity; Antenna Radiation Patterns

20050123850 Miller (Edmund K.), Santa Fe, NM, USA
Far Field Analysis of Radiation Sources
Miller, Edmund K.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2008; In English; See also 20050123676; Copyright; Avail: Other Sources

Finding where the far field power originates from a scatterer or antenna is of interest not only from the viewpoint of antenna design or controlling radar scattering, but is also a problem of fundamental physics. One approach to this problem, at least conceptually, might be provided by the Lienard-Wiechert potentials. These show explicitly that radiation is due to accelerated charge. Although it's obvious where some of the charge acceleration occurs on a simple object such as a wire antenna or flat plate, apparently no analytical connection has been established between equivalent source distributions computed from numerical solutions and charge acceleration. Indeed, a connection between equivalent sources on the surface of a perfect electric conductor (PEC) and the behavior of physical charge within an actual conductor is not completely clear. Hence, the specific question of how much power is contributed per unit area from a PEC to far field radiation may not have an obvious answer, a situation that fortunately has not hindered analysis and design. Progress has been made in related areas, however. Various kinds of broadband imaging schemes, typically using on Fourier transforms and variable illumination angles, yield images that reveal geometrical details about an object, and imply where radiation comes from. Images have also been developed from single-frequency, bistatic far field information using numerical solutions for source distributions induced by various kinds of excitation. The approach described here, called Far field Analysis of Radiation Sources (FARS), also uses bistatic far fields at a single frequency. Instead of imaging, we seek to determine the contribution made to the total power flow at a given far field observation point by each incremental source, s(sub i), on the PEC boundary.
Author
Far Fields; Radiation Sources; Imaging Techniques

20050123911 New Mexico State Univ., Las Cruces, NM, USA
Research Supporting Satellite Communications Technology
Horan Stephen; Lyman, Raphael; [2005]; 96 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2864
Report No.(s): NMSU-ECE-05-002; No Copyright; Avail: CASI; A05, Hardcopy

This report describes the second year of research effort under the grant Research Supporting Satellite Communications

Technology. The research program consists of two major projects: Fault Tolerant Link Establishment and the design of an Auto-Configurable Receiver. The Fault Tolerant Link Establishment protocol is being developed to assist the designers of satellite clusters to manage the inter-satellite communications. During this second year, the basic protocol design was validated with an extensive testing program. After this testing was completed, a channel error model was added to the protocol to permit the effects of channel errors to be measured. This error generation was used to test the effects of channel errors on Heartbeat and Token message passing. The C-language source code for the protocol modules was delivered to Goddard Space Flight Center for integration with the GSFC testbed. The need for a receiver autoconfiguration capability arises when a satellite-to-ground transmission is interrupted due to an unexpected event, the satellite transponder may reset to an unknown state and begin transmitting in a new mode. During Year 2, we completed testing of these algorithms when noise-induced bit errors were introduced. We also developed and tested an algorithm for estimating the data rate, assuming an NRZ-formatted signal corrupted with additive white Gaussian noise, and we took initial steps in integrating both algorithms into the SDR test bed at GSFC.
Author
Satellite Communication; Technology Utilization; Research Projects

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20050109928 Technische Hogeschool, Eindhoven, Netherlands
Some Developments in Fresnel Zone Plate Lens Antennas
Herben, M. H. A. J.; Hristov, H. D.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 726-729; In English; See also 20050109927; Copyright; Avail: Other Sources

The paper summarizes in brief the basic outcomes of the several year research on the Fresnel zone plate lenses and antennas accomplished at the Eindhoven University of Technology (EUT). Added are also some results obtained at the Technical University of Varna (TUV) as an extension of the joint work on the subject between EUT and TUV initiated under a CEC/COST research contract. The optical Fresnel zone plate (FZP) consisting of alternate open and opaque annuli was created by Soret (1875). In short we will call it a half-open FZP. Wood (1898) studied further the half-open FZP and created the much more efficient phase-reversal FZP. Microwave/mm-wave FZPs were applied mainly to Fresnel zone plate antennas (FZPAs). The first rnicrowave FZPA was patented in 1936. During the next two decedes, studies on different FZPA varieties were carried out at frequencies from 15 to 24 GHz. The mm-wave FZP and FZPA developments and applications were reported in 1961.A bilaterally planar microwave variety of the Wood's phase-reversal FZP was proposed in 1976, and described in 1985 by Wiltse. A small FZP-type antenna, oomprising one dielectric ring director that fits into the second Fresnel zone was described by one of the present authors and his co-workers in 1980. Van Buskirk and Hendrix created the so-called reflection FZP and applied it to a small X-band radiotelescopic FZPA. In the present paper, however, we shall pay attention to the transmission FZPs and FZPAs only.
Derived from text
Fresnel Lenses; Dielectrics; Superhigh Frequencies; Millimeter Waves; Microwaves; Lens Antennas

20050109929 Technische Univ., Brunswick, Germany
Representation of Absolute Electric Fieldstrength by Superposition of Radiated and Guided Waves
Werner, J.; Enders, A.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 764-767; In English; See also 20050109927; Copyright; Avail: Other Sources

A commonly used method of calibrating sensors for high frequency electric fields is based on the use of closed TEM-waveguides. But this method does not allow the determination of errors produced by any coupling between the sensor v.ud the waveguide. In this paper a new method of electric field sensor calibration is presented which allows the determination of coupling errors. This is done by a superposition of radiated and guided waves and this error can be quantified by measurements. Consequently a higher accuracy in the representation of electric fieldstrength and calibration of sensors and antennas can be obtained.
Author
Electromagnetic Fields; Calibrating; Electric Fields; High Frequencies; Waveguides

20050109930 Politecnico di Turin, Turin, Italy

Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas

Pirinoli, P.; Garino, M. Sereno; Vecchi, G.; Orefice, M.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 822-825; In English; See also 20050109927; Copyright; Avail: Other Sources

In this paper, the magnetic-wall cavity modes are used as basis functions for the full wave analysis of an annular patch, proximity coupled to a feeding microstrip line, carried out with the spectral-domain version of the Method of Moments. Particular emphasis is given to the effect of the commonly adopted exclusion of TE modes. An efficient, time saving technique for the evaluation of the reaction integrals is also presented.

Author

Microstrip Transmission Lines; Patch Antennas; Method of Moments; Spectrum Analysis; Cavities

20050109933 Industrial Technology Research Inst., Hsinchu, Taiwan, Province of China

A T-Strip Loaded Rectangular Microstrip Patch Antenna for Dual-Frequency Operation

Deng, Sheng-Ming; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 940-943; In English; See also 20050109927; Copyright; Avail: Other Sources

A dual-frequency operation on a T-strip loaded microstrip patch antenna is introduced. The procedure for simultaneous input impedance matching at both resonant frequencies is described as well. We performed simulation and experiment. Both of them show good consistence between each other. Finally based on our simulation and experimental results, analysis for return losses and radiation patterns is also discussed.

Author

Microstrip Antennas; Impedance Matching; Antenna Radiation Patterns; Resonant Frequencies; Patch Antennas

20050109934 Universidad Politecnica de Madrid, Madrid, Spain

Dual-band Compact Square Waveguide Corrugated Polarizer

Rebollar, J. M.; deFrutos, J.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 962-965; In English; See also 20050109927; Copyright; Avail: Other Sources

A compact polarizer based on a corrugated waveguide of square cross-section including the input and output transitions is analysed by means of an accurate and efficient full wave software based on Mode Matching, and a dual-frequency band polarizer of high electrical performance in the Ku band has been 'fully' designed. The good agreement between the numerical and experimental results confirms both the design process and the proposed polarizer which can easily include different cross-sections of the attached Orthomode Transducer (OMT) and horn devices, thus resulting in a very compact antenna.

Author

Polarizers; Corrugated Waveguides; Electrical Properties; Transducers

20050109935 Chiba Univ., Chiba, Japan

Numerical Analysis of Thin Coaxial Antennas for Microwave Coagulation Therapy

Saito, Kazuyuki; Hayashi, Yoshihiko; Yoshimura, Hiroyuki; Ito, Koichi; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 992-995; In English; See also 20050109927; Copyright; Avail: Other Sources

In the recent few decades, various types of applications of the microwaves have been investigated and have been applied to thermal therapy, In particular, minimally invasive interstitial therapies using thin applicators have expanded dramatically. In this paper we describe the characteristics of thin coaxial antenna by numerical analysis for the microwave coagulation therapy.

Author

Numerical Analysis; Microwaves; Therapy

20050109939 Army Communications-Electronics Command, Fort Monmouth, NJ, USA

Tapered Leaky-wave Ultra Wide-band Microstrip Antenna

Nalbandian, Vahakn; Lee, Choon Sae; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1236-1239; In English; See also 20050109927; Copyright; Avail: Other Sources

Previous wide-band or ultra wide-band antennas have been bulky such as horn, helical and log periodic antennas. Conventional microstrip antennas are planar, conformal and inexpensive but have narrow frequency bandwidths. It is

extremely desirable to have antennas with all the advantages of microstrip antennas and large bandwidths. The proposed wide-band planar leaky-wave microstrip antenna provides such a need.
Derived from text
Broadband; Microstrip Antennas; Tapering; Fabrication

20050109941 Indian Inst. of Tech., Guwahati, India
Closed Form Expression For Mutual Partial Inductance Between Two Skewed Linear Current Segments
Ray, Saikat; Gogoi, Anup K.; Mallik, Ranjan K.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1278-1281; In English; See also 20050109927; Copyright; Avail: Other Sources

A closed form expression is presented for mutual partial inductance between two current segments which may be non-parallel and may be located on different planes. This expression for a pair of skewed lines can be used for computation the inductances for three dimensional packages and interconnect.
Author
Inductance; Linearity; Segments; Skewness; Electric Current

20050109948 Georgia Inst. of Tech., Atlanta, GA, USA
On the Accuracy of the Transmission Line Theory for the Insulated Linear Antenna
Hertel, Thornsten W.; Smith, Glenn S.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 768-771; In English; See also 20050109927
Contract(s)/Grant(s): DAAH-04-96-1-0161; Copyright; Avail: Other Sources

An insulated linear antenna consists of a metallic, cylindrical conductor covered by a concentric sheath of dielectric with relative permittivity eri. Insulated antennas are almost always used in an ambient medium, such as soil, seawater, or biological tissue, whose electrical properties are quite different from those of the insulation; that is, either the relative permittivity sigma(sub re) or the conductivity sigma(sub e) of the external medium is much greater than that of the insulation.
Author
Electrical Properties; Insulation; Transmission Lines; Cylindrical Bodies; Cylindrical Antennas

20050109949 Illinois Univ., Urbana-Champaign, IL, USA
Efficient Electromagnetic Modeling of Microstrip Structures in Multilayer Media
Ling, Feng; Jiao, Dan; Jin, Jian--Ming; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 776-779; In English; See also 20050109927; Copyright; Avail: Other Sources

A variety of methods have been developed for electromagnetic modeling of microstrip structures, such as antennas, circuits, and interconnects. A review of them reveals that the method of moments (MoM) solution of the integral equation has received intense attention. Many variations of this method have been implemented and investigated. Among them, the solution based on the mixed potential integral equation (MPIE) using the Rao-Wilton-Glisson (RWG) basis functions is an attractive approach. On the other hand, when microstrip structures become more complicated, multilayer media are employed to allow for more versatile designs. This fact necessitates the modeling to be capable of dealing with microstrip structures in multilayer media. To achieve this goal, the evaluation of Green's functions in the form of the Sommerfeld integral (SI) for multilayer media is crucial. One approach to rapidly evaluate the SI is the discrete complex image method (DCIM). This method has been extensively employed to analyze microstrip structures. However, most of the work is confined to single-layered or double-layered structures. The extension of the DCIM to multilayer media is considered difficult because of the treatment of the surface-wave contribution. In this paper, we show that the extraction of surface-wave contribution is not necessary for the DCIM and, therefore, the spatial domain Green's functions can be efficiently evaluated.
Derived from text
Electromagnetism; Confinement; Circuits; Extraction; Surface Waves

20050109950 City Univ. of Hong Kong, Kowloon, Hong Kong
A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method
Liu, Y. W.; Lan, K.; Mei, K. K.; Song, Y. M.; Zhao, W. Y.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 788-791; In English; See also 20050109927
Contract(s)/Grant(s): CUHK-7000897; CERG-9040273; Copyright; Avail: Other Sources

Recently, fast computational methods based on directly thinning the matrix of Method of Moment (MoM), such as Impedance Matrix Localization (IML), wavelet expansions, and Reduced Expansion and Field Testing (REFT), have been

introduced. In this paper, we propose a simpler approach to thin the MoM matrix by using the concept of Measured Equation of Invariance (MED). This approach is referred to as Matrix Decomposition by MEI (MDMEI). A little effort is required to add the resulting method to any of a variety of MoM programs for solving problems of wire antenna, and conducting object scattering.
Author
Matrix Methods; Wavelet Analysis; Decomposition; Invariance; Impedance; Matrices (Mathematics)

20050109951 Amirkabir Univ. of Technology, Tehran, Iran (Islamic Republic of)
A New Time Domain Analysis of Vertical Dipole in the Vicinity of a Planar Dielectric Interface
Rafi, Gh. Z.; Moini, R.; Faraji-Dana, R.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 792-795; In English; See also 20050109927; Copyright; Avail: Other Sources

The present paper deals with the trm_sient fields transmitted and reflected through the interface between the air and ground. Excitation for the electromagnetic fields is produced by a vertically oriented impulsive electric dipole. The ground medium has arbitrary permittivity and permeability, but it is restricted to be lossless. Mathematical formulation of the problem is given for the magnetic vector potential, whose solution is derived in a new approach without using frequency domain formulation. The main emphasis here is to derive simple expressions for transient vector potential and Electromagnetic fields.
Author
Electric Dipoles; Dielectrics; Planar Structures; Time Domain Analysis

20050109952 Houston Univ., TX, USA
An Annular-Ring Reduced Surface Wave Microstrip Antenna
Mehrotra, Amit R.; Jackson, David R.; Williams, Jeffery T.; Long, Stuart A.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 810-813; In English; See also 20050109927; Copyright; Avail: Other Sources

Recently, a new general method for constructing RSW antennas was introduced, which applies to planar microstrip antennas of arbitrary shape. In this method the substrate inside the patch cavity (below the patch metalization) is replaced with another material that has an optimum relative permittivity, given by the square of the normalized wavenumber of the TM(sub 0) surface wave (the TM(sub 0) wavenumber divided by k(sub o)). This design principle will be used here to design and study a RSW antenna in the shape of an annular ring. The annular-ring shape is chosen because an annular ring antenna is smaller than a circular patch antenna for a given permittivity inside the patch cavity. This leads to a RSW antenna that is smaller in size than the previous RSW designs. The tradeoffs between antenna size and impedance characteristics, including bandwidth and input resistance, will be discussed in detail.
Author
Microstrip Antennas; Surface Waves; Bandwidth; Impedance; Dipole Antennas

20050109955 Commonwealth Scientific and Industrial Research Organization, Epping, Australia
Analysis of Radiation from Two Separate Axisymmetric Horns Using the Method of Moments
Cooray, F. R.; Bird, T. S.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 862-865; In English; See also 20050109927; Copyright; Avail: Other Sources

A method of moments (MoM) technique is described for analyzing the radiation from two parallel axisymmetric horns whose apertures are non-coplanar. Using the equivalence principle and appropriate boundary conditions, a set of integral equations is obtained with currents on the horn surfaces as the unknowns. These integral equations are solved by the MoM to yield the surface currents. The radiation patterns of the two horns as well as the coupling between them are calculated from these surface currents. Numerical results are presented for a pair of axisymmetric horns.
Author
Method of Moments; Symmetry; Antenna Radiation Patterns; Horn Antennas

20050109961 Universidad Politecnica de Catalunya, Catalunya, Spain
A Procedure to Design Wide-Band Electromagnetically-coupled Stacked Microstrip Antennas Based on a Simple Network Model
Anguera, Jaume; Puente, Carles; Borja, Carmen; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 944-947; In English; See also 20050109927; Copyright; Avail: Other Sources

It is well known that microstrip patch antennas have a poor bandwidth (BW) due to the small spacing between the patch

and the ground plane. A stacked patch configuration has been demonstrated experimentally as a feasible solution, but little information on the design procedure is available. Here, a systematic design procedure based on a single network model is shown.
Author
Microstrip Antennas; Patch Antennas; Bandwidth; Broadband; Spacing

20050109962 North Carolina State Univ., Raleigh, NC, USA
An Inhomogeneous Waveguide Transformer with Hard Walls for the Excitation of Quasi-optical Amplifiers
Ozkar, M.; Mortazawi, A.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 958-961; In English; See also 20050109927
Contract(s)/Grant(s): DAAG-55-97-132; Copyright; Avail: Other Sources

Inhomogeneous waveguide transformers with hard walls are proposed for the excitation of quasi-optical amplifiers. A program based on the mode matching technique is used to analyze inhomogeneous transformers with dielectric loaded waveguide sections. The Generalized Scattering Matrix (GSM) of the whole block is obtained which can be used to predict the fields at the output given the incident excitations. A tapered hard wall horn is replaced with a three section transformer of approximately half the size while maintaining its performance.
Author
Waveguides; Transformers; S Matrix Theory; Dielectrics

20050109963 Universitat Politecnica de Catalunya, Barcelona, Spain
Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas
Mallorqui, Jordi, J.; Aguasca, Albert; Cardama, Angel; Pages, Roma; Haro, Josep; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 978-981; In English; See also 20050109927
Contract(s)/Grant(s): CIRIT-CIDEM; Copyright; Avail: Other Sources

One of the of the main problems regarding the efficiency in a heating industrial system using high power microwaves is related with the uncontrolled changes on the load. These changes can be caused both by the different kinds of materials to be processed in the same oven and by the temperature rise which modifies the material's physical properties, particularly its dielectric permittivity. Usually, the microwave generator is matched to the antenna feeding the oven by means of a waveguide matching system, typically a two, three or four capacitive-screw tuner empirically adjusted for a given load. Once the heating process is started, the temperature dependence of the complex permittivity usually changes the impedance seen by the generator, worsening the mismatch factor and reducing the efficiency of the beating process. A similar happens when the load is inhomogeneous or discontinuous; it is not feasible to manually re-adjust the matching network for every different sample processed. Until now the solution has been simple but highly inefficient: to increase the incident power in order to overcome the mismatching effects.
Derived from text
Conjugate Gradient Method; Microwaves; Microwave Antennas; Heating; Dielectrics

20050109964 Rome Univ., Rome, Italy
Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media
Baccarelli, P.; DiNallo, C.; Frezza, F.; Galli, A.; Lampariello, P.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 982-985; In English; See also 20050109927; Copyright; Avail: Other Sources

This work investigates the capabilities of reaching excellent radiative performances with new topologies of leaky-wave antennas employing gyrotropic media. Based on previously-recognized attractive radiation characteristics in simple antenna configurations (such as a transversely-magnetized ferrite grounded slab or a laterally ferrite-loaded open rectangular waveguide with a current-line excitation), significant enhancements are suggested and tested here. In particular, it is seen that the use of multiple-layered structures gives additional desirable features for practical purposes: our analysis shows that, by properly choosing geometrical and physical parameters, it is possible to conveniently modify the phase and leakage properties of this kind of radiators, thus obtaining substantial improvements as regards the characteristics of the radiation patterns.
Author
Antenna Radiation Patterns; Gyrotropism; Waveguide Antennas; Rectangular Waveguides; Antenna Design; Ferrites

20050109965

Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space

Hackett, Ronald; Taylor, Clayborne D.; McLemore, Donald; Dogliani, Harald; Walton, William A., III; Leyendecker, Albert J.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1000-1003; In English; See also 20050109927; Copyright; Avail: Other Sources

Providing a high concentration of electromagnetic energy into small regions has applications in hyperthermia treatment of cancer and other maladies. A detailed discussion of the topic is provided by Durney and Iskander. Producing a narrow beam radiation in biological tissue requires a high operating frequency with a wavelength that is small with respect to the target characteristic dimensions. However, the optimal wavelengths do not sufficiently penetrate the tissue to depths for effective treatment. Consequently lower frequencies are used with less target discrimination. Other applications for developing a high concentration of electromagnetic power include short-pulse radar and high-energy beams. Several publications discuss the optimization of transient radiation. Generally, these papers address the maximization of the transient radiated field at a specified time and far field location . In this paper, an approach is presented for producing a high concentration of electromagnetic energy into small regions involving free space or non-dispersive materials. The technique utilizes an array of ultra-wideband antennas radiating short duration pulses. It is shown that precise control of the time delays of the pulses radiated from the individual elements allows selective targeting of regions in space where the pulses may overlap in a coherent fashion. This approach is similar to using time delays for array beam steering. In fact, as the target area is moved away from the array into the far zone, the focusing of power into small regions deteriorates into a beam steering problem.

Derived from text

Target Recognition; Hyperthermia; High Frequencies; Far Fields; Radar Beams

20050109966 National Cheng Kung Univ., Tainan, Taiwan, Province of China

Numerical Computation on Radiation Characteristics of Square Loop Antennas at the Wrist Position of a Human Body in Personal Wireless Communications

Wei, Yih-Feng; Chen, Wen-Tzu; Chuang, Huey-Ru; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1016-1018; In English; See also 20050109927; Copyright; Avail: Other Sources

The trend of miniaturization for the cellular phone or other portable communicators in personal communications will lead to the ‘watch-type’ handset carried at the wrist position. It is of great interests to investigate radiation characteristics of the square-loop antenna, which may be used in this ‘watch-type’ communicator, influenced by the human hand and body. Fig. 1 shows this antenna-body coupling system. A 3-D realistically shaped man model (1.7 m height) with homogenous muscle phantom is constructed. As shown in Fig. 1, the loop antenna may have different position and orientation With respect to the wrist. The loop antenna embedded in the watch belt can also encircle the wrist. The average power gain, G(sub avg), over the eight equal-angle positions in the H-plane is appropriate for evaluating the antenna performance in wireless communications, it is important to note that the power gain defined under the antenna ohmic-loss and the body absorption radiation efficiencies associated with (7) should be used to evaluate the antenna performance in the communication link budget. Fig. 2 shows an example of Antenna patterns of the square loop antenna in free space and proximate to the wrist of a human body at 280 MHz VHF radio paging band. Note that 3-D put,ms are only for proximate-to-wrist case. Significant variation of antenna patterns in free space and at the wrist position is observed. More numerical results of the square loop antenna proximate to the wrist position of the body with different position and orientation at different frequency bands will he presented and discussed.

Author

Antenna Radiation Patterns; Communication Networks; Loop Antennas; Power Gain; Wireless Communication

20050109967 China Scientific and Technical Univ., Hefei, China

Improved Smokescreen For MM Wave And IR

ZhiPing, Chen; Qi, Zhu; ShanJia, Xu; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1020-1023; In English; See also 20050109927; Copyright; Avail: Other Sources

Since 1970 ‘s,because of some limitation of IR and optical system especially the shortcoming on occasion of rain, smoke, dust and canister, MM wave systems are given emphasis again. Compared with microwave and IR systems, MM wave systems also possess advantages of the two. With more extensively application of MM wave system ,we improved traditional smokescreen and thin metallic strips, then measured some propagation features in them.

Derived from text

Microwave Equipment; Infrared Instruments; Dust; Metal Strips

20050109968 Netherlands Foundation for Research in Astronomy, Dwingelo, Netherlands

A Fast and Accurate Scheme for Calibration of Active Phased-array Antennas

Hampson, G. A.; Smolders, A. B.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1040-1043; In English; See also 20050109927; Copyright; Avail: Other Sources

The international radio-astronomy community is currently making detailed plans for the development of a new radio telescope: the Square Kilometre Array (SKA) [1]. This instrument will be a hundred times more sensitive than telescopes currently in use. One approach for this new telescope is to use a phased array consisting of more than 10(exp 6) receiving elements with a mixed RF/digital adaptive beamformer. At this moment, a demonstrator receive-only active phased-array system is being tested at NFRA, the One Square Metre Array (OSMA). This is a scale model with 144 receiving elements with a mixed RF/Digital beamforming architecture. One of the main issues in getting a high-performance phased-array system with accurate beam control and low side-lobes is an accurate and fast on-line calibration facility. The proposed 'Multi-Element Phase-toggle' (MEP) method is an extension of the phase-toggle method used in [2] and allows groups of elements to be calibrated simultaneously by using FFT signal processing techniques. Measured results from the OSMA system performance and of the remaining errors after MEP calibration will be presented.

Derived from text

Fast Fourier Transformations; Antenna Arrays; Calibrating; Phased Arrays; On-Line Systems

20050109970 Manitoba Univ., Winnipeg, Manitoba, Canada

Study of Micromachined Microstrip Lines Using FDTD

Lu, Yuyuan; Shafai, L.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1066-1069; In English; See also 20050109927; Copyright; Avail: Other Sources

In recent years, micromachined/grooved microstrip microwave components have attracted much attention due to their lower loss than their counterparts with normal substrates. However, most of the previous work has focused on experiment measurement. A few modellings have also been carried out [1-2]. In this paper, FDTD is used to extend the studies to the loss and field calculation in grooved microstrip lines. Good results are obtained and will be discussed in this paper.

Derived from text

Finite Difference Time Domain Method; Microstrip Transmission Lines; Finite Difference Theory; Micromachining

20050109971 Idaho Univ., Moscow, ID, USA

Three Dimensional Optical Fiber Simulation

Sullivan, Dennis M.; Liu, Jun; Kuzyk, Mark; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1082-1085; In English; See also 20050109927

Contract(s)/Grant(s): DAAH04-96-1-0406; Copyright; Avail: Other Sources

The optical fiber has made possible the transmission of enormous amounts of information at ever increasing speeds. The limit of the speed is not the transmission bandwidth of the fiber optic cable, but the multiplexing electronics used to send, receive, or reroute information. An all optical switching component offers the possibility of input and output at rates which can use the full potential bandwidth of the fiber optic cable 1,2. It is expected that computer simulation can contribute significantly to the development of nonlinear switching mechanisms primarily for two reasons: 1. There is a greater need for explicit understanding of the nonlinear electromagnetic phenomena, particularly the phase information. 2. Extremely complex physical models can be simulated and easily altered. This is an enormous advantage over fabricating experimental models. One such simulation method is the finite-difference time-domain (FDTD) method 3. This is an explicit method to calculate the electromagnetic propagation of light energy by implementing the time domain Maxwell's equations. It has been shown to be capable of simulating nonlinear electromagnetic phenomena. Such simulations have been carried out by several research groups, but three dimensional simulation is problematic because of the computer resources required. In this paper we show that a full three dimensional simulation over many wavelengths is possible without using extraordinary computer resources.

Derived from text

Optical Fibers; Three Dimensional Models; Finite Difference Time Domain Method; Maxwell Equation; Computerized Simulation; Data Transmission; Fiber Optics

20050109972 Ohio State Univ., OH, USA

Low-cost Adaptive Arrays for Analysis of Wireless Systems

Ellingson, S. W.; Kim, H. J.; Ayotte, K. S.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1100-1103; In English; See also 20050109927; Copyright; Avail: Other Sources

This paper describes a low-cost adaptive array system suitable for both vector channel measurements and field evaluation of array signal processing techniques. This system processes signals from four antennas with a bandwidth of 2 MHz. Low cost is achieved by sending digitized receiver output directly to the internal memory of a personal computer, as opposed to traditional architectures which use a dedicated high speed bus or interconnected DSPs. The current system acquires up to 7 seconds of data in this manner before stopping to process the data. Additional cost savings are achieved using an undersampling A/D downconversion scheme, a two stage modular downconversion which allows system operation in both VHF mad L-band, and a simple passive array calibration scheme. A demonstration of the system direction-of-arrival estimation at 220 MHz is presented. Ongoing work in developing an improved system is also presented.
Author
Antenna Arrays; Signal Processing; Calibrating; Data Processing; High Speed; Ultrahigh Frequencies; Very High Frequencies

20050109981 Communications Research Lab., Tokyo, Japan
3-D Spectral Domain Green's Function for Arbitrarily Multilayered Dielectric Structure
Li, Keren; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1266-1269; In English; See also 20050109927; Copyright; Avail: Other Sources

In this paper, we present a full-wave analytical 3-D Green's function in spectral domain for arbitrarily multilayered dielectric media. The Green's functions are two scalar potentials created by a horizontal element dipole, corresponding two electromagnetic modes, transverse magnetic and transverse electric modes to the normal direction of the layer plane. The analytical formulas in spectral domain have simple form and hold for arbitrary number of the dielectric layers.
Author
Dielectrics; Green's Functions; Three Dimensional Models

20050109982 China Scientific and Technical Univ., Hofei, China
Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section
Zeng, X. Y.; Xu, S. J.; Yoneyama, T.; Luk, K. M.; Wu, Ke; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1282-1285; In English; See also 20050109927; Copyright; Avail: Other Sources

NRD guide has been used in antenna applications at millimeter wavelength since it was proposed by Yoneyama and Nishida in 1981. As we know, waveguide losses increase significantly and usual antenna structures become more difficult to fabricate in view of reduced size as frequency increases. Leaky NRD waveguide shows great promise to overcome these problems. NRD guide leaky wave antenna is also attractive because of its easy fabrication at millimeter-wave band by simply introducing asymmetry in the cross section of the guide. Several forms of leaky NRD waveguide structures have been suggested for millimeter-wave applications. Oliner etc. have analyzed the leakage properties of the NRD guide with rectangular profile. Here the leakage characteristics of the NRD guide with arbitrary profile of cross-sections are systematically studied.
Derived from text
Fabrication; Leakage; Cross Sections; Waveguide Antennas

20050109983 Illinois Univ., Urbana, IL, USA
Cylindrical 3D PML-PLRC-FDTD Schemes for Frequency-dispersive and Inhomogeneous Media
Teixejra, F. L.; Chew, W. C.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1304-1307; In English; See also 20050109927
Contract(s)/Grant(s): F49620-96-1-0025; N00014-95-1-0872; NSF ECS-93-02145; Copyright; Avail: Other Sources

We present three-dimensional (3D) finite-difference time-domain (FDTD) schemes for transient simulation of electromagnetic wave propagation in complex (inhomogeneous and frequency-dispersive media with conductive loss) media and cylindrical coordinates. The proposed cylindrical FDTD scheme incorporates an extension of the perfectly matched layer (PML) absorbing boundary condition (ABC) to 3D cylindrical coordinates coupled to the piecewise-linear recursive convolution (PLRC) algorithm for dispersive media, accounting for both Lorentz and Debye multi-species frequency-dispersive models. Both split-field and unsplit (anisotropic medium) formulations of the cylindrical PML-PLRC-FDTD scheme are implemented and compared.
Derived from text
Finite Difference Time Domain Method; Electromagnetic Wave Transmission; Finite Difference Theory; Anisotropic Media; Cylindrical Bodies

20050109996 Georgia Inst. of Tech., Spartanburg, SC, USA

History and Evolution of Fresnel Zone Plate Antennas For Microwaves and Millimeter Waves

Wiltse, James C.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 722-725; In English; See also 20050109927; Copyright; Avail: Other Sources

This paper summarizes some of the growth in technology for Fresnel zone plate antennas in the microwave and millimeter-wave regions. A brief description is given of the earliest developments of Fresnel zone plates at optical frequencies. Most of the material concerns recent results obtained for microwaves and millimeter-waves.

Author

Millimeter Waves; Microwaves; Superhigh Frequencies; Light (Visible Radiation); Wave Diffraction

20050109997 Electromagnetic Sciences, Inc., Norcross, GA, USA

Metallic Zone Plates for Sectoral Horns

Black, Donald; Nguyen, Christine; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 730-733; In English; See also 20050109927; Copyright; Avail: Other Sources

Fresnel zone pla_es are planar devices with lens-like focusing properties. The planar structure makes a zone plate easy to construct and provides lower absorption loss and weight. This paper reports on the Fresnel zone plates to be constructed from metal. Typically in the past, zone plates have been fabricated from dielectric material. In addition to the advantages mentioned earlier, metallic zone plates can be machined or cast directly into sectoral horns.

Author

Metal Plates; Planar Structures; Dielectrics

20050109998 Southeast Univ., China

Review on the Layered Fresnel Zone Lens Antenna

Zhang, Wen-Xun; Jiang, Guo-Zhong; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 734-737; In English; See also 20050109927; Copyright; Avail: Other Sources

The Fresnel zone plate have long history in optics, but have not yet been popularly applied in microwaves. It is lack of an exact but practical method to analyze those structures with electrically large profile but electrically small sizes in radius. The scalar-flux analysis for a optical FZP with very long focal length and very large aperture (comparing to the wavelength) does not completely suit the microwave FZP, for which the vector-field analysis is necessary due to the shorter focal length and smaller aperture. For a single-layer FZP without (or neglecting) dielectric substrate, several analysis methods had been employed in different references. The physical optics based on Kirchhoff vector-diffraction integral; the UTD/GTD for treating the edge diffraction of the conducting rings; the MoM in spatial domain based on integral equation model; and also spectral domain technique (SDT) based on vector Hankel transform. All of them had been recognized in the accuracy of engineering application; but the full-wave analyses including MoM and SDT provided rigorous theoretical modeling and solving procedure, they are also available for the FZP with substrate. However, the Green's function in stratified media for MoM modeling meets very complicated formulation and tedious manual procedure than that in SDT approach.

Derived from text

Fresnel Lenses; Dielectrics; Lens Antennas; Diffraction; Microwaves

20050109999 Kumamoto Inst. of Tech., Japan

A Design Method of Offset Fresnel Zone Plate Reflector as Receiving Antenna

Onodera, Toshio; Hoashi, Takafumi; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 742-745; In English; See also 20050109927; Copyright; Avail: Other Sources

Fresnel zone plate reflector (FZPR) as receiving antenna consists of Fresnel zone plate lens (FZPL), a reflecting plate (reflector)just behind a quarter wave length from the FZPL and a conical horn for receiver. Usually FZPR uses the non-blocking offset configuration, by which the FZPL is composed from elliptical zones. The FZPR is also called as offset phase reversal zone plate reflector and is the object for studying in the paper. The paper describes a calculation method on characteristics of the FZPR based upon Kirchhoff's diffraction integral formula. By using the method, it shows how to determine an optimum position and diameter of the conical horn and a calculated relation between offset angles and receiving powers. Then the calculation method is verified by building and measuring four FZPRs with 90deg offset angle and different focal length.

Author

Fresnel Lenses; Diffraction; Lens Antennas

20050110000 Technical Univ. of Varna, Varna, Bulgaria

Variety of Cylindrical Fresnel Zone Plate Antennas

Hristov, H. D.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 750-753; In English; See also 20050109927

Contract(s)/Grant(s): BNSFR-TH-701/97; Copyright; Avail: Other Sources

According to their shape the Fresnel zone plates (FZP) may be divided into two main configurations: planar and curved. From a practical point of view the planar in form FZPs and antennas are most popular because they are remarkable for their simplicity, small size and weight. Curved FZPs (spherical, parabolic, cylindrical, conical, etc.) and Fresnel zone plate antennas (FZPAs) have better focusing property compared to planar ones. Also, in many practical cases the curved FZPAs may compete with the ordinary microwave/mm wave antennas if special beam shapes, scanning properties, low price and simple technology are key requirements. In the present paper only cylindrical in shape FZPAs are considered. It seems that the first cylindrical RF/microwave FZPA configurations were proposed in the late thirties by Bruce who patented an oval zone plate with a focal line source rather than a point source. Fresnel zones on a cylindrical surface can be made in shape of circular rims (rim-type FZP) or straight strips (strip-type FZP). These two forms of cylindrical Fresnel zone plates (CFZPs) laid one on top of the other arrange another CFZP, the so-called cross-type CFZP. Recently, Ji and Fujita developed a cylindrical Fresnel zone plate antenna (CFZPA) with an omni directional radiation pattern. By virtue this is a very low efficiency half-open (or Soret-type) zone plate antenna with a zone lens consisting of alternate open and opaque half-period zones. It was studied at 9 GHz and was meant for a wireless base station of indoor LAN system.

Derived from text

Fresnel Region; Microwave Antennas; Antenna Radiation Patterns; Cylindrical Antennas

20050110001 National Inst. of Standards and Technology, Boulder, CO, USA

The Co-conical Field Generation System - A 40 GHz Antenna Calibration Cell

Novotny, David R.; Ondrejka, Arthur; Johnk, Robert; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 772-775; In English; See also 20050109927; Copyright; Avail: Other Sources

A prototype test cell for generating standard fields suitable for antenna calibrations from DC to 40 GHz has been developed and tested. A 1 meter scale model of the Co-Conical Field Generation System (CFGS), an expanding, constant impedance coaxial transmission system has been constructed. By maintaining symmetry throughout the cell, a uniform and calculable wavefront is established. This symmetry also maintains the dominant TEM mode structure and more importantly, allows for the gradual and efficient termination of the incident energy. Simple termination schemes have generally provided better than 20 dB absorption of the injected energy with complex designs showing much more promise. The field structure within the test volume has been mapped by measuring the reflections by a small passive scatterer. The measurement results agree well with transmission line theory and show no significant signs of mode degradation as energy propagates down the cell. Various numerical techniques agree well with the measurement results and transmission line equations, allowing for further study of scattering effects within the cell.

Derived from text

Microwave Antennas; Degradation; Transmission Lines; Scale Models; Coaxial Cables

20050110003 Lafayette Coll., Easton, PA, USA

Beamspace STAP for Circular Arrays

Jouny, I.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 784-787; In English; See also 20050109927; Copyright; Avail: Other Sources

Beamspace space-time adaptive processing for oversampled circular antenna arrays using refocusing and/or interpolating beamspace transformation is examined in this study. Three beamspace transformations that rely on array interpolation, phase adjustment, and Toeplitz induced mapping are compared in the context of pulse to pulse space-time adaptive processing. The paper presents recommendations regarding the applications of these algorithms in STAP and presents a comparison in terms of performance, computer processing time, and robustness.

Author

Space-Time Adaptive Processing; Antenna Arrays; Algorithms; Dipole Antennas

20050110004 Michigan Univ., Ann Arbor, MI, USA

Modeling Surface Currents on Electrically Large Impedance Cylinders - 2D, TM Case

Cascoato, Mark D.; Sarabandi, Kamal; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 780-783; In English; See also 20050109927

Contract(s)/Grant(s): DAAH04-96-1-0377; Copyright; Avail: Other Sources

Scattering and diffraction from terrain obstacles have a major effect on radio wave propagation in a natural environment. Mountains, ridge lines and hills can exhibit the properties of a long, slowly curving feature essentially infinite in one dimension. The local radius of curvature, tau(sub c), of these obstacles is large compared to wavelength (tau(sub c) much greater than lambda/100) and therefore diffraction from convex surfaces as opposed to wedge diffraction is the more applicable approach. No GTD field solutions for diffraction from convex surfaces are valid in all regions around the object. The calculation of surface currents will generate the exact fields in all regions through the radiation integrals. If the exact surface current is formulated in terms of a physical optics (PO) term and correction or diffraction term, where J(subex) = J(sub po) + J(sub D), the diffraction current J(sub D) is highly localized to the shadow boundary for surfaces with large, slowing varying, radius of curvature. J(sub D) for a circular from section is therefore applicable to any convex surface where the local radius of curvature is known. Surface diffraction currents can be generated by applying Fock theory however the formulations are mathematically complex, and in the lit region near the shadow boundary numerical integration must be performed. In a recent study a heuristic approach was used to develop a macromodel which simply and accurately predicts the asymptotic behavior of the Fock currents for a PEC circular cylinder illuminated by a plane wave at oblique incidence. In this paper a method is developed to extend this method for the TM case, normal incidence, to that of an impedance cylinder which more accurately represents a natural terrain feature. In the analysis developed in the next section a first order surface impedance boundary condition (SIBC) is used to relate the surface magnetic current to the surface electric current on an impedance cylinder. If the surface electric current is known therefore, all currents are known. To generate the surface electric currents for the TM case the exact formulation (eigenexpansion) for the surface currents on an impedance cylinder is expanded in a Taylor series in terms of the normalized surface impedance. The first term in the expansion represents the PEC case with higher order terms adjusting for the impedance case. The higher order expressions can be separated in terms of normalized impedance, which is external to the summation of the eigenexpansion, and terms which are a function of cylinder radius. By observation of the Fock currents for an impedance surface tile asymptotic behavior of the Taylor series terms as a function of cylinder radius can be predicted. Evaluation of the Taylor series show convergence for any cylinder radius.
Author
Boundary Conditions; Circular Cylinders; Numerical Integration; Surface Properties; Electric Current

20050110005 Saratov Univ., USSR
Parameters of Microstrip Patch Antenna under the Consideration Using the Piece-wise Basis Functions
Davidovich, M. V.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 796-799; In English; See also 20050109927; Copyright; Avail: Other Sources

Surface integral equation (SIE) method is widely used for solution of boundary problems in electromagnetics. The impedance and admittance SIA can be received by use of spectral domain approach and by mode-matching technique for fields at the boundaries of the partial areas. The fields in this method are expressed using the Treftz's basis for Maxwells equations. The SIE have been applied for regular planar transmission line structures and rectangular resonators (rectangular patch antennas). There is the problem for applications of the two-dimensional SIE for structures with complicated forms as its kernels have the non-integrable singularity.The most attractive cases for application are when Microstrip Vibrator Antenna (MVA) or Microstrip Patch Antenna (MPA) have a complicated surface. The goal of this paper is the calculation of MPA parameters introducing the new technique which reducing the singularity of the SIE. This technique is based upon three points. The first is the representation of surface current over some new surface potentials. The second is the application of the vector integral theorems for transfer the differential operators from kernels to introduced potentials. And the third is s the application of the inverse operator-function. It allows one to reduce the kernel singularity from nonintegrable to the more weak ones. As a result, one can get the two-dimensional Cauchy-singular, logarithmic singular, or regular kernels. This approach also allows to improve the convergence of matrix elements and to apply the piece-constant basic functions for field representation.
Author
Boundary Value Problems; Integral Equations; Electromagnetism; Maxwell Equation; Microstrip Antennas; Patch Antennas

20050110006 Padua Univ., Italy
A New Method to Compute the Fundamental Mode Resonant Frequencies of Microstrip Annular Rings
Panariello, G.; Schettino, F.; Verolino, L.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 818-821; In English; See also 20050109927; Copyright; Avail: Other Sources

The practical advantages of microstrip structures have been discussed in several papers and are too well known to need repeating here. Aim of this paper is the evaluation of the resonant frequencies of the fundamental mode of a microstrip annular ring resonator whose geometry is shown in Figure 1. Many authors analysed this problem adopting non uniformly convergent expansions, not adequate to reconstruct the right edge behaviour. Our aim is to expand the unknown current densities by means

of basis functions factorising the edge behaviour in order to accelerate the convergence of the series, as already done in a static case.
Author
Resonant Frequencies; Convergence; Current Density

20050110013 Hokkaido Univ., Sapporo, Japan
A Resonant Type Leaky-Wave Antenna Using an Image NRD Guide
Yamamoto, Manabu; Itoh, Kiyohiko; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 800-803; In English; See also 20050109927
Contract(s)/Grant(s): MOE-07405019; Copyright; Avail: Other Sources

High performance antennas are required in microwave/millimeterwave systems such as satellite communications, indoor wireless LAN's and automobile collision-avoidance radar system. Leaky-wave antennas are expected to be useful for these applications, and have been studied in many literatures. However, their practical use is still limited. One of the reasons of this may be that the main beam direction of these antennas cannot be broadside because of a traveling-wave line source distribution. The purpose of this paper is to propose a new leaky-wave antenna constructed from an image non-radiating dielectric waveguide. A half-sinusoidal source distribution, which is very long in comparison with the free-space wavelength, is realized by using a resonant phenomenon of a leaky mode near its cutoff frequency. Thus the broadside radiation with low side lobe level and high directivity can be obtained. Experimental results measured at Ku band will be presented to demonstrate the effective performance of the proposed antenna.
Author
Microwave Equipment; Waveguide Antennas; Satellite Communication; Dielectric Waveguides; Superhigh Frequencies

20050110014 Illinois Univ., Urbana-Champaign, IL, USA
Moment Method Based Analysis of Dielectric-resonator Antennas
Liu, Zhijun; Chew, Weng Cho; Michielssen, Eric; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 806-809; In English; See also 20050109927; Copyright; Avail: Other Sources

In many applications dielectric resonator antennas (DRAs) provide an interesting alternative to more traditional metallic antennas. When compared to the latter, DRAs are small and low cost, and they exhibit smaller losses, especially in the millimeter wave band within which the conductor loss of a metallic antenna becomes severe. Aperture coupling provides isolation between the feed circuit and the radiating structure. The antenna can be designed to have wide bandwidth, high gain, and circular polarization by choosing a suitable material for the dielectric resonator (DR) and by optimizing its geometry. DR.As have been studied previously, albeit mostly experimentally. Some papers analyzed DRAs using the FDTD method, which especially requires more computational resources than the method of moments (MoM). To date, only hemispherical and cylindrical DRAs have been analyzed using the MoM; the modes of such structures can be expressed approximately in closed form. Reference has successfully analyzed DRs coupled to microstrip circuits using a 3-D FEM/BEM-hybrid approach. This method can also be used to analyze DRAs. This paper analyzes DRAs based on electric and magnetic field integral equations. The integral equations are solved in the spatial domain using the MoM. Thus the physics of radiation, surface waves, and mutual coupling are all rigorously included into the model. The unknown currents on the surface of the resonator, the aperture, and the feed line are all expanded in RWG bases. Therefore, the dielectric resonator and the aperture may be of arbitrary shape.
Author
Dielectrics; Method of Moments; Millimeter Waves; Surface Waves; Resonators; Boundary Element Method; Electric Fields; High Gain

20050110015 Houston Univ., TX, USA
Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas
Khayat, Michael A.; Williams, Jeffery T.; Jackson, David R.; Long, Stuart A.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 814-817; In English; See also 20050109927; Copyright; Avail: Other Sources

Recently, a new microstrip patch, the Shorted Annular Ring-Reduced Surface Wave (SAR-RSW) antenna, has been developed. This microstrip antenna, shown in Figure 1, produces only a small amount of surface-wave excitation. In addition, if printed on an electrically thin substrate, this antenna only weakly excites lateral waves (the space-wave fields that propagate along the air-dielectric interface). In this presentation we will summarize our study of the mutual coupling between SAR-RSW antennas. The mutual coupling between conventional circular patches will be used as a comparative reference, since these

results are representative of the coupling between typical microstrip antennas. The same analysis is used for both antennas, since the SAR-RSW antenna becomes a conventional circular patch in the limiting case when the inner radius goes to Zero. We will present numerical results from a theoretical analysis of the mutual coupling, along with experimental results. The mutual coupling behavior will then be explained using an asymptotic analysis, which demonstrates how the mutual coupling varies with patch separation. Finally, a theoretical investigation of both lateral- and surface-wave contributions to the coupling will be performed to investigate the importance of these two contributions to the mutual coupling.
Author
Microstrip Antennas; Surface Waves; Wave Excitation; Asymptotic Series; Dielectrics

20050110016 Mississippi Univ., University, MS, USA
Asymptotic Boundary Conditions for Strip-loaded Surfaces of Cylindrical Structures with Arbitrarily Shaped Cross-section
Kishk, Ahmed A.; Kildal, Per-Simon; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 834-837; In English; See also 20050109927
Contract(s)/Grant(s): NSF-ECS-98-09862; Copyright; Avail: Other Sources

Recently, an asymptotic strip boundary condition (ASBC) was reported to analyze planar or circular cylindrical dielectric structures loaded with periodic strips. Some of these strip-loaded surfaces have been classified as artificially soft or hard surfaces. The accurate analysis of such surfaces must be done by using Floquet mode expansions of the fields, which is very difficult and laborious and also is limited to certain conical geometries and uniform periods of the strips. The ASBC does not suffer from such limitation and disadvantage, and is asymptotically correct when the period of the strips approaches zero. The ASBC applies to the components of the E- and H-fields that are tangential to the surface of the grid. Each one of these two tangential field components is divided into two sub components, one parallel with the strips and one orthogonal to the strips. Then, the ASBC states that the tangential parallel E-field component is zero over the whole grid, the tangential orthogonal E-field component (Eo)iS continuous across the grid, the tangential parallel H-field component is continuous across the grid, and the tangential orthogonal H-field component is discontinuous across the grid by the value of the electric current flowing along the conducting strips. So far, the ASBC is applied to conical structures. Here, we show how we have implemented the ASBC in a moment method code for analysis of cylindrical structures with arbitrarily shaped cross-sections.
Author
Boundary Conditions; Method of Moments; Electric Current; Floquet Theorem; Dielectrics

20050110018 Georgian Polytechnic Inst., Tbilisi, Georgia
The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas
Shubitidze, P.; Zaridze, R.; Economou, D. P.; Kaklamani, D. I.; Uzunoglu, N. K.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 870-873; In English; See also 20050109927; Copyright; Avail: Other Sources

An efficient numerical method is developed in analyzing antenna elements of a cylindrically shaped conformal array system based on microstrip antennas, by taking into account curved surfaces and various substrate materials. In order to optimize the design parameters of such an antenna to achieve the desired directivity and input impedance, a three-dimensional electromagnetic code based on the Method of Auxiliary Sources is developed. The validity of the method is checked and numerical results are presented. Both near field and far field calculations are made and presented in the paper.
Author
Cylindrical Antennas; Antenna Design; Dielectrics; Numerical Analysis; Auxiliary Power Sources

20050110020 Royal Melbourne Inst. of Tech., Australia
Design of Large Broadband Patch Arrays
Ghorbani, K.; Waterhouse, R. B.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 928-931; In English; See also 20050109927; Copyright; Avail: Other Sources

There are several applications that require broadband and low profile scanning arrays, able to cover a large scan volume. One such application is radio astronomy, where it is necessary to have large sky coverage over a wide range of microwave frequencies. For this application, a scannable, pencil beam radiation pattern is required by the antenna to reduce potential interference sources, such as manmade satellites. Microstrip patch antennas are a candidate being considered for these applications due to their low profile and relatively low production costs, however in their conventional form these antennas have typically narrow impedance bandwidths and also have limited scanning potential in large arrays due to the excitation of

surface waves. These trapped waves cause potential scan blindnesses, limiting the coverage area of the scannable array. In this paper we thoroughly investigate the impedance behaviour and scanning potential of microstrip patch antenna arrays consisting of the broadband elements presented. In particular, a design strategy is developed for these broadband printed antenna arrays. Arrays of probe-fed stacked microstrip patches utilizing high-low dielectric constant material combinations are also investigated. All the arrays presented are analyzed using full-wave spectral domain infinite array analyses.
Derived from text
Antenna Arrays; Patch Antennas; Antenna Radiation Patterns; Bandwidth; Broadband; Impedance; Microstrip Antennas; Microwave Frequencies

20050110022 Florida Inst. of Tech., Melbourne, FL, USA
Broad Band Patch Antennas Using a Wedge-shaped Air Dielectric Substrate
Jo, Young-Min; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 932-935; In English; See also 20050109927; Copyright; Avail: Other Sources

In this paper, a wedge-shaped air dielectric patch antenna is analyzed using H-P HFSS to determine the impedance and radiation characteristics. The model data are compared with experimental data measured in our laboratory. This antenna provides improved performance that is desirable in a personal communication (cellular and PCS) handsets. The use of the antenna in the handset can reduce the electromagnetic field levels from the antenna to the head since the beam pattern of the antenna is directed away from the head of users when this dielectric shape is used. Another advantage of the antenna is increased bandwidth. The bandwidth is significantly improved compared to normal dielectric microstrip patch antennas.
Author
Microstrip Antennas; Patch Antennas; Broadband; Bandwidth; Dielectrics; Impedance; Radiation Distribution

20050110029 Aerospace Corp., USA
A Low Loss, Dual Polarized Switch for Polarization State Selection
Dybdal, R. B.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 954-957; In English; See also 20050109927
Contract(s)/Grant(s): F04701-93-C-0094; Copyright; Avail: Other Sources

The continuing development of satellite communication systems presents opportunities for user antennas capable of operating with several different systems. From a user perspective, an antenna that can operate sequentially with several systems is more desirable than having to use separate, dedicated antennas for each satellite system. This 'multi-media antenna' approach (Ref. 1) can also reduce user costs. While a variety of antenna designs exist for multiple frequency operation, an additional challenge exists for systems that use polarization reuse to extend the system capacity. The orthogonal polarization states in polarization reuse systems have stringent purity requirements to avoid cochannel interference; a typical requirement is to maintain a -27 dB isolation between polarization states. However, since some satellite programs use linear polarization while others use circular polarization, antennas for multiple program applications must be able to select either linear or circular polarization states as appropriate to the satellite system being used at the moment, while maintaining the required polarization isolation for each state.
Derived from text
Linear Polarization; Cochannel Interference; Antenna Design; Switches; Satellite Communication; Circular Polarization

20050110033 Ecole Nationale Superieure d'Electrotechnique, d'Electronique, d'Informatique, d'Hydraulique de Toulouse, Toulouse, France
Interconnect and Packaging Electrical Circuits Network
NGongo, R. S.; Aubert, H.; Baudrand, H.; Martins, G.; LaLaurie, J.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 974-977; In English; See also 20050109927; Copyright; Avail: Other Sources

Emphasis with multimodal variational approach in the resonant transverse theory, and a rigorous electric circuits are proposed for modeling the connection in the planar transmission lines taking into account the shielding effects. The proposed electrical circuits have been implanted in the available CAD circuit with success and allows an accurate prediction to the planar discontinuities behavior.
Author
Circuits; Discontinuity; Packaging; Shielding; Transmission Lines

20050110034 Centre National de la Recherche Scientifique, Gif-sur-Yvette, France

Reduction of the Model Noise in Non-linear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner

Geffrin, J. M.; Mallorqui, J. J.; Joachimowicz, N.; Redondo, R.; Vall-Ilossera, M.; Franza, O.; Joisel, A.; Bolomey, J. Ch.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 996-999; In English; See also 20050109927

Contract(s)/Grant(s): HF1997-2013; Copyright; Avail: Other Sources

For a decade, microwave tomography has been drastically boosted by the development of efficient reconstruction algorithms based on an iterative solution of the corresponding non-linear inverse problem. Distorted Born Method and Newton Kantorovich Techniques are two equivalent approaches where the measured scattered field is iteratively compared to the scattered field calculated from a numerical model, the dielectric contrast of which is adjusted for minimizing the error on the scattered fields. In such approaches, the so-called model noise refers to the disability of the numerical model to reproduce the experimental setup. The model noise has an evident and direct impact on the quality of the reconstructed images. More particularly, the accuracy of the electric field radiated by the antennas of a microwave scanner, inside the target area, has been shown to play a significant role on the overall image quality. Taking into account the antenna environment, like the boundary wall supporting the antenna array of the scanner, is of prime importance, especially when operating at low frequency. For instance, the wall of a 60 cm diameter whole-body microwave scanner cannot be neglected at 434 MHz, even when using the immersion technique consisting to put the target in water. Indeed, at such a frequency, the attenuation introduced by water is not sufficient to avoid multiple reflections on the scanner boundary walls. Consequently, the way of calculating the incident field constitutes a key factor in iteratively solving non-linear inverse problems.

Derived from text

Mathematical Models; Iterative Solution; Electric Fields; Antenna Arrays; Microwaves; Dielectrics

20050110035 Yamagata Univ., Japan

Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation

Yamamoto, Tetsuya; Ono, Mitsuhiro; Ando, Makoto; Goto, Naohisa; Ishii, Nobuo; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 986-989; In English; See also 20050109927; Copyright; Avail: Other Sources

Near field distributions in the radial line slot antennas (RLSA) for surface wave coupled plasma (SWP) are examined. RLSAs are suitable for uniform, high density and large-area plasma generation. In order to realize higher productivity, quick evacuation of reaction gas by making narrow gap process space is highly required. Since wafer is placed closely to the antenna aperture in this case, the evaluation of electromagnetic near-fields in RLSAs for plasma process is effective and indispensable. The plasma distribution control by changing the slot pattern is also possible based upon the information of near field distributions Novel slot pattern, which has many transverse slots, is fabricated and tested. The exponential attenuation of the fields in boresight direction is measured and the interesting and remarkable characteristics of novel RLSAs for SWP process are confirmed.

Author

Slot Antennas; Near Fields; Distribution Functions; Electromagnetic Fields; Plasma Generators; Surface Waves; Wave Generation

20050110036 Charite Campus Virchow-Klinikum, Berlin, Germany

Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator

Wlodarczyk, W.; Nadobny, J.; Wust, P.; Monich, G.; Deuflhard, P.; Felix, R.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1004-1007; In English; See also 20050109927; Copyright; Avail: Other Sources

The conventional therapy of deep-seated pelvic tumors can be considerably improved by additive use of the rf regional hyperthermia (HT). Such HT applicators are working between 70 and 100 MHz as phased arrays of axially aligned water-loaded dipoles of approx. 45 cm length which are equidistantly placed on the circumference of the patient. The deposited power can be moderately focused in the tumor exploiting the constructive interference of longitudinally polarized E-field as well as its transversal steering by phase control of four channels. Unfortunately, the bone/tissue boundaries cause high E-field elevations resulting in hot spots which can degrade the treatment. Numerical studies have shown that these hot spots can be resolved when the 3D instead of the 2D phase steering is applied. However, segmenting axially the applicator and preserving the previous values of the operation frequency and the entire length of the applicator cylinder results in shortened dipoles of reduced efficiency (mismatching, normal E-field components). The purpose of this contribution is to develop high performance

short antenna structures which can be used as basic array elements of the 3D phased array for HT applications in pelvis. As basic radiation elements short coaxial choke antennas which are immersed in water-boxes attached to the water-bolus are used. Desired input impedance can be obtained and stabilized against load variations by their mirror images induced by water/air interfaces in radial and polar directions. An additional bending of the dipole ends away from the load reduces the normal E-field components at patients's skin. End cross rods introduce top capacity which further lengthen electrically the antenna. In addition, this structure offers an attractive solution for current balancing.
Author
Antenna Arrays; Cylindrical Bodies; Phased Arrays; Impedance; Phase Control

20050110037 National Sun Yat-Sen Univ., Kaohsiung, China
Designs of Broadband Microstrip Antennas with Embedded Slots
Sze, Jia-Yi; Wong, Kin-Lu; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 936-939; In English; See also 20050109927; Copyright; Avail: Other Sources

By embedding a pair of properly-bent slots close to the nonradiating edges of a rectangular microstrip patch, two resonant modes [TM(sub 10) and TM(sub delta0)(1 \h delta \h 2)] with the same polarization planes and similar radiation characteristics can be excited with good impedance matching for single-feed dual-frequency operation. Since such a design is with a low frequency ratio between the two operating frequencies, it is expected that broadband operation can also be obtained, if suitable slots other than that used in [1] are embedded in the patch. In this article, we present two different designs of the embedded slots that make possible a wide operating bandwidth of a rectangular microstrip antenna. Antenna designs and typical experimental results of the obtained broadband performances are described and discussed.
Author
Antenna Design; Broadband; Bandwidth; Impedance Matching; Microstrip Antennas; Slots

20050110038 Spectrum Sciences Inst., Nepean, Ontario, Canada
Advancement of Methodology for RF Dosimetry
Wojcik, Jacek J.; Cardinal, Paul G.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1008-1011; In English; See also 20050109927; Copyright; Avail: Other Sources

The issue of RF safety has recently come to the forefront of both public and regulatory attention. In 1996, the US FCC released its Report and Order 96-326, which specified the acceptable limits for wireless devices and systems, and tightened the requirements for certification and licensing purposes. In 1998, Industry Canada initiated development of certification methodology for compliance with non-ionizing radiation Specific Absorption Rate (SAR) limits established by Health Canada in its Safety Code 6. The SAR measuring system and its critical components are discussed in this paper.
Author
Radio Frequencies; Dosimeters; Certification; Ionizing Radiation; Radiation Absorption

20050110039 Skopje Univ., Yugoslavia
Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications
Kacarska, M.; Ololoska-Gagoska, L.; Loskovska, S.; Grcev, L.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1012-1015; In English; See also 20050109927; Copyright; Avail: Other Sources

Wireless communications, specifically cellular communications, is currently the fastest growing segment of the telecommunications industry. Therefore, anyone designing cellular transceivers must consider the power drain that occurs between user and antenna and be sensitive to the growing concern over potentially harmful effects upon tissue exposed to the steady transfer of electromagnetic energy. Because of electromagnetic interaction, a certain amount of energy radiated by handset devices is absorbed by the user's body tissue. How much power transfers between the two depends on a range of variables, such us primarily the location of the antenna on the handset, and the distance between the user and the antenna. Although many numerical studies concerning electromagnetic interaction based either on solving an integral equation using finite-difference time-domain or finite element methods exist, only few studies calculating heterogeneous realistic models of a human body can be found. High specific absorption rates (SAR) and concomitant 'hot spots' may result due to the applied radio frequency (RF) fields. Since parts of the body, such as the brain in the head, are very sensitive to a change of the local temperature, the problems of induced current densities and energy deposition should therefore be treated in detail. A number of mathematical models have been used to estimate potential and current distributions, as well as the impedance of the different parts of the head. In this paper the current density distributions and specific absorption rate are calculated and visualized. To find out the position of high energy deposition as well as their values, we performed finite element simulation for a

heterogeneous model of the human head exposed to a linearly polarized RF magnetic field at 900 MHz. The ease of modeling is established through the variable shape of the elements, which do not have to be the same throughout. Obtained results from this calculation are valid for the exposure of a human head to continuous wave RF electromagnetic energy.
Derived from text
Current Distribution; Wireless Communication; Finite Element Method; Radio Frequencies; Current Density; Density Distribution

20050110042 Michigan Univ., Ann Arbor, MI, USA
Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods
Li, Zhifang; Volakis, John L.; Papalambros, panos Y.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1026-1029; In English; See also 20050109927; Copyright; Avail: Other Sources

The nonreciprocal properties of ferrites have been used to control printed circuits and antennas. The material properties of ferrites are mainly controlled by the direction and strength of an externally applied magnetic field, thus enabling control of various antenna radiation and scattering characteristics. These unique properties of ferrite materials provide many desirable features such as tunability, polarization diversity, beam steering, and radar cross section (RCS) control. On the other hand, because of the additional variables such as bias field, bias direction and saturation magnetization, use of optimization method is suitable for ferrite antennas to obtain desired performance. In this paper, we will study the effect of biased ferrite substrate on resonant frequency tuning [1] and beam steering [2] of patch antennas. The tools used will be the gradient-based optimization methods in conjunction with finite element - boundary integral (FE-BI) methods. The use of design optimization methods will greatly facilitate the selection of 'best' antennas. Compared with traditional antenna designs, optimization processes not only decrease simulation time, but also save on huge hardware manufacturing costs with the removal of expensive trial and error processes.
Derived from text
Design Optimization; Patch Antennas; Ferrites; Finite Element Method; Resonant Frequencies; Substrates; Antenna Design

20050110043 University of Central Florida, Orlando, FL, USA
Normalization of NEXRAD Antenna Gain for Overlapping Radars
Boustany, Sami; Jones, W. Linwood; Kasparis, Takis; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999]; In English; See also 20050109927; Copyright; Avail: Other Sources

The NOAA National Weather Service operates a network of NEXRAD Doppler meteorological radars to measure severe weather, and precipitation is inferred from the volume scattering from hydrometeors. The NEXRAD, WSR-88D radar, is a calibrated system that measures absolute volume reflectivity (dBZ). A geophysical algorithm is used to relate rainfall intensity to the measured dBZ. The NEXRAD system comprises overlapping radars to provide nearly complete coverage over the continental US. After installation and certification, absolute radar calibration for the NEXRAD is maintained by a loop-back calibration that samples the transmitter through a known attenuation into the receiver and processor; however there is no provision to recalibrate the antenna gain and radome losses. Without an external calibration, any NEXRAD may have biases that can cause significant errors in the precipitation products.
Derived from text
Antenna Gain; Meteorological Radar; Doppler Radar; Calibrating; Algorithms

20050110045 Waterloo Univ., Ontario, Canada
Generalized Coincident Arrays for the Direct Measurement of the Principal Solution in Radio Astronomy
MacPhie, Robert H.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1044-1047; In English; See also 20050109927; Copyright; Avail: Other Sources

Linear receiving arrays of equispaced elements followed by square-law detection, when used to map the brightness distribution of radio sources, act as low-pass spatial frequency filters with bandwidths proportional to the size of the arrays. Moreover, within the passband, the arrays' spatial frequency distribution (sfd) is non-uniform. This results in a brightness distribution map of the radio sources which has spatial frequency distortion within and no higher frequencies outside the finite passband of the conventional linear array. However, the radio sources' sfd within the passband can be restored to its true value, as first proposed by Bracewell and Roberts. They called this the principal solution. If, we consider an M + 1 element array, each of whose element outputs is split into two parts and the two linear combinations are multiplied and time-averaged (two coincident multiplicative arrays), it was shown by Utukuri and MacPhie that the sfd of the array can be made uniform within its passband. This permits the direct measurement of the principal solution. In this paper the original principal solution

multiplicative array is first generalized to the case of an array of N + 1 sub arrays each of which has M + 1 isotropic elements. Again, the element outputs are split and combined to form the outputs of two coincident arrays. Moreover, the uniform sfd necessary to directly measure the principal solution is achieved but with a fewer total number of elements. For large arrays approximately half as many elements are required.
Derived from text
Linear Arrays; Brightness Distribution; Frequency Distribution; Low Frequencies; Spatial Distribution; Bandwidth

20050110047 Communications Satellite Corp., Clarksburg, MD, USA
Radio Star Flux Density Expressions for Accurate Antenna Gain Measurements
Ekelman, E. P.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1048-1051; In English; See also 20050109927; Copyright; Avail: Other Sources

This paper reports on measurements and analysis to resolve discrepancies in earth station G/T measurements when using radio stars as calibration sources.The radio star flux expressions for Omega, Orion, and Virgo have been investigated to supplement the results previously reported in 1996[1], which considered Cassiopeia,Taurus,end Cygnus. Recognizing the need for accurate sources to measure antenna G/T and gain from locations in the Southern Hemisphere,the data for Omega,Orion and Virgo were collected (with Cassiopeia-used as the reference) and analyzed to determine accurate flux density expressions to determine antenna gain. In addition, an independent method for measuring the antenna gain was used to confirm that the gains found based on matching Cassiopeia results are correct.
Derived from text
Antenna Gain; Flux Density; Radio Stars; Calibrating

20050110048 Arizona State Univ., Tempe, AZ, USA
Full-wave Analysis of HF Antennas on Helicopters Using the FDTD, FEM and NEC
Georgakopoulos, Stavros V.; Polycarpou, Anastasis C.; Balanis, Constantine A.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1058-1061; In English; See also 20050109927; Copyright; Avail: Other Sources

High-frequency (HF) wire antennas are often installed on helicopters to provide communications beyond line-of-side (BLOS) especially for the near-vertical-incidence skywave (NVIS) mode. In this mode, the radiated pattern should exhibit a maximum almost vertically upwards. For frequencies between 2 and 12 MHz, the ionosphere acts as a shield which reflects/refracts and directs incident waves toward the earth thereby allowing communications over hills and forests without the need of a satellite. For a wire antenna to effectively operate within this range of frequencies, the physical length of the antenna must exceed the length of the helicopter, which is practically impossible. Thus, the antenna design should be improved by optimizing not only the shape and length of the antenna but also its location on the helicopter. In addition, the design might incorporate inductive or capacitive loads which play an important role in providing a better impedance match. Another factor, which should always be taken into account at HF frequencies, is the rotation of the helicopter's rotor blades. The electrical length of the rotor blades at HF frequencies is a significant fraction of the wavelength (lambda/2 at 10 MHz); therefore, they adversely affect the radiation patterns for NVIS mode as their orientation constantly changes with respect to the fuselage. This phenomenon is often referred to as rotor modulation. To first analyze and eventually try to achieve an optimum design of an HF antenna on a helicopter in free space is a difficult task. The reason is twofold: first, there are many parameters that could be possibly varied; second, accurate numerical methods which can handle large computational problems must be implemented. In this paper, three different numerical methods are presented to predict input impedance and radiation patterns of scaled HF antennas mounted on a scaled helicopter model. These include the finite-difference time-domain (FDTD) method [1], the finite element method (FEM) [2] and the method of moment (MoM), specifically the NEC4 code [3]. Predictions are sometimes compared with each other and/or with measurements. In addition to a large computational size, another major challenge for all these methods is the highly resonant nature of these antennas, loops or inverted-L's, which makes the overall problem ill-conditioned. The advantages and disadvantages of each method, in relation to the analysis of HF antennas in the presence of geometrically complex structures, are emphasized.
Derived from text
Antenna Radiation Patterns; Finite Difference Time Domain Method; Finite Element Method; Time Domain Analysis; Antenna Design

20050110049 MacQuarie Univ., Sydney, Australia
Modelling Wave Propagation in Diagonal Microstrip Lines Using Enhanced FDTD Equations
Foroughipour, Mahmoudreza; Esselle, Karu P.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1070-1073; In English; See also 20050109927; Copyright; Avail: Other Sources

Wave propagation in microstrip lines not parallel to the FDTD grid is modelled accurately using enhanced FDTD equations for sharp diagonal edges. It is assumed that the metal strip is infinitely thin, and its edges are diagonal to FDTD cell faces. A microstrip line, at 60 from the grid, is analysed using enhanced equations, and the phase constant and the effective dielectric constant are computed over a wide range of frequencies. The same diagonal microstrip line is analysed using standard staircase and split-call models. It is found that only the enhanced-equations technique generate accurate results when the grid is very coarse. For example, the error in the computed effective dielectric constant of a microstrip line at 40 GHz is 0.8%, 6.1% and 12.8%, using enhanced, split-cell and staircase techniques, respectively. The enhanced equations are found to be stable even when the time step is set to the maximum limit.
Author
Finite Difference Time Domain Method; Wave Propagation; Microstrip Transmission Lines; Metal Strips; Finite Difference Theory

20050110050 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques
Liu, Feng; Schuut-Aine, Jose E.; Chen, Ji; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1074-1077; In English; See also 20050109927; Copyright; Avail: Other Sources

As the speed of high performance VLSI circuits increases, the full-wave nature of the interconnections becomes important. Wave aspects such as signal distortion and signal coupling between different interconnects must be considered. One of the consequences of this is that accurate electrical modeling of these structures is necessary to insure accurate simulation in the design stage. This requirement can be fulfilled by a full-wave modeling approach, which includes these effects by solving Maxwell's equations. Among the available full-wave techniques, the finite-difference time-domain (FDTD) method is one of the most attractive methods. The main advantage of the FDTD technique is its ability to model complicated structures. Recently, some work was performed on the extraction of equivalent circuit parameters of multi-conductors by FDTD [I-2]. However, the computational efficiency and memory requirements limited the practicality of these methods. The memory requirements stem from the three-dimensional nature of the FDTD mesh. Only after the impulse has reach stability and the modes have been defined along the direction of propagation can a discrete Fourier transform be used to select the information of interest.
Derived from text
Very Large Scale Integration; Transmission Lines; Finite Difference Time Domain Method; Fourier Transformation; Conductors; Maxwell Equation; Integrated Circuits

20050110051 Tennessee Technological Univ., Cookeville, TN, USA
Time-domain Techniques for Reconstructing Lossy Layered Media from One-sided Scattering
Frolik, J. L.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 828-831; In English; See also 20050109927; Copyright; Avail: Other Sources

The electromagnetic (EM) inverse scattering problem under consideration is to compute the parameter profile (i.e., permittivity, attenuation constant, thickness) of a layered dielectric from scattering data (i.e., reflection response to an impulsive plane wave). It is well known that EM plane wave propagation through a dielectric varying in only one dimension can be modeled as voltage or current propagation through a 1-D transmission line. Furthermore, a media consisting of a stack of homogeneous but parametrically different dielectric layers can be modeled as a discrete transmission line. Here, we model the lossy layered dielectric as an asymmetric discrete lattice filter and employ digital signal processing (DSP) techniques to the reconstruction of the media. Previous work, reviewed, considered lossless media using one-sided responses and lossy media using two-sided scattering response. Often, it is not practical or even possible to measure the two-sided scattering of a media (e.g., soils, forest canopies, walls). This is the problem under consideration in this presentation. We present a discussion and comparison of two algorithms for reconstructing lossy layered media from one-sidedtime-domain plane wave impulse reflection responses. Unique features of these algorithms are that they: 1) 1/ave their origins in DSP theory; 2) are fast algorithms that have been modified to solve both the forward and inverse scattering problem; 3) solve the scattering problems exactly, including accounting for multiple reflections; and 4) solve the lossy media problem using only one-sided impulse reflection response data. In addition, algorithm stability and time sampling constraints are introduced.
Author
Time Domain Analysis; Inverse Scattering; Electromagnetic Scattering; Electric Potential; Transmission Lines; Algorithms

20050110052 Utah Univ., Salt Lake City, UT, USA

Extension and Validation of the Equivalent Sources Helical Antenna Modeling with the FDTD Code

Lazzi, Gianluca; Yu, Q. S.; Gandhi, Om P.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1054-1057; In English; See also 20050109927; Copyright; Avail: Other Sources

the Finite-Difference Time Domain method (FDTD) is currently the most used numerical techniques for dosimetry of wireless devices. A concern is that the structurally complex antennas might not be modeled accurately. Specifically, helical antennas are often used and these are incompatible with rectangular grid FDTD without resorting to staircase approximation of the antenna geometry. We have introduced therefore in a previous publication a new method to model small diameter normal mode helical antenna with the FDTD code for cellular telephone applications. This approach, that uses equivalent electric and magnetic sources to model the helix, has however not been previously tested for cases where the diameter of the helix may be more than two times the grid size. In this paper, we present a modified weighted equivalent source method and its experimental validation for these larger diameter helical antennas. The test case presented in this paper has been suggested by the IEEE Standards Coordinating Committee SCC-34 as a benchmark test to validate the modeling capabilities of the FDTD code for helical structures.

Author

Helical Antennas; Finite Difference Theory; Dosimeters

20050110053 Ghent Univ., Belgium

Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports

VandenBerghe, S.; Olyslager, F.; DeZutter, D.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1078-1081; In English; See also 20050109927; Copyright; Avail: Other Sources

To calculate the S-parameters of microwave structures, the Finite-Difference Time-Domain (FDTD) method is frequently used. In the past considerable attention has been given at modelling the metal strip placement [1] and at the absorbing boundary conditions of waveguides [2], but little has been published about exciting the structures in FDTD [3]. This paper presents a new formalism based on the Total Field - Scattered Field (TFSF) method commonly used to excite a structure with a plane wave. Similar to the TFSF method, the calculating space is divided in two regions: a 'total field region' and an 'error field region'. In the error field region, the field consists of the total field minus the field corresponding to the TEM mode. The modal field, which carries the propagating energy, is extracted or inserted at the interface between both regions. The remaining field consists of evanescent modes that have not yet sufficiently decayed and error fields generated by the imperfect boundary conditions. The difference between this new approach and the previously published method of [4] is that in the new method the complete propagating mode (both incident and reflected part) is removed in the error field region. As such the reflected or transmitted energy, will never reach the absorbing boundary conditions, so these conditions have to be less stringent than when other source mechanisms are used. This means they can be placed closer to the simulated structure or in the case of a PML less layers must be used. In both cases the necessary resources are reduced. F_rthermore, since we excite with the propagating mode, the source formalism will not excite evanescent modes allowing us to place the source close to the microwave structure. We also use a method based on the orthogonality of the modes, to detect the modal amplitude, which we need in order to calculate the S-parameters. This allows us to place the port regions very close to the structure again reducing the calculating space.

Derived from text

Finite Difference Time Domain Method; Finite Difference Theory; Time Domain Analysis; Boundary Conditions; Evanescence; Microwaves

20050110060 Salerno Univ., Italy

Higher-order Impedance Boundary Conditions for Complex Layered Planar Coatings

Galdi, Vincenzo; Pinto, Innocenzo M,.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1296-1299; In English; See also 20050109927; Copyright; Avail: Other Sources

The widespreading use of complex materials (e.g., bianisotropic, nonreciprocal), in the form of thin coatings on conducting bodies, e.g., in shielding and backscattering reduction/enhancement applications, demands more efficient CAD tools based on effective models. Approximate Impedance Boundary Conditions (henceforth IBCs), whenever applicable, can be very helpful in reducing the computational cost of numerical methods. Recently, Hoppe and Rahmat-Samii devised a spectral domain approach for systematically deriving higher-order IBCs (henceforth HOIBCs) for piece-wise homogeneous coatings with arbitrary constitutive properties on planar as well as curved metallic boundaries. This approach turns out to be very well suited for CAD implementations, on account of its wide applicability and high accuracy. In this communication, we extend the aforementioned method by studying the problem of scattering by an isotropic, longitudinally inhomogeneous,

dielectric coating on a general (i.e., polarization-rotating) impedance planar boundary. Such an extension allows an easy handling of multi-layer coatings consisting of arbitrarily sta_cked homogeneous-bianisotropic and inhomogeneous-dielectric layers.
Derived from text
Boundary Conditions; Impedance; Numerical Analysis; Coatings; Dielectrics; Planar Structures

20050110065 Siemens A.G., Munich, Germany
Low Complexity Space-frequency Rake Receivers for WCDMA
Brunner, Christopher; Haardt, Martin; Nossek, Josef A.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1104-1107; In English; See also 20050109927; Copyright; Avail: Other Sources

Adaptive space-frequency rake receivers use diversity combining and multi-user interference suppression to obtain a considerable increase in performance in DS-CDMA systems such as WCDMA. The main advantages of operation in the space-frequency domain include a reduced computational complexity and an improved noise suppression. To this end, the signal-plus-interference-and-noise (SIN) and the interference-plus-noise (IN) space-frequency covariance matrices are required. The optimum weight vector for symbol decisions is the 'largest' generalized eigenvector of the resulting matrix pencil. If we decouple spatial and frequency processing with respect to interfering users, the IN space-frequency covariance matrix can be approximated by the Kronecker product of the frequency and the spatial covariance matrix. Then this IN covariance matrix is estimated by using the outputs of the antenna elements before correlation and the output of the conventional rake fingers of the antenna elements may be utilized to approximate the SIN covariance matrix. Thus, the required correlations are reduced to the number of rake fingers. Moreover, the computational complexity which is required to estimate the optimum weight vector may be reduced significantly.
Author
Frequencies; Code Division Multiple Access; Low Frequencies; Receivers; Eigenvectors; Antenna Components

20050110070 Tohoku Univ., Sendai, Japan
Measurement of Radiation Efficiency of Antennas in the Vicinity of Human Head Model Proposed By COST 244
Chen, Qiang; Yoshioka, Hiroki; Igari, Kazuhisa; Sawaya, Kunio; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1118-1121; In English; See also 20050109927; Copyright; Avail: Other Sources

In the design of antennas for the portable telephones, it is important to evaluate the radiation efficiency of the antennas in the vicinity of the human body, since the radiation efficiency could decrease due to power absorption by human body. However, if different antennas are designed by different people, and different human models are used in their evaluations, their results can not be compared each other directly to determine which antenna has a highest radiation efficiency. Therefore, It is required to develop some canonical problems that may be utilized for comparing the numerical and experimental results of the characteristics of various antennas. Working Group 3 of COST 244 has proposed some canonical problems for comparing different numerical methods developed for calculation of absorbed power in the human head to assess the potential hazard caused by the use of mobile communication devices[l], The objective of this report is to measure the radiation efficiency of antennas in the vicinity of the human head models defined by COST 244 to investigate how the radiation efficiency changes with the different models. The pattern integration method is used as the measurement method[2]. The experimental results are shown and compared with the numerical results by using the Finite Difference Time Domain (FDTD) method.
Derived from text
Finite Difference Time Domain Method; Radiation Measurement; Numerical Analysis; Finite Difference Theory

20050110072 Illinois Univ., Urbana, IL, USA
A Topological Viewpoint on Consistency Aspects of Electromagnetic Theory on a Lattice
Texixeira, F. L.; Chew, W. C.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1254-1257; In English; See also 20050109927
Contract(s)/Grant(s): F49620-96-1-0025; N00014-95-1-0872; NSF ECS-93-02145; Copyright; Avail: Other Sources

In many applications, the continuum electromagnetic (EM) theory needs to be replaced by a discrete theory on a spatial lattice. A lattice EM theory has well-known phenomena not present on the continuum counterpart, such as finite frequency cut-off and rotational symmetry breaking. These may be viewed as approximations of to the continuum theory, but not as inconsistencies. The latter usually leads to pervasive and more deleterious phenomena such as spurious modes and unconditional instabilities. Invariably, the starting point to derive a discrete theory is the continuum theory itself. In the vector calculus paradigm, this can by done by, e.g., finite difference or finite volume approximation. However, the lack of a precise

discrete formulation of a lattice theory is a handicap if the objective is to provide a self-contained, self-consistent lattice EM theory. This is especially important in the case of irregular, sub-gridded, or locally distorted lattices. Here, we will explore the natural path to find a lattice approximation to a field theory formulated in terms of differential forms. This will employ the known mapping of forms onto linear functions (cochains) on the space of some lattice elements (chains). Then, we will use the natural factorisation of Maxwell's equations (ME's) into a topological part and a metric part to describe the exact (combinatorial) lattice counterparts to the topological equations and the nature of the lattice approximation to the metric equations. The objective of this work is to discuss basic requirements for an ab initio consistent lattice EM theory, clarifying their relationship with topological and metric aspects of the theory.
Derived from text
Topology; Consistency; Electromagnetism; Lattices (Mathematics); Approximation

20050110078 Universidade Federal de Uberlandia, Brazil
Symmetry Synthesis of the Multiport Scattering Matrix as a First Step in the Design of Electromagnetic Devices and Components with Bianisotropic Media
Dmitriev, V.; Costa, J. C W A.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1270-1273; In English; See also 20050109927; Copyright; Avail: Other Sources

There is a tendency in practice of em device design to use the highest possible symmetries because they allow one to obtain better frequency responses, to simplify calculations, tuning and regulation of the devices. Some restrictions for example technological ones, may influence on the symmetry choice. In 2D planar structures, we can usually use symmetrical solutions with plane and axes of symmetry, that is we consider symmetry of plane figures. In the up-to-date technology, there exists a trend to use 3D structures, which provide miniaturization and ar improvement of some of the parameters and characteristics. In these structures, we may investigate more sophisticated symmetries especially in those with magnetic media. All the possible symmetrical matrices for reciprocal and nonreciprocal two-ports have been obtained. The complete symmetry nomenclature of the three-ports is discussed. The problem of four-ports has been partly discussed, and for four-port circulators with nonreciprocal coupling effect has been solved. In this paper, we will outline a general method for symmetry synthesis of multiport device based on magnetic group theory. This theory gives an opportunity to consider all the possible symmetry solutions to the problem of synthesis and to fred an optimal one. The method will be illustrated with an example of a nonreciprocal four-port divider symmetry synthesis. The full group tree for four-ports will also be derived.
Derived from text
S Matrix Theory; Anisotropy; Symmetry; Electromagnetism; Ports (Openings)

20050110080 National Univ. of Singapore, Singapore
Electromagnetic Radiation of Antennas in the Presence of an Arbitrarily Shaped Dielectric Object: Green Dyadics and Their Applications
Huang, Yeqin; Li, \hLe-Wei; Leong, Mook-Seng; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1274-1277; In English; See also 20050109927; Copyright; Avail: Other Sources

Although electromagneitc scattering problems have been investigated extensively by using Waterman's T-Matrix Method (TMM), the radiation problem of an antenna in the presence of an arbitrarily shaped object were not considered thereof. In this paper, the technique of surface integral equations has been employed; and as a result, a terse and analytical representation of the dyadic Green's functions (DGF's) in the presence of an arbitrarily shaped dielectric object is obtained in a similar fashion to that in the T-Matrix Method. In the case of a dielectric sphere, this representation reduces to the same expression as obtained elsewhere in a different approach. As applications of the approach in the paper, radiation problems of an electric dipole in the presence of superspheroids and rotational parabolic bodies are solved although the theoretical formulas derived here can be applied to arbitrary current distributions located anywhere in the presence of an object of arbitrary shape.
Author
Dyadics; Electromagnetic Radiation; Matrices (Mathematics); Antennas

20050110099 Rennes Univ., France
Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials
Poilasne, G.; Pouliguen, P.; Mahdjoubi, K.; Desclos, L.; Terret, C.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1328-1331; In English; See also 20050109927; Copyright; Avail: Other Sources

MPBG are periodic s_ctures composed by metallic parts. The reflection characteristics of MPBG are depending on fi'equency. They exhibit bands in which there is no propagation mode inside the structure. MPBG composed by continuous

wires and MPBG composed by discontinuous wires have different responses when excited by a normal incident plane wave. Recalls on MPBG excited with plane waves are given in section II. In order to obtain angular responses, in section III, the structures are excited by an omni-directionnal antenna [1]. To switch from continuous to discontinuous wires, active components can be added on the wires. Using just a few wires with active elements on it, beam shaped by MPBG [2] can be either turned on/off or shaped in different ways. These theoretical results are presented in section IV. In order to reduce the number of active elements or to have more possibilities, structures composed by both continuous and discontinuous wires are also presented. It is demonstrated that the behavior of these structures can approximately be deduced from the behavior of the different parts alone [3]. Finally, a structure using continuous wires and discontinuous wires, an which active elements are implemented, is presented.
Derived from text
Antenna Radiation Patterns; Beamforming; Energy Gaps (Solid State); Plane Waves

20050110148 NASA Marshall Space Flight Center, Huntsville, AL, USA
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative
Grugel, R. N.; Fincke, M.; Sergre, P. N.; Ogle, J. A.; Funkhouser, G.; Parris, F.; Murphy, L.; Gillies, D.; Hua, F.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Soldering is a well established joining and repair process that is of particular importance in the electronics industry. Still. internal solder joint defects such as porosity are prevalent and compromise desired properties such as electrical/thermal conductivity and fatigue strength. Soldering equipment resides aboard the International Space Station (ISS) and will likely accompany Exploration Missions during transit to, as well as on, the moon and Mars. Unfortunately, detrimental porosity appears to be enhanced in lower gravity environments. To this end, the In-Space Soldering Investigation (ISSI) is being conducted in the Microgravity Workbench Area (MWA) aboard the ISS as 'Saturday Science' with the goal of promoting our understanding of joining techniques, shape equilibrium, wetting phenomena, and microstructural development in a microgravity environment. The work presented here will focus on direct observation of melting dynamics and shape determination in comparison to ground-based samples, with implications made to processing in other low-gravity environments. Unexpected convection effects, masked on Earth, will also be shown as well as the value of the ISS as a research platform in support of Exploration Missions.
Author
Soldering; Porosity; Thermal Conductivity; International Space Station; Wetting

20050110216 NASA Marshall Space Flight Center, Huntsville, AL, USA
Electrical Conductivity of HgTe at High Temperatures
Li, C.; Lehoczky, S. L.; Su, C.-H.; Scripa, R. N.; [2004]; 1 pp.; In English; 2004 Materials Research Society Fall Meeting, 29 Nov. - 3 Dec. 2004, Boston, MA, USA; Copyright; Avail: Other Sources; Abstract Only

The electrical conductivity of HgTe was measured using a rotating magnetic field method from 300 K to the melting point (943 K). A microscopic theory for electrical conduction was used to calculate the expected temperature dependence of the HgTe conductivity. A comparison between the measured and calculated conductivities was used to obtain the estimates of the temperature dependence of Gamma(sub 6)-Gamma(sub 8) energy gap from 300 K to 943 K. The estimated temperature coefficient for the energy gap was comparable to the previous results at lower temperatures (less than or equal to 300 K). A rapid increase in the conductivity just above 300 K and a subsequent decrease at 500 K is attributed to band crossover effects. This paper describes the experimental approach and some of the theoretical calculation details.
Author
Mercury Tellurides; Conductivity; Temperature Dependence; Magnetic Fields; Electrical Resistivity

20050110328 HRL Labs., LLC, Malibu, CA USA
Photonic Analog-to-Digital Conversion Technology
Ng, W.; Lu, L.; Yap, D.; Bridges, W.; Mokhtari, M.; Dec. 2004; 106 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-C-0022; DARPA ORDER-J409; Proj-G993
Report No.(s): AD-A429797; AFRL-SN-RS-TR-2004-347; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report documents the work undertaken by HRL Laboratories, LLC and its subcontractors, California Institute of Technology and Raytheon Electronics Systems, on the development of multi-GHz photonic analog-to-digital (A/D)

conversion technologies (PACT). Using an electro-optic modulator, the analog-input to the A/D converter was impressed (i.e. photonically sampled) on a train of low-jitter picosecond pulses (wavelength - 1540 rim) generated by a mode-locked Er-fiber laser. After photodetection, the electrical outputs of the photodiodes were fed to a variety of electronic quantizers for digitization. Specifically, the HRL Program demonstrated InP-HBT bandpass Delta-Sigma A/D converter with 10 bits of resolution, using photonic sampling at 10 GHz. The Program also demonstrated photonic clock distribution to multiple flash A/D converters, and a 40 GHz photonic time-interleaved architecture based on wavelength division multiplexed technologies. For the 40 GHz time-interleaved architecture, the program achieved --4 SFDR-bits of resolution. PACT is compatible with antenna remoting systems that utilize fiber optic links for signal distribution.
DTIC
Analog to Digital Converters; Photonics

20050110369 Naval Postgraduate School, Monterey, CA USA
Digital Phased Array Architectures for Radar and Communications Based on Off-the-Shelf Wireless Technologies
Ong, Chin S.; Dec. 2004; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429867; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis is a continuation of the design and development of a three-dimensional 2.4 GHz digital phased array radar antenna. A commercial off-the-shelf quadrature modulator and demodulator were used as phase shifters in the digital transmit and receive arrays. The phase response characteristic of the demodulator was measured and the results show that the phase difference between the received phase and transmit phase is small. In order to increase the bandwidth of the phased array, a method of time-varying phase weights for linear frequency modulated signal was investigated. Using time-varying phase weights on transmit and receive give the best performance, but require the range information of the target. It is more practical to use time-varying phase weights on only one side (transmit or receive but not both), and constant phase weights on the other side. The simulation results showed that by using time-varying phase weights, the matched filter loss is not as severe as it is when using the conventional fixed weights technique. It is also found that this method is only effective for small scan angles when the time-bandwidth product is large. The approach to implement time-varying phase weights on transmit using commercial components such as direct digital synthesizer and quadrature modulator is discussed.
DTIC
Commercial Off-the-Shelf Products; Phased Arrays; Wireless Communication

20050110405 Delaware Univ., Newark, DE USA
Experimental Characterization of Photonic Band Crystals for Tera Hertz Devices
Prather, Dennis W.; Jan. 2004; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0484
Report No.(s): AD-A429924; ELEG332132-103104; AFRL-SR-AR-TR-05-0002; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this project we are working to develop novel photonic crystal and planar integrated devices for THz frequencies. To achieve these goals we are developing custom high-resolution electron beam lithography (EBL) pattern generation processes and deep reactive etching techniques. To this end we have made progress in the areas of THz device design, fabrication, and characterization and have demonstrated the first THz photonic crystal slab single channel defect waveguide as well as a planar integrated ring cavity coupled waveguide. Details of these devices and the progress made to date in the overall effort are presented in this report.
DTIC
Crystals; Waveguides

20050110418 California Inst. of Tech., Pasadena, CA USA
Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling
Yariv, Amnon; Scherer, Axel; Green, William; Jan. 2005; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MDA972-00-1-0022
Report No.(s): AD-A429947; No Copyright; Avail: Defense Technical Information Center (DTIC)

Precise control of coupling between waveguides and resonant cavities enables the realization of several novel and improved devices, including low-power modulators, switches, filters, and wavelength routers. The goal of this program is to theoretically and experimentally evaluate and develop schemes for efficient, controlled coupling in optical polymer and

semiconductor devices. Chip-based devices should be inexpensive, producible, and have the potential to be miniaturized and integrated with electronics. Technological progress under this grant has included the development and optimization of a soft-lithography technique for replica molding of optical polymer devices, and a suite of III-V semiconductor fabrication techniques suitable for electrically driven structures. Optical polymer and semiconductor material systems have been employed to realize a large number of novel devices, including high-contrast tunable optical filters, low voltage Mach-Zehnder interferometers, and a compact, low power racetrack resonator switch based on controlled waveguide-resonator coupling. The goals of the project will be accomplished in four phases, as follows: (1) modeling, fabrication, and testing of waveguides and ring resonators in optical polymers, indium phosphide (InP) based semiconductors, and silicon on insulator (SOI) substrates; (2) demonstrate coupling between waveguides and microresonators; (3) demonstrate control of coupling; and (4) optimize working parts and final demonstration.
DTIC
Electric Potential; Electro-Optics; Fabrication; Light Beams; Optical Equipment; Resonators; Semiconductor Devices; Switching; Waveguides

20050110419 Virginia Univ., Charlottesville, VA USA
Improving Overlay in Nanolithography with a Deformable Mask Holder
Harriott, L. R.; Dec. 2004; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0736
Report No.(s): AD-A429949; 114696-GG10374-02; ARO-43040.1-EL-DRP; No Copyright; Avail: Defense Technical Information Center (DTIC)

In very fine-line VLSI photolithography, alignment and overlay errors due to distortion in the projected image of a photomask relative to an existing pattern on a silicon wafer are becoming such serious problems :hat product-yield is beginning to drop precipitously. We propose to solve these problems by deliberately deforming a mask with a system of piezoelectric actuators in such a way that its induced deformations precisely match those of the wafer and so that all of the alignment marks at each chip site can be pulled into registration simultaneously during exposure. The centerpiece of our program is a proof-of-concept demonstration of inducing predictable distortions in a photomask by means of piezoelectric transducers in a deformable mask holder. In this report, we outline our program and provide a status report of the ongoing work. We have constructed and tested the deformable mask holder for the proof-of concept demonstration and performed measurements of mask distortions as a function of applied force.
DTIC
Deformation; Etching; Holders; Lithography; Masks; Nanofabrication; Nanotechnology

20050110434 Silvaco Data Systems, Inc., Santa Clara, CA USA
Hierarchical CAD Tools for Radiation Hardened Mixed Signal Electronic Circuits
Nicklaw, Christopher; Maurer, Mark; Tabbert, Chuck; Milanowski, Randall; Jan. 2005; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W31P4Q-04-C-R276; ARPA ORDER-S016-02
Report No.(s): AD-A429971; TR-A2; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report covers the final report of our phase I effort to develop a mixed signal simulator with radiation modeling capability. Silvaco's Harmony-AMS(Analog/Mixed Signal) simulator was modified to enable the simulation of single events, total ionizing dose, and dose rate in a commercial hierarchical design flow.
DTIC
Circuits; Computer Aided Design

20050110455 Cincinnati Univ., OH USA
Development, Exploitation, and Transition of Computer Aided Engineering (CAE) Tools
Carter, Harold W.; Jun. 2003; 356 pp.; In English
Contract(s)/Grant(s): F33615-96-2-1945; Proj-6096
Report No.(s): AD-A430002; AFRL-IF-WP-TM-2004-1535; No Copyright; Avail: CASI; A16, Hardcopy

This report documents research results from 22 tasks related to microelectronic modeling and software design aids conducted by researchers at six universities in Ohio and Michigan. Tasks include CMOS-based microwave component design and fabrication, parallel and mixed-signal VHDL and VBHDL-AMS simulator algorithms, conversion tools for VHDL-AMS models, System-on-a-Chip methods, VHDL-AMS modeling of operational amplifiers, mechatronic component design

analysis, video/audio data compression using wavelets, and design methods for mixed analog/digital circuits.
DTIC
Circuits; Computer Aided Design; Electrical Engineering; Exploitation

20050110461 California Univ., Santa Barbara, CA USA
Systematic Studies of Carbon Doping in High Quality GaN Grown by Molecular Beam Epitaxy
Speck, James S.; Dec. 2004; 17 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0314; Proj-2305
Report No.(s): AD-A430009; AFRL-SR-AR-TR-05-0046; No Copyright; Avail: CASI; A03, Hardcopy

For the final contract period September 1, 2003 - December 31, 2004, we have completed the following tasks: * Sucessfully incorporated carbon into all MBE-grown HEMTs (in conjunction with the DARPA Wide Bandgap Semiconductor program) and realized record power non-field-plated GaN HEMTs (for both MBE and MOCVD. * In collaboration with Prof. Steve Ringel's group at Ohio State (under ONR support), completed an initial study of deep level optical studies of carbon-doped MBE GaN. Completed initial studies of Fe-doping in MBE GaN as an alternative approach for realizing semi-insulating GaN.
DTIC
Additives; Carbon; Gallium Nitrides; Molecular Beam Epitaxy

20050110467 Michigan Univ., Ann Arbor, MI USA
Compact Reconfigurable HF-UHF Antennas
Sarabandi, Kamal; Jun. 2004; 134 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0197
Report No.(s): AD-A430016; 991549; ARO-39879.2-EL; No Copyright; Avail: Defense Technical Information Center (DTIC)

The development of a compact reconfigurable HF-UHF antenna is of great practical importance in mobile military communications where low visibility and high mobility are required Variations of monopole and diPOLE ANTENNAS IN USE TODAY ARE NARROWBAND and ARE PROHIBITIVELY LARGE and BULKY AT THESE FREQUENCIES Broadband antennas are not only large but also suffer from jamming susceptibility and undesirable complex multiplexing requirements. Development of efficient small geometry planar and reconfigurable antennas is investigated Based on a resonating slot structure small antennas that exhibit simultaneous bandselectivity and antijam characteristics, So far very small antennas using novel topologies have been developed that areas as small as (0.05lamba)2. Also efficient reconfigurability over a very wide range of frequency using electronic switches has been demonstrated, Design of DC contact efficient MEMS switches and wideband designs are also being considered.
DTIC
High Frequencies; Telecommunication; Ultrahigh Frequencies

20050110476 Conductus, Inc., Santa Barbara, CA USA
Frequency Agile Materials for Electronics (FAME)
Moeckly, Brian; Nov. 2004; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-C-0287
Report No.(s): AD-A430027; 0287-F; No Copyright; Avail: Defense Technical Information Center (DTIC)

High performance HTS microwave filters stand to benefit from the capability to electrically tune their frequency of operation. This function may be performed with electric-field tunable dielectric materials such as SrTiO3 (STO). We have optimized the growth of STO thin films for this purpose using the growth techniques of pulsed laser ablation and reactive coevaporation. We have achieved loss tangents on the order of 0.001 at 65 K for these materials, while maintaining acceptable tunability. We have further optimized the design of STO thin-film capacitors, and we have integrated these structures into specially-designed lumped-element YBa2Cu3O7.6 (YBCO) microwave resonators and filters in order to tune their center frequencies. In this report we briefly summarize our materials development efforts as well as the design and performance of frequency agile thin-film HTS resonators and filters. This project culminated in the demonstration of a stand-alone electrically tunable 6-pole HTS filter.
DTIC
Frequencies; Frequency Hopping

20050110486 Plasmion Corp., Hoboken, NJ USA

Ultra-Smooth As-Deposited Optical Films

Paik, Dr. Namwoong; Mar. 2004; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DASG60-02-C-0034

Report No.(s): AD-A430039; No Copyright; Avail: Defense Technical Information Center (DTIC)

In the Phase I program, PLASMION demonstrated the capability of Negative Sputter Ion Deposition to deposit optical thin films with state-of-the-art properties, specifically ultrasmooth surfaces, high packing density, refractive index close to bulk values, and stability to environmental exposure. The objective of this Phase II program was to utilize these films to fabricate high-quality, economical optical devices for high energy laser applications. Prototype dielectric mirrors will be delivered which have higher reflectivity, lower loss, and higher laser damage threshold than currently available technology, with lower projected costs per unit. PLASMION accomplished these goals by designing and constructing a flexible system for the fabrication of state-of-the-art thin film optical devices using Negative Sputter Ion Deposition. This system was used to fabricate the deliverable devices for the Phase II program, and will also serve as the platform for PLASMION s planned commercialization of optical thin film deposition equipment in Phase III.

DTIC

Optical Materials; Thin Films

20050110487 Naval Research Lab., Washington, DC USA

Proceedings of the Workshop on Power Sources for Distributed Autonomous Systems

Dahlburg, Jill P.; Swider-Lyons, Karen S.; Tender, Leonard M.; Bright, Harold J.; Feb. 2005; 18 pp.; In English

Report No.(s): AD-A430040; NRL/MR/1001--05-8860; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Workshop on Power Sources for Distributed Autonomous Systems was held on 23-24 February 2004 at the Naval Research Laboratory in Washington, DC. The purpose was to explore optimization, utilization, and integration of power and energy sources to enable new and high-value DoD distributed autonomous systems capabilities. Four central consensus conclusions emerged. The realization of future and high-value Department of Defense (DoD) distributed autonomous systems capabilities will require significant focus on power integration. All components of autonomous systems, including power and energy sources, should be considered at design inception and carried through fruition in a concerted effort. Current availability of capable miniature/low-power sensors, communications hardware, data storage and processing tools, platform mobility elements, energy and power awareness, and R&D-oriented systems design provides an expeditious opportunity to achieve new and useful distributed autonomous systems capabilities. Highest likelihood for success is by means of enfranchising multiple small, applications driven, interdisciplinary development teams of scientists, engineers and DoD customers.

DTIC

Autonomy; Conferences; Supplying

20050110532 Princeton Univ., NJ USA

High Frequency Performance of Self-Assembled Monolayer (SAM) Organic FETs

Sturm, James C.; May 2004; 20 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0750

Report No.(s): AD-A430106; No Copyright; Avail: CASI; A03, Hardcopy

As a step towards developing FETs with a device length of a single molecule, modeling shows that FET action in FETs of very short channel length are most likely to occur for long (\g5 nm) channel lengths. Therefore self-assembled monolayers of a stacked 11-mercaptoundecanoic acid (MUA) were grown to define an arbitrarily long device length (in excess of 10 nm). The electrical properties of these films were investigated with a self-aligned mesa structure which maximizes device yield by minimizing the device area while still retaining compatibility for the first time with integrated metal wiring. Devices with between 3-7 MUA layers (device length up to 11 nm) were insulating, with currents that decreased exponentially with the number of MUA layers.

DTIC

Computer Storage Devices; Current Density; Electrical Resistance; Field Effect Transistors; High Frequencies; Molecular Structure

20050110534 Air Force Research Lab., Mesa, AZ USA

An Integrated Procedure for Measuring the Spatial and Temporal Resolution of Visual Displays

Winterbottom, Marc D.; Geri, George A.; Morgan, Bill; Pierce, Byron J.; Dec. 2004; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-1123

Report No.(s): AD-A430109; 2004-PAPER-1855; No Copyright; Avail: Defense Technical Information Center (DTIC)

Spatial and temporal resolution are two of the most fundamental characteristics of visual displays, and yet they are often incorrectly defined and specified. In order to address this problem, we have developed techniques for estimating both spatial and temporal resolution, and we have compared the resulting estimates to data obtained from perceptual tasks. The spatial resolution technique is based on a VESA standard (FPDM, Ver. 2.0), and was applied to several CRT displays. It was found that the pixel count does not adequately define display resolution when the former exceeds the bandwidth of the display device. In addition, the spatial resolution measurements were found to correlate well with perceptual assessments of the orientation of target aircraft simulated at various distances. The temporal resolution technique involved measuring the response of various displays to simple light patterns that could be flickered at up to 30Hz. Data obtained for CRT projectors indicated that temporal artifacts obtained with these devices are due primarily to the limited frame rate of the image generator, rather than to limitations in the temporal response of the projectors. In addition, data obtained from liquid crystal on silicon (LCoS) profectors indicated luminance interacts with eye movements to produce temporal artifacts that can reduce the quality of the displayed imagery. The results of a perceptual test, based on the perceived separation of moving lines, were consistent with the measured temporal resolution of the two displays. All measurement and analysis techniques described here have been implemented in a software package that is available from AFRL, Mesa, Arizona.

DTIC

Display Devices; Spatial Resolution; Temporal Resolution; Visual Perception

20050110536 Queensland Univ., Saint Lucia, Australia

Experimental Implementation of Efficient Linear Optics Quantum Computation

Milburn, G. J.; Ralph, T. C.; White, A. G.; Nov. 2004; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0651

Report No.(s): AD-A430113; ARO-42631-PH-QC.21; No Copyright; Avail: Defense Technical Information Center (DTIC)

One of the earliest proposals for implementing quantum computation was based on encoding each qubit in two optical modes, each containing exactly one photon. However, it is extremely difficult to unitarily couple two optical modes containing few photons. In 2001, Knill, Laflamme, and Milburn (KLM) found a way to circumvent this restriction and implement efficient quantum computation using only passive linear optics, photodetectors, and single photon sources. This efficient linear optical quantum computing (LOQC) is distinct from other linear optical schemes that are not efficiently scalable. The technological requirements for even the simplest gates in the KLM proposal initially seemed out of reach. However, Ralph, White, Munro and Milburn soon showed that, in principle, demonstrations of key gates and techniques could be achieved with current technology. The objective of the research undertaken in this project was to produce, in three years, a prototype two-qubit gate for photons using the KLM linear optics quantum computation approach, and to develop a blue-print for a multiple qubit device that might be implemented over a longer time scale. A non-deterministic two-qubit gate was demonstrated that operates with high fidelity. A number of key tasks were demonstrated using this gate, and several theoretical investigations of short, medium, and longer term issues for the LOQC approach were successfully completed.

DTIC

Error Correcting Codes; Logic Circuits; Quantum Computation; Quantum Electronics; Quantum Optics

20050110549 Army Medical Research and Development Command, Aberdeen Proving Ground, MD USA

IEEE Sensors 2004 Conference

Harmer, Greg; Oct. 2004; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-M-0424

Report No.(s): AD-A430135; No Copyright; Avail: Defense Technical Information Center (DTIC)

This work describes the use of an array of SAWs (surface acoustic wave devices) to detect and identify chemical warfare agents (nerve and mustard simulants) in a background of interferents (methanol, diesel and hexane). Even in a varying concentration and realistic gas delivery profiles, an array of SAWs is able to identify and predict the concentrations of simulants in real-time. This application differs from standard electronic noses (e-noses) as it is analytic. Much of the previous work in the field of sensor arrays and mixtures (usually binary or tertiary) tries to learn the whole sample space, due to the use of non-selective sensors. The SAWs used in this array, although not completely selective have a very high sensitivity to

only the simulants. Thus, using the appropriate classification algorithms a real-time chemical detector can be realized. The system was tested with a wide range of gas profiles and was able to identify and quantitate the simulants to a high degree of accuracy.
DTIC
Conferences; Surface Acoustic Wave Devices

20050110554 Maryland Univ., College Park, MD USA
A Novel InAs Quantum Wire System
Yang, C. H.; Yang, M. J.; Cheng, K. A.; Culbertson, J. C.; Jan. 2003; 4 pp.; In English
Report No.(s): AD-A430142; No Copyright; Avail: Defense Technical Information Center (DTIC)

This article reports on a new technique in patterning high-quality, low-dimensional electrons in single InAs quantum wells. Grown by molecular beam epitaxy, the single InAs quantum well is sandwiched between AlSb barriers and capped by a thin layer of InAs. When the InAs cap layer is patterned by electron beam lithography and selectively removed, electrons are induced in the InAs quantum well below due to the different surface Fermi-level pinning voltages on the exposed AlSb layer from the InAs cap. One-dimensional quantum wires can thus be conveniently defined by lithography and nm-shallow etching. The authors demonstrate that these one-dimensional electrons possess a long elastic mean free path (\g 1.4 micrometers) and a long coherence length (\g 3 micrometers) at 2 K.
DTIC
Fabrication; Fermi Surfaces; Indium Arsenides; Nanotechnology; Quantum Wires; Wire

20050110565 Houston Univ., TX USA
Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors
Chu, C. W.; Salama, K.; Jan. 2005; 7 pp.; In English
Contract(s)/Grant(s): F46920-01-1-0391; Proj-2308
Report No.(s): AD-A430184; AFRL-SR-AR-TR-05-0053; No Copyright; Avail: CASI; A02, Hardcopy

The success of high temperature superconductor technology in the efficient use, generation, transmission, and storage of electrical energy is determined by the performance of the coated conductor and by the ability to fabricate it in long lengths at a reasonable cost. Our program on materials and processing of coated high temperature superconducting conductors has had two components in the past year: 1) improving the Jc by introducing effective pinning centers to increase the interlayer coupling and reduce the compound anisotropy by cation substitution and introduction of nano-particles; and 2) electroplated Ni layer on textured Cu substrate for Cu- based HTS coated conductors.
DTIC
Coatings; Conductors; Energy Storage; High Temperature; High Temperature Superconductors; Quality Control; Superconductivity

20050110850 Naval Undersea Warfare Center, Newport, RI USA
A Bipolar Electrode for Use in a Semi Fuel Cell
Patrissi, Charles J., Inventor; Medeiros, Maria G., Inventor; Carreiro, Louis G., Inventor; Tucker, Steven P., Inventor; Atwater, Delmas W., Inventor; Aug. 2004; 16 pp.; In English
Report No.(s): AD-D020186; No Copyright; Avail: CASI; A03, Hardcopy

A bipolar electrode fabricated with a combination of materials that will physically separate the catholyte from the metal anode of the electrode while providing high electrical conductivity between the metal anode and the catalyst cathode. This is accomplished by layering the catalyst cathode over a composite of conductive adhesive and conductive foil that is then affixed to the metal anode.
DTIC
Bipolarity; Electrical Resistivity; Electrodes; Fuel Cells

20050110851 Department of the Navy, Washington, DC USA
Low Frequency Sonar Countermeasure
Frank, Thomas A., Inventor; May 2004; 17 pp.; In English
Report No.(s): AD-D020187; No Copyright; Avail: CASI; A03, Hardcopy

A multi-port projector of acoustic energy in water includes a cylindrical hollow transducer having open annular ends. A

thin, flexible member is secured to each annular end to extend across each opening to be displaced by the transducer, and the transducer and flexible members form an interior sealed from ambient water. A battery/electronics module is in the interior and is spaced from the transducer and flexible members to couple driving signals to the transducer for reciprocally displacing it and the flexible members in response to the driving signals. An inert liquid fills the interior around the module, and an open truss on each annular end exposes the flexible members to the ambient water. Cylindrical portions coaxially extending with the transducer on a common longitudinal axis are connected to the open trusses for projecting acoustic energy of lower frequency than conventional cylindrical transducers of similar size.
DTIC
Acoustics; Countermeasures; Low Frequencies; Patent Applications; Piezoelectric Transducers; Signal Transmission; Sonar; Sound Generators; Sound Waves

20050111480 Helsinki Univ. of Technology, Espoo, Finland
Pipeline Analog-to-Digital Converters for Wide-Band Wireless Communications
Sumanen, L.; Dec. 2002; 236 pp.; In English
Report No.(s): PB2005-103595; Copyright; Avail: National Technical Information Service (NTIS)
During the last decade, the development of the analog electronics has been dictated by the enormous growth of the wireless communications. Typical for the new communication standards has been an evolution towards higher data rates, which allows more services to be provided. Simultaneously, the boundary between analog and digital signal processing is moving closer to the antenna, thus aiming for a software defined radio. For analog-to-digital converters (ADCs) of radio receivers this indicates higher sample rate, wider bandwidth, higher resolution, and lower power dissipation.
NTIS
Analog to Digital Converters; Radio Receivers; Wideband Communication; Wireless Communication

20050111514 University of Southern California, Los Angeles, CA, USA
Integrated Microphotonic Receiver for Ka-Band
Levi, A. F. J.; [2005]; 57 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG3-2559; No Copyright; Avail: CASI; A04, Hardcopy
This report consists of four main sections. Part I: LiNbO3 microdisk resonant optical modulator. Brief review of microdisk optical resonator and RF ring resonator. Microwave and photonic design challenges for achieving simultaneous RF-optical resonance are addressed followed by our solutions. Part II: Experimental demonstration of LiNbO3 microdisk modulator performance in wired and wireless RF-optical links. Part III: Microphotonic RF receiver architecture that exploits the nonlinear modulation in the LiNbO3 microdisk modulator to achieve direct photonic down-conversion from RF carrier without using any high-speed electronic elements. Part IV: Ultimate sensitivity of the microdisk photonic receiver and the future road map toward a practical device.
Author
Optical Resonators; Microelectronics; Optoelectronic Devices; Receivers; Extremely High Frequencies; Modulators

20050111546 Helsinki Univ. of Technology, Espoo, Finland
Design of Robust Controllers for Telecom Power Supplies
Gadoura, I. A.; 2002; In English
Report No.(s): PB2005-103603; REPT-132; Copyright; Avail: National Technical Information Service (NTIS)
A Telecom power supply is studied and analyzed from control system viewpoint. It consists of three stages: AC/DC rectifier, a backup battery, and a Telecom load. The AC/DC rectifier stage can be composed of paralleled DC/DC converters preceded by paralleled AC/DC converters. However, paralleled DC/DC converters are only considered in this thesis because they constitute the main dynamics in practice. A system of paralleled DC/DC converters operating in continuous inductor current mode with either voltage mode control or peak current mode control are modeled and analyzed using state-space representation.
NTIS
Control Systems Design; Electric Batteries; Voltage Converters (DC to DC); Loads (Forces)

20050111569 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digital Converter
Buchner, Stephen; Campbell, Arthur B.; Sternberg, Andrew; Massengill, Lloyd; McMorrow, Dale; Dyer, Clive; [2003]; 6 pp.; In English; European Conference on Radiation and its Effects on Components and Systems, 15-19 Sep. 2003, Noordwijk, Netherlands; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

The SEU rate in a flash ADC (AD9058) on board a space experiment varied by more than an order of magnitude, depending on the input. A pulsed laser aided in elucidating the reasons, which were found to be the result of the unique design of the AD9058.
Author
Analog to Digital Converters; Single Event Upsets

20050111570 NASA Langley Research Center, Hampton, VA, USA
Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios
Nguyen, Truong X.; Koppen, Sandra V.; Smith, Laura J.; Williams, Reuben A.; Salud, Maria Theresa P.; March 2005; 214 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DTFA03-96-X-90001; 23R-772-96
Report No.(s): NASA/TP-2005-213537; L-19097; No Copyright; Avail: CASI; A10, Hardcopy

Radiated emissions in aircraft communication and navigation bands are measured from third generation (3G) wireless mobile phones. The two wireless technologies considered are the latest available to general consumers in the US. The measurements are conducted using reverberation chambers. The results are compared against baseline emissions from laptop computers and personal digital assistant devices that are currently allowed to operate on aircraft. Using existing interference path loss data and receivers interference threshold, a risk assessment is performed for several aircraft communication and navigation radio systems. In addition, cumulative interference effects of multiple similar devices are conservatively estimated or bounded. The effects are computed by summing the interference power from individual devices that is scaled according to the interference path loss at its location.
Author
Navigation; Wireless Communication; Aircraft Communication; Threat Evaluation; Radiotelephones

20050111582 CM Technologies Corp., Coraopolis, PA, USA
Demonstration and Validation of the Excited Dielectric Test (Trade Name) Method to Detect and Locate Defects in Aircraft Wiring Systems
Van Alstine, R.; Allan, G.; Jan. 2005; In English
Report No.(s): PB2005-103180; DOT/FAA/AR-04/43; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the development of an advanced test technique for assessing the condition of installed aircraft wiring. The Excited Dielectric Test (EDT) method is an electrical test that exploits a basic property of polar insulation materials, that is, some small amount of current will flow through the insulation material when the wire is exposed to an alternating electric field. The magnitude of this current varies with the frequency of the applied field and, in polar insulation materials, there is a specific frequency at which a maximum current occurs. This current is often expressed in terms of the phase angle. The other aspect of the EDT method is the time domain reflectrometry (TDR). Aircraft wiring can be modeled as a classical transmission line (i.e., a continuous structure of resistors, inductors, and capacitors). Applying this model, the electrical characteristics of the wire (e.g., impedance, capacitance, DF, resistance) can be analyzed as distributed elements represented by a voltage waveform. TDR has been shown to be extremely effective in measuring the distributed characteristics of wiring.
NTIS
Defects; Dielectrics; Wiring; Reliability Analysis; Aircraft Design

20050123566 Fluor Daniel Hanford, Inc., Richland, WA, USA, Pacific Northwest National Lab., Richland, WA, USA
Remote System Technologies for Deactivating Hanford Hot Cells
Berlin, G. T.; Walton, T. L.; 2004; In English
Report No.(s): DE2004-826346; No Copyright; Avail: National Technical Information Service (NTIS)

Remote system technologies are being deployed by Fluor Hanford to help accelerate the deactivation of highly-radioactive hot cell facilities. These technologies offer improved methods for accessing difficult-to-reach spaces and performing tasks such as visual inspection, radiological characterization, decontamination, waste handling, and size reduction. This paper is focused on the application of remote systems in support of deactivation work being performed in several legacy facilities at Hanford (i.e., the 324 and 327 Buildings). These facilities were previously used for fuel fabrication, materials examination, and the development of waste treatment processes. The technologies described in this paper represent significant

improvements to Hanford's baseline methods, and may offer benefits to other U.S. Department of Energy (DOE) sites and commercial operations.
NTIS
Remote Control; Deactivation; Decontamination

20050123677 Vigo Univ., Vigo, Spain
Measurement of Transmission Coefficients of Radiowaves through Building Materials in the 5.8 GHz Frequency Band
Cuinas, Inigo; Sanchez, Manuel Garcia; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1474-1477; In English; See also 20050123676
Contract(s)/Grant(s): CICyT-TIC97-1129-C04-03; Copyright; Avail: Other Sources

Transmission coefficients of radio waves trough different building materials in the 5.8 GHz frequency band have been obtained. Several samples of each material have been measured, showing that using just a single sample is not enough to characterize the transmission coefficient. It has also been found that some obstacles have a polarisation dependent behaviour.
Author
Radio Transmission; Coefficients; Microwave Transmission

20050123678 University of Central Florida, Orlando, FL, USA
Experimental Validation of a Neural Network Direction Finder
ElZooghby, A. H.; Southall, H. L.; Christodoulou, C. G.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1592-1595; In English; See also 20050123676; Copyright; Avail: Other Sources

This paper discusses an experimental neural network based smart antenna capable of performing direction Finding. A cylindrical eight-element phased array antenna is used to collect complex signals radiated by two sources. Three direction of arrival (DOA) estimation algorithms are applied to the measured data, namely, the Fourier Transform, the MUSIC algorithm and the Radial Basis Function Neural Network (RBFNN) algorithm. Comparisons show the superior performance of the RBFNN and its ability to overcome many limitations of the conventional and other superresolution techniques, specifically by reducing the computational complexity and the ability to deal with highly correlated sources.
Author
Neural Nets; Phased Arrays; Antenna Arrays; Radio Direction Finders

20050123679 King Abdul Aziz Univ., Jeddah, Saudi Arabia
A Viable Model for Power Focussing in a Lossy Cylinder
Wait, James R.; Nabulsi, Khalid A.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1634; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper, we are interested in controlling the power dissipation in a lossy cylinder of finite length when a field is applied on its surface and where the applied surface field is assumed to be independent of the azimuthal angle. In addition the cylinder is assumed homogenous. A procedure will be presented to show how this is accomplished. To begin, a field is assumed on the axis of the lossy cylinder such that the required dissipation inside the cylinder is obtained (or visa versa). Analytical evaluation of the source on the surface of the cylinder can then be carried out. The solution here involves an inverse problem where the source is unknown and its response is specified. In this form, the source is continuous. A realization of the source (surface field) in terms of a discrete array is also given. This is done by assuming that the source is zero on the surface of the cylinder except at a finite number of points. The source can then be realized by applying voltages at these points and the values of the voltages correspond to the actual source on the surface. In a practical situation, the voltages are applied across a finite number of thin cylindrical slots cut in a metal encasing. Results will be presented that show excellent agreement between the actual source and the discrete array in producing the field on the axis of the cylinder. In fact, a small number of slots (fifteen or less) produce accurate agreement with the required field on the axis of the cylinder. Hyperthermia treatment of cancer in cylindrical objects such as limbs, and torsos are one potential application. Non destructive testing of manufactured cylindrical products is another application where the energy is focussed at a given region in the cylinder.
Author
Electric Potential; Cylindrical Bodies; Electric Fields; Electric Power

20050123681 Ohio State Univ., Columbus, OH, USA
Matrix Pade Via Lanczos for FEM Problems
Slone, Rodney D.; Lee, Robert; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1708-1711; In English; See also 20050123676; Copyright; Avail: Other Sources

Recently there has been a great deal of interest in using the Pade' Via Lanczos (PVL) technique to analyze the transfer functions and impulse responses of large scale linear circuits. In this paper, Matrix-Pade' Via Lanczos (MPVL), which can be used on multiple-input multiple-output systems, is applied to solve models resulting from applying the Finite Element Method (FEM) to electromagnetic wave propagation problems. The resulting solution procedure allows wideband frequency simulations with a reduction in computation time. Numerical simulations using this method are shown along with traditional methods using an LU decomposition at each frequency point of interest. Comparisons in accuracy as well as computation time are also given.
Author
Electromagnetic Wave Transmission; Finite Element Method; Transfer Functions; Linear Circuits; Impulses; Broadband

20050123686 Michigan Univ., Ann Arbor, MI, USA
Surface Integral Equations for Three Dimensional Surfaces Containing Circuit Analog Sheets
Topsakal, E.; Volakis, J. L.; Ross, Daniel C.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1832-1835; In English; See also 20050123676; Copyright; Avail: Other Sources
Author
Integral Equations; Analog Circuits; Surface Properties; Antenna Design

20050123687 Universidad Politecnica de Valencia, Valencia, Spain
Circuital Analysis of a Two-port Angular Sector
Penaranda-Foix, Felipe; Ferrando-Bataller, Miguel; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1852-1855; In English; See also 20050123676; Copyright; Avail: Other Sources
The objective of this communication is to introduce an element that allows us to analyze two-dimensional diffraction problems in a circuital way. The circuital analysis of electromagnetic problems, together to the segmentation technique, allow to analyse big problems, in an electromagnetic sense, with the additional advantage that a change in a material is readily computed. This makes this method very appropriate for its use in CAD tools. In this communication the problem of a sector considered as a quadripole is only presented, in such a way that we can see the advantages of the method. It is easy to see how we can enlarge the problem to a four-port net. Finally, we must say that only the TM case is presented here.
Author
Computer Aided Design; Diffraction; Electromagnetic Properties; Circuits

20050123690 Tomorrow's Research, Ellensburg, WA, USA
The World's First Comparison of Outdoor RCS Test Ranges
Knott, Eugene F.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1988-1991; In English; See also 20050123676; Copyright; Avail: Other Sources
In the mid-1960s the U.S. Air Force solicited bids for an evaluation of the RCS measurement capabilities of outdoor RCS test ranges operating in the USA at the time. Under the direction of Ralph E. Hiatt, then Head of the University of Michigan Radiation Laboratory, Rad Lab researchers prepared and submitted what turned out to be the winning bid. Five test ranges were identified to participate in the evaluation. The assessment was based on a series of measurements of the RCS patterns of five precision test cylinders and two models of an Agena B satellite. Of the five participating test ranges, one never completed its test assignment, and the one range that completed all tests with the highest accuracy and lowest cost was also the first to be taken over by another company. One test range severely damaged the largest test object but never mentioned that fact in its final report.
Author
Test Ranges; Radar Cross Sections

20050123698 City Univ. of Hong Kong, Kowloon, Hong Kong
Synthesis of Shaped-Beam Pattern for Mobile Antenna
Hu, Jin-Lin; Chan, Chi-Hou; Lin, Shi-Ming; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1596-1599; In English; See also 20050123676; Copyright; Avail: Other Sources
In the mobile communication system, the base station antennas are often required to radiate the shaped-beam patterns, which have as low a level as possible toward the interference zone where the same frequency is used and, conversely, have as high a level as possible toward the service zone (Fig.l). So, the synthesis of the shaped-beam pattern is one of great importance to designing the base station antennas. The problem of synthesizing shaped-beam patterns has received much

attention over the years and many synthesis methods have been presented. In this paper, we present a new synthesis method of the shaped-beam pattern by controlling only the excitation phases of the array elements. We first apply the array theory and the optimization theory to construct an objective function. Then, we employ apply the quasi-Newton method to minimize this nonlinear problem. Two synthesis examples based on the 16-element linear arrays are presented to demonstrate the efficiency of our method.
Derived from text
Mobile Communication Systems; Beams (Radiation); Excitation; Radiation Distribution; Linear Arrays; Frequencies

20050123700 Central Marine Research and Design Inst., Saint Petersburg, Russia
A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences
Marchuk, L. A.; Venskauskas, E. K.; Saveliev, A. N.; Venskauskas, K. K.; Titarenko. L. A.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1616-1619; In English; See also 20050123676; Copyright; Avail: Other Sources

A method for an antenna array (AA) beamforming, providing in the presence of interference correlated with a signal, obtaining of signal/(interference+noise) output ratio (SINR) values close to a potentially achievable value, is suggested. The method may be applied to AA of an arbitrary geometry, and for its realization accurate a priori data are not required.
Author
Adaptation; Antenna Arrays; Beamforming; Signal to Noise Ratios; Interference

20050123701 Altahady Univ., Sirte, Libyan Arab Jamahiriya
Design of a Smart Antenna for Reducing Co-Channel Interference in Cellular Mobile Communications
Saleeb, Adel A.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1620-1623; In English; See also 20050123676; Copyright; Avail: Other Sources

Smart antenna techniques offer the possibility of increasing the performance of mobile cellular communications systems by improving immunity to co-channel interference. Thus, the frequency-reuse distance can be reduced, and the number of available channels per cell is increased. In this paper a smart antenna was designed, and the number of elements, the distance between elements, and the weighting coefficients were calculated. The increase in the number of channels per cell was found to be 75%.
Author
Mobile Communication Systems; Antenna Design; Antenna Arrays; Electromagnetic Interference; Channels (Data Transmission)

20050123702 Sandia National Labs., Albuquerque, NM, USA
Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method
Johnson, W. A.; Warne, L. K.; Jorgenson, R. M.; Kotulski, J. D.; Butler, C. M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1633; In English; See also 20050123676
Contract(s)/Grant(s): DE-AC04-94AI-85000; Copyright; Avail: Other Sources

The state of affairs regarding the Electric Dyadic Green's function and its singularity at the time of the mid 70's when the first author was studying as a graduate student under Dr. Donald G. Dudley was at best confusing. A review of contributions made in this area (W. A. Johnson, A. Q. Howard, D. G. Dudley, Radio Sci., 14, 961-967, 1979) will be given. The distributional interpretation of the irrotational component of this dyad, a free space spectral expansion, and results obtained by analytically evaluating the k2 spectral integral through contour integration will be reviewed. It is also shown that away from the source one may represent the electric field in terms of the solenoidal vector wave functions alone, but the coefficients of these expansions must be modified to account for the contribution previously due to the irrotational vector wave functions. These results have been extended to spherical (R. E. Collin,Electromagnetics, 6,183- 207, 1986) and cylindrical coordinates (R. E. Collin, Field Theory of Guided Waves, Ch. 2, 1991.) A brief discussion of the pros and cons of potential methods versus field dyadic green's function methods will be given. Potential methods have enabled the development of general-purpose codes as the present day EIGER (Electromagnetic Interactions Generalized) code. As illustration some sample results involving slot subcell models and cavity coupling problems will be given.
Author
Electromagnetic Interactions; Green's Functions; Wave Functions; Coefficients; Electric Fields; Dyadics

20050123703 California Univ., Irvine, CA, USA

Dual Band Dual Linear Polarization Elliptical Microstrip Ring Antenna

Ramirez, Raul R.; DeFlaviis, Franco; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1636-1639; In English; See also 20050123676; Copyright; Avail: Other Sources

An analysis is presented for an aperture coupled microstrip elliptical ring antenna. Results demonstrate that the antenna has a dual resonance and the separation between resonances is controlled by the eccentricity of the ring. The antenna is excited by two independent perpendicular microstrip feeds parallel to the minor and major axis of the elliptical ring and which are located on a dielectric slab below the common ground plane. The orthogonality of the feeds creates two orthogonal linear polarized radiated fields. Theory demonstrates resonant frequencies from 12.0 GHz to 16.5 GHz, VSWR \h 2 bandwidth of 6%, and isolation of 15-30 dB. The antenna radiates a single main beam with a 3 dB beamwidth of 90deg and cross-polarization greater than 30 dB. The elliptical ring antenna is small (D/lambda(sub 0) = 0.315) at the lower resonance and the two layer design produces a completely planar antenna system which is compatible with microwave and millimeter, MIC, and monolithic MMIC integrated circuits.

Author

Microstrip Antennas; Linear Polarization; Antenna Design; Cross Polarization; Dielectrics; Integrated Circuits

20050123707 Pisa Univ., Italy

A New Genetic-Algorithm-based Frequency Selective Surface Design for Dual Frequency Applications

Manara, G.; Monorchio, A.; Mittra, R.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1722-1725; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper, an optimization procedure based on the genetic algorithm is applied to the design of frequency selective surfaces (FSSs) for dual frequency applications, fabricated by printed circuit technology. The inclusion of the shape of the mask in the set of parameters controlling the optimization scheme enables us to obtain the requisite frequency and polarization performance, while simultaneously reducing the number of layers in some cases.

Author

Frequencies; Genetic Algorithms; Selective Surfaces; Printed Circuits

20050123718 Calgary Univ., Alberta, Canada

Small Antenna Efficiency by the Reflection and the Q Measurement Methods

Johnston, Ronald H.; McRory, John G.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1810-1813; In English; See also 20050123676; Copyright; Avail: Other Sources

Two methods of determining antenna efficiency are compared. One is called the reflection method and the other is called the Q method. Both methods use data that is collected from a shorted waveguide in a similar manner to the 'Wheeler cap method'. The reflection method gives the expected results from two reference antennas. The Q method gives results that deviate from the expect values for two broadband reference antennas but give better results on two narrowband antennas.

Author

Antennas; Broadband; Narrowband; Waveguides

20050123719 Pisa Univ., Italy

Design and Simulation of Active Spiral Inductors for RF Integrated Circuits

D'Angelo, G.; Granchi, A.; Monorchio, A.; Neri, B.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1836-1839; In English; See also 20050123676; Copyright; Avail: Other Sources

A numerical simulation scheme is presented in this paper for the design of miniaturized inductors and transformers compatible with a silicon-based standard bipolar process for RF integrated circuits. A combination of FDTD method and SPICE simulator has been used for the feasibility study of high Q integrated active coils.

Author

Integrated Circuits; Inductors; Radio Frequencies; Finite Difference Time Domain Method; Bipolarity

20050123720 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, Germany

Discrete Mode Matching Method for the Analysis of Quasi-planar Structures

Ioffe, A.; Dreher, A.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1840-1843; In English; See also 20050123676; Copyright; Avail: Other Sources

The discrete mode matching (DMM) is an efficient full-wave analysis method, which is applied to planar multilayer and

multiconductor waveguide structures. Its extension to analyze quasi-planar multilayer structures is performed.
Author
Planar Structures; Waveguides

20050123721 Etisalat Univ. Coll., Sharjah, United Arab Emirates
Accurate and Efficient Computation of the Periodic Green's Function in Multilayered Media via a Hybrid Spectral/Spatial Summation with Optimized Complex Images
Shubair, R. M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1860-1863; In English; See also 20050123676; Copyright; Avail: Other Sources

The computation of the periodic Green's function in multilayered dielectric media is required for the analysis of the radiation or scattering characteristics of a wide class of structures including frequency-selective surfaces (FSS), optical gratings, beam couplers, and reflector antennas. The electromagnetic modeling of these periodic structures involves the formation of a boundary integral equation in which the kernel is a Green's function series that is very slowly convergent. To determine the radiation or scattering characteristics of the periodic structure, the derived integral equation is solved using the Method of Moments (MoM) where repeated evaluations of the Green's function series are required to fill in the impedance matrix of the structure being modeled. The slow convergence of the Green's function series would, therefore, result in a considerable amount of computation time. Many of the series-acceleration techniques that have been proposed dealt with the periodic Green's function in homogeneous free-space [1],[2]. Thus, an accurate and efficient technique that overcomes the slow convergence of the Green's function series in multilayered dielectric media would be mostly appreciated. The contribution of this paper is to provide such a technique that can apply to a wide class of problems involving general multilayered media structures. The technique is developed based upon the combination of a hybrid spectral/spatial summation with an optimized complex-image prediction model recently presented in [3]. It is shown that this combination results in a simple yet accurate and rapidly convergent formula for the computation of the periodic Green's function.
Derived from text
Method of Moments; Periodic Functions; Dielectrics; Integral Equations; Kernel Functions; Selective Surfaces; Reflector Antennas

20050123726 California Univ., Los Angeles, CA, USA
Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials
Kyriazidou, Chryssoula A.; Merrill, William M.; Contopanagos, Harry F.; Alexopoulos, Nicolaos G.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1912-1915; In English; See also 20050123676; Copyright; Avail: Other Sources

Composite periodic structures, also named photonic Band Gap (PBG) materials, have attracted a lot of attention lately due to their controllable dispersive properties that allow a wide range of applications in novel antenna structures and Frequency Selective Surfaces. Up to now, the analysis of PBG structures has been performed by numerical methods. Therefore optimizing the performance of a particular PBG design usually requires a case-by-case, trial and error method which is both CPU-time consuming and physically obscure. In order to bypass these limitations and isolate the response of the medium from the device in use, an effective description for PBG crystals is needed far beyond the quasistatic limit of traditional Effective Medium Theories. Such an effective description for a metalo-dielectric Photonic Band Gap (PBG) material with disk inclusions has been developed analytically. In this paper, we generalize this approach by presenting the effective permittivity and permeability functions for inclusions of a general canonical shape. This is useful in optimizing the band gap formation as a function of the shape of the implants. We focus on flat inclusions of infinitesimal thickness that create thin planar geometries which are relevant for microwave devices.
Author
Dielectrics; Permeability; Permittivity; Photonics; Energy Gaps (Solid State)

20050123728 Universidad Politecnica de Valencia, Valencia, Spain
Precise Dielectric Properties Determination of Laminar-shaped Materials in a Partially-filled Waveguide
Catala-Civera, J. M.; Penaranda-Foix, F.; Sanchez-Hernandez, D.; delosReyes, E.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1942-1945; In English; See also 20050123676; Copyright; Avail: Other Sources

An enhanced technique for complex dielectric properties characterization of laminar shaped materials is presented. The technique is based upon scattering measurements of a partially-filled rectangular waveguide. The influence of the different

parameters regarding the achievable accuracy have also been analyzed in order to determine the optimum sample configuration. Measurements of some commercial dielectric substrates used for printed antenna design were performed and have been used for validation purposes.
Author
Antenna Design; Dielectric Properties; Laminates; Rectangular Waveguides

20050123729 Universidad Politecnica de Valencia, Valencia, Spain
Characterization of Complex Dielectric Properties of Materials Using a Hybrid Iterative Method
Esteban, H.; Catala, J. M.; Cogollos, S.; Boria, V. E.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1946-1949; In English; See also 20050123676; Copyright; Avail: Other Sources

A new technique for the accurate calculation of complex dielectric properties of materials is presented. This technique is based on an optimization procedure which makes use of scattering measurements and simulated results of a cylindrical rod of dielectric material passing through a rectangular waveguide completely. The simulation tool employed is based on a very accurate hybrid iterative method. Results for the dielectric properties of low and high loss materials are presented and compared with results from technical literature.
Author
Dielectric Properties; Iteration; Optimization; Characterization

20050123730 Universidad Politecnica de Catalunya, Barcelona, Spain
Vectorial Waveguide Reflectometer for Dielectric Characterization of Materials Under Power Microwaves
Mallorqui, Jordi J.; Aguasca, Albert; Ribo, Serni; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1950-1953; In English; See also 20050123676
Contract(s)/Grant(s): PETRI-95-0084-OP; Copyright; Avail: Other Sources

The temperature rise in a material modifies its physical properties, particularly its dielectric permittivity. In many applications involving relatively high levels of power the electrical behavior of the different materials will change as they are heated by the radiation. For instance, the numerical codes that simulates the behavior of microwave heating processes in order to improve the design of the feeding antennas must take into account the load variations with temperature. The measurement of the changing dielectric characteristics of materials is of great interest for the industry. Previous works used completely filled waveguides near a shorting plate. The method supplied excellent results at low power levels, while the sample was not heated. When the power is risen, the field distribution of the TE(sub l0) mode causes a non-uniform heating of the sample and the measured permittivity corresponds to an average value. In order to reduce this problem a method using a partially filled waveguide is presented. The reduced sample dimensions and its positioning into the waveguide assures a near homogeneous power distribution implying a uniform heating.
Derived from text
Dielectrics; Microwaves; Reflectometers; Waveguides; Mathematical Models

20050123731 Michigan Univ., Ann Arbor, MI, USA
Electromagnetic Interference from Wind Turbines
Sengupta, Dipak L.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1984-1987; In English; See also 20050123676; Copyright; Avail: Other Sources

During the late nineteen seventies and eighties the University of Michigan Radiation Laboratory, under sponsorship from the U.S. Department of Energy, studied theoretically an experimentally the effects of wind turbines (WT's) on the performance of various electromagnetic systems. During the initial stage of this investigation Professor Ralph E. Hiatt was with the Radiation Laboratory and provided valuable guidance whenever needed. In memory of him the present talk will summarize selected portions of the fundamental work carried out and techniques developed under the program which are now routinely used throughout the world for such interference measurements and analyses.
Derived from text
Electromagnetic Interference; Wind Turbines

20050123746 Jiaotong Univ., Xian, China
Causality and Restrictions on the Initial-Boundary Conditions for Signal Propagation in Attenuating Medium
Wang, Gang; Wang, Wenbing; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1478-1481; In English; See also 20050123676
Contract(s)/Grant(s): NSFC-69601002; Copyright; Avail: Other Sources

To investigate the propagation of nonsinusoidal signal in bounded attenuating medium, it is generally required to solve the 2nd order hyperbolic partial differential equation (PDE) with specified initial-boundary conditions (IBCs). Because of the lack of;veil-posed conditions of such PDE system, some problems aroused in such system, referred to as Harmuth's problem, relating to the validity of Maxwell's equations for signal propagation in attenuating media. Recent investigations on the equivalence between the magnetic and electric sources in attenuating medium shows that similar problem arises. Mathematically, the problem is essentially restricted to the case whether we can give a complete solutions, including the associated magnetic (electric) propagation for electric (magnetic) excitation, for some specified signal such as the step function signal or the exponential ramp signal since for many other excitations, the equations with corresponding IBCs can be solved successfully. The lack of well-posed conditions baffles a comprehensive solving of the problem and has led to different solving techniques to give a unique and causal solution in practice. Actually, the well-posed condition is not all of the matter. As stated by Courant and Hilbert, 'that properly posed problem are by far not the only ones which appropriately reflects real phenomena', some physical laws must be added. Causality law is such one. By investigating the restrictions on the IBCs due to the causality requirement, supplement requirements on the IBCs of the 2nd order hyperbolic PDE, though does not mean the well-posed IBCs, can be offered to help the evaluation of Harmuth's modification to Maxwell's equations.
Derived from text
Attenuation; Boundary Conditions; Propagation; Magnetic Properties; Maxwell Equation; Equivalence

20050123754 Central Marine Research and Design Inst., Russia
Interference Cancellation Systems for Electromagnetically Dense Platforms
Venskauskas, Kostas; Venskauskas, Eduard; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1612-1615; In English; See also 20050123676; Copyright; Avail: Other Sources

An interference cancellation system based on theoretical considerations was constructed to suppress interference at receiver input from one or more high-powered transmitters and to permit collocation of the receiver and transmitters. The fundamental characteristics and field test performance of the interference cancellation systems were classified and it is shown that the new cancellation systems have a good possibility of being put into practical use.
Author
Cancellation; Transmitters; Electromagnetic Interference; Receivers

20050123755 Nippon Electric Co. Ltd., Japan
3D Super Resolution Algorithm for Analysis of Multi-path Propagation Structure
Kuwahara, Y.; Susukida, Y.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1604-1607; In English; See also 20050123676; Copyright; Avail: Other Sources

Analyzing multi-path propagation structure of the mobile communication environment is an important process to develop anti-fading techniques for high-speed digital radio communication. The multi-path propagation structure can be clarified by estimating the DOA(Direction Of Arrival),TOA(Time of Arrival) and relative power of incident waves.We have proposed a high resolution algorithm for analysis of multi-path propagation structure, and applied it to our multi-path propagation parameter measurement equipment. It is featured by paired DOA/TOA/relative power estimation using the super-resolution techniques under the mobile communication environment, and it has a capability of expanding 3D estimation, that is 2D DOA and TOA estimation. In this paper, we present the 3D super resolution algorithm and computer simulation.
Derived from text
Radio Communication; High Resolution; Computerized Simulation; Estimating; High Speed; Algorithms

20050123757 Technische Univ., Delft, Netherlands
Nonlinear Inversion in Three-dimensional Cross-well Induction Logging using Full-Vectorial Multi-Frequency Data
Abubakar, A.; Haak, K. F. I.; vandenBerg, P. M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2144-2147; In English; See also 20050123676; Copyright; Avail: Other Sources

A method for reconstructing the electrical conductivity from the cross-well induction logging measurements is presented. This work extends the method previously developed for the electrode logging (static) case to the more complicated induction logging (below 100 kHz) case using full-vectorial multi-frequency data. The target is assumed to be located in an object domain D embedded in an unbounded homogeneous domain with conductivity sigma(sub 0). To reconstruct the conductivity of this object domain D from a knowledge of the secondary field, we assume that the object is illuminated successively by a number of divers point magnetic dipoles directed in the logging direction at the borehole axes (j = 1,...,J), and at different frequencies (i = 1,...,I) with time factor exp(-i omega(sub i)t). For each excitation, we then have a full-vector three-dimensional

problem where the primary electric field is denoted as E(sup D)(sub i,j), and the total electric field as E(sub i,j). We assume that for the description of the material properties the Maxwell model for diffusion problem holds. We then introduce the conductivity contrast chi = sigma/sigma(sub 0) - 1, where sigma is the spatially dependent conductivity of the object domain D.
Author
Electrical Resistivity; Nonlinearity; Magnetic Dipoles

20050123761 Illinois Univ., Urbana, IL, USA
Complexity Issues in Inverse Scattering Problems
Chew, W. C.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1627; In English; See also 20050123676; Copyright; Avail: Other Sources

This talk will overview the inverse scattering problem. It will begin by discussing linear inverse scattering problems followed by nonlinear inverse scattering problems. Popular linear inverse scattering methods are diffraction tomography, holographic method, synthetic aperture radar method, and Born inversion method. These methods generally do not account for multiple scattering of the wave field inside a scatterer. Though simple, certain physics is a missed in these methods. To account for multiple scattering, one has to resort to nonlinear inverse scattering methods. This can be achieved via the use of the Born iterative method, the distorted Born iterative method, or the Newton-type methods. These methods have been used to process measurement data from microwave, acoustic wave, as well as electrical impedance tomography.
Derived from text
Inverse Scattering; Transmitters; Iterative Solution; Newton Methods; Diffraction; Electrical Impedance

20050123763 Kassel Univ., Germany
Identification Versus Imaging
Langenberg, K. J.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1629; In English; See also 20050123676; Copyright; Avail: Other Sources

The Singularity Expansion Method (SEM) represents the Laplace transform of a transient electromagnetic signal scattered by a target in terms of the superposition of a complex pole series and entire functions. Since the pole pattern in the.Laplace domain is representative for a particular target, identification schemes have been built upon this observation, yet they suffered from the very noise sensitivity of pole extraction algorithms and from the long-time misunderstanding of the role of the entire functions. The clarifying contributions by D.GJ)udley and his students are recognized, in particular for the application of SEM to ultrasonic elastic wave scattering for nondestructive testing purposes. It turned out that in this case, the entire function contn'butions become overwhelmingly dominant, and therefore, it seemed much more appropriate to concentrate on these 'first arrivals' employing imaging instead of identification schemes. The development and evaluation of such imaging algorithms is reviewed as being approximate linearized solutions of inverse scattering, and applications with regard to scalar acoustic, vector electromagnetic and tensor elastic waves are presented, which range from ultrasonic testing to ground probing radar. In cases where resonant - complex pole - contributions contaminate the - entire function - first arrivals,nonlinear inverse scattering schemes have to be applied, and some results referring to the Ipswich Data will be presented.
Author
Imaging Techniques; Electromagnetic Radiation; Inverse Scattering; Extraction; Ultrasonic Radiation; Elastic Waves

20050123764 Sandia National Labs., Albuquerque, NM, USA
Pulsed Power Fusion
Quintenz, J. P.; Seidel, D. B.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1630; In English; See also 20050123676
Contract(s)/Grant(s): DE-AC04-94AL-85000; Copyright; Avail: Other Sources

Since the early 1970's, scientists in laboratories around the world have been utilizing pulsed power drivers with very short (10's of nanoseconds) pulsed lengths for inertial confinement fusion (ICF) experiments. In the USA, this research has been sponsored by Defense Programs within the Department of Energy. Over the course of the insuing 25 years, the fundamental pulsed power components and accelerator architectures have evolved to a remarkable extent and today electrical pulses exceeding 50 TW are routinely obtained on the Z accelerator at Sandia National Laboratories. Many of the technological advances in pulsed power were driven by the demanding requirements placed upon accelerators by the needs of the fusion program. These requirements are driven by the goal of achieving up to 1 GJ of fusion yield from an ICF capsule for defense and energy applications. While the fusion yield goal has remained remarkably the same for the better part of two decades, the

required driver energy, capsule symmetry, and capsule drive pulse shape have evolved considerably as the community has learned more about the coupling of driver energy into the capsule ablator and the capsule response to this energy deposition. At the same time as the driver requirements were changing, the driver options for pulsed power were evolving as well. Early driver technologies included intense electron beams and z pinches. A zpinch, is a magnetic field driven implosion of a conductor, in this case a plasma. In the late 70_ there was a shift in emphasis toward accelerating and focusing light ions and very intense beams of up to 5 TW/c_were produced but these intensities remain far below the required approx. 100 TW/sq cm.

Derived from text

Inertial Confinement Fusion; Energy Transfer; Electric Fields; Magnetic Fields; Conductors

20050123765 Ohio State Univ., Columbus, OH, USA

Transient Plane Wave Scattering from Objects Near Lossy Ground with FDTD

Lee, Robert; Dvorak, Steve; Cangellaris, Andreas; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1631; In English; See also 20050123676; Copyright; Avail: Other Sources

The application of the finite difference time domain (FDTD) method to plane wave scattering from objects near a lossy ground has a major problc_n associated with it. Typically, an outer boundary condition is used to truncate the computation domain (such as an absorbing boundary condition or a perfectly matched layer); however, these formulations require a separation of the incident and scattered fields. For objects in free space, the transient incident plane wave can be represented analytically. For objects near a lossy half space, the transient incident wave must be obtained numerically through an application of the reverse Fourier transform. This numerical calculation must be done for all unknowns along a specified Surface surrounding the object for all lime. Thus, a direct application is very computationally expensive. Recently, some work has been done to efficiently evaluate the solution of a transient plane wave incident on a lossy halfspace (Pao, Dvorak, and Dudley, IEEE Antennas and Propagat, July 1996). We can now use this solution to obtain the incident wave solution in the FDTD method. To test out this concept, we consider a two-dimensional FDTD code which utilizes the anisotropic PML as the outer boundary condition. The solution is compared to those obtained from the 'brute force' approach with the inverse Fourier transform. Also, the computation time results are compared to demonstrate the efficiency of our method versus the 'brute force approach'

Author

Plane Waves; Finite Difference Time Domain Method; Wave Scattering; Boundary Conditions

20050123766 Houston Univ., TX, USA

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas

Williams, Jeffery T.; Jackson, David R.; Long, Stuart A.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1632; In English; See also 20050123676; Copyright; Avail: Other Sources

During the last few years a new class of microstrip patch antennas has been introduced. These microstrip antennas only produce a small amount of surface excitation and are referred to as Reduced Surface Wave (RSW) antennas. In addition, if printed on electrically thin substrates, these antennas only weakly excite lateral waves. As a result, these antennas do not suffer from the deleterious effects of surface and lateral wave scattering or the mutual coupling associated with the surface and lateral waves. These characteristics make the RSW antenna ideal for applications where the supporting substrate or ground plane of the antenna is small, cases in which diffraction of the surface and lateral waves from the edges of the structure may be quite significant for conventional microstrip antennas. These RSW antennas also show promise for array applications, where the presence of surface and lateral waves produce significant mutual coupling, which complicates the design process and leads to scan blindness. In this presentation we will summarize our studies of patch antennas that have reduced surface and lateral wave excitation. We will discuss a variety of structures that yield good RSW performance, and we will introduce a general method for constructing RSW antennas of arbitrary shape. Numerical results from the theoretical analyses of these antennas, along with supporting experimental results, will be presented. These results will include input impedance, bandwidth, radiation patterns, and mutual coupling. The results verify that extremely low surface-wave and lateral-wave excitation can be achieved with these designs, resulting in negligible diffraction of the surface and lateral waves from the support structure and very small mutual coupling between elements. In addition, we will demonstrate techniques for designing dual-band and circularly polarized RSW antennas.

Author

Microstrip Antennas; Patch Antennas; Antenna Radiation Patterns; Excitation; Surface Waves; Wave Excitation

20050123767 Alcatel Space Industries, Toulouse, France

Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar

Mangenot, Cyril; Lorenzo, Jerome; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1640-1643; In English; See also 20050123676; Copyright; Avail: Other Sources

An analysis is presented for an aperture coupled microstrip elliptical ring antenna. Results demonstrate that the antenna has a dual resonance and the separation between resonances is controlled by the eccentricity of the ring. The antenna is excited by two independent perpendicular microstrip feeds parallel to the minor and major axis of the elliptical ring and which are located on a dielectric slab below the common ground plane. The orthogonality of the feeds creates two orthogonal linear polarized radiated fields. Theory demonstrates resonant frequencies from 12.0 GHz to 16.5 GHz, VSWR \h 2 bandwidth of 6%, and isolation of 15-30 dB. The antenna radiates a single main beam with a 3 dB beamwidth of 90deg and cross-polarization greater than 30 dB. The elliptical ring antenna is small (D/lambda(sub 0) = 0.315) at the lower resonance and the two layer design produces a completely planar antenna system which is compatible with microwave and millimeter, MIC, and monolithic MMIC integrated circuits.

Author

Cross Polarization; Microstrip Antennas; Millimeter Waves; Antenna Design; Beams (Radiation); Dielectrics; Integrated Circuits

20050123777 Jordan Univ. of Science and Technology, Irbid, Jordan

Quasi-static Analysis of Asymmetric Cylindrical Coplanar Waveguide

Al-Zoubi, Asem; Obeidat, Khaled; Dib, Nihad; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1824-1827; In English; See also 20050123676; Copyright; Avail: Other Sources

Quasi-static characteristics of the asymmetric cylindrical coplanar waveguide (CCPW) are investigated using three different techniques: the conformal mapping method (CMM), the point matching method (PMM), and the finite difference method (FDM). The effect of various parameters on the characteristics of the CCPW is studied.

Author

Static Characteristics; Asymmetry; Cylindrical Bodies; Planar Structures; Waveguides

20050123778 North Carolina State Univ., Raleigh, NC, USA

Analysis of Shielded CPW Spatial Power Combiners

Khalil, Ahmed I.; Yakovlev, Alexander B.; Steer, Michael B.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1828-1831; In English; See also 20050123676

Contract(s)/Grant(s): DAAG55-97-K-0132; Copyright; Avail: Other Sources

A fast integral equation formulation is implemented in conjunction with the GSM to analyze waveguide-based CPW spatial power combiners. The GSM includes internal ports to account for active MMIC devices with passive circuit elements. The Kummer transformation is applied to accelerate slowly converging double series that occur in evaluating the impedance matrix elements.

Author

Waveguides; Integral Equations; Antenna Arrays

20050123779 Clemson Univ., SC, USA

Analysis of a Charge Probe and its Response near Metallic and Dielectric Interface

Ozzaim, Cengiz; Butler, Chalmers M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1684-1687; In English; See also 20050123676; Copyright; Avail: Other Sources

An electrically short thin-wire antenna oriented normal to a conducting surface is often used to measure the normal electric field or charge density at the surface. Calibration of the so-called charge probe is relatively simple if there are no nearby objects which can 'load' the probe and alter its response. A probe on a surface near a dielectric or conducting interface, as suggested in Fig. 1, is a case of practical interest in which probe loading must be accounted for if accurate measurements are expected. The main purposes of this paper are to lay the groundwork for an understanding of probe loading and to suggest a simple method for accounting for the effects of loading as the charge probe becomes arbitrarily close to the interface. From image theory the structure of Fig. 1 is seen to be equivalent to that of Fig. 2. The structure may represent either a radiator, if the wire is driven at the center, or a scatterer, if it is excited by an impressed field. The medium in which the probe is located is characterized by (mu(sub 0),(Epsilon(sub 0)) and that of the dielectric medium by (mu(sub 0), Epsilon, Epsilon(sub 0)). The primary quantities of interest are the driving point impedance and the current distribution on the wire. The problem of a wire

antenna near and parallel to a dielectric interface has been extensively investigated by methods that account for the presence of the interface via expensive Sommerfeld integrals. Most approximate techniques which avoid evaluation of Sommerfeld integrals break down when the distance between the wire and the interface is much smaller than the wavelength at the operating frequency. So usually Sommerfeld integrals are evaluated rigorously in an accurate analysis. In the present paper, we present a simple and accurate method for determining the current in a short wire very near an interface. Data computed from a method employing Sommerfeld integrals and the proposed approximate method are compared.
Author
Dielectrics; Electric Charge; Electric Fields; Antennas; Calibrating; Current Distribution

20050123782 Belgrade Univ., Yugoslavia
A New Approach for Accurate Analysis of Antennas Above Real Ground
Kolundzija, Branko M.; Dordevic, Antonije R.; Petrovic, Vladimir V.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1692-1695; In English; See also 20050123676; Copyright; Avail: Other Sources

Analysis of radiating structures above homogeneous conducting half-space (real ground) can be based on exact approaches (Sommerfeld method or Exact image theory) or some approximate method. (For survey of various methods see, e.g., Ref. [3]). Exact approaches involve calculation of semi-infinite integrals of special functions, which is an additional, time-consuming numerical task. On the other hand, approximate methods usually have uncertain accuracy and/or limited range of validity. In both cases it is necessary to augment the existing numerical code for analysis of radiating structures in a vacuum, to include the influence of the ground. This can be, however, a significant programming effort. The aim of this paper is to show how a method for the analysis of composite metallic and dielectric structures in a vacuum can be, without any modifications, used for accurate analysis of antennas above real ground. For this purpose, the WIPL-D program (a version of the WIPL program that includes dielectrics) will be used.
Author
Approximation; Numerical Analysis; Antennas; Dielectrics; Structural Analysis; Validity

20050123785 Manitoba Univ., Winnipeg, Manitoba, Canada
Reduced-Order Models for the Field Analysis of Hybrid Systems
Li, L. Y.; Ciric, I. R.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1712-1715; In English; See also 20050123676; Copyright; Avail: Other Sources

Hybrid electromagnetic structures containing transmission lines and lumped circuit elements are commonly found in interconnect circuits. At sufficiently low frequencies, the transmission lines can be modeled either by cascading lumped parameters or by using distributed parameters. For systems operating in the GHz frequency range, the quasi-TEM approximation is no longer valid and models taking into account all the components of the electromagnetic field should be used to accurately characterize the system performance. In most cases, however, the formulation of electromagnetic field problems based on these rigorous models yields very large systems of equations whose solution requires a large amount of computation. In order to reduce the computational cost involved, in this paper we construct a reduced-order electromagnetic field model based on moment-matching _echniques, for instance the Complex Frequency Hopping (CFH) [1], [2], for the analysis of hybrid systems consisting of transmission line structures and linear lumped circuit elements. Moment-matching techniques approximate the s-domain function associated with a linear system by a reduced-order model function that has a relatively small number of poles with respect to the original system function. Such a reduced-order model can be used to calculate the frequency and time responses with higher efficiency. In addition, by introducing linear lumped circuit elements into Maxwell's equations, both the transmission lines and the lumped elements can be analyzed by only using field models instead of treating them separately by different techniques. As a result, an efficient global solution for hybrid systems can be achieved. Numerical examples are presented to illustrate the performance of the proposed method.
Author
Hybrid Structures; Electromagnetic Fields; Frequency Hopping; Linear Circuits; Microwave Frequencies

20050123787 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization
Cwik, Tom; Fernandez, Salvador; Ksendzov, A.; LaBaw, Clayton C.; Maker, Paul D.; Muller, Richard E.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1726-1729; In English; See also 20050123676; Copyright; Avail: Other Sources

Frequency selective surfaces are widely used in the microwave and millimeter wave regions of the spectrum for filtering

signals. They are used in telecommunication systems for multi-frequency operation or in instrument detectors for spectroscopy. The frequency selective surface operation depends on a periodic array of elements resonating at prescribed wavelengths producing a filter response. The size of the elements is on the order of half the electrical wavelength, and the array period is typically less than a wavelength for efficient operation. When operating in the optical region, diffraction gratings are used for filtering. In this regime the period of the grating may be several wavelengths producing multiple orders of light in reflection or transmission. In regions between these bands (specifically in the infrared band) frequency selective filters consisting of patterned metal layers fabricated using electron beam lithography are beginning to be developed. The operation is completely analogous to surfaces made in the microwave and millimeter wave region except for the choice of materials used and the fabrication process. In addition, the lithography process allows an arbitrary distribution of patterns corresponding to resonances at various wavelengths to be produced. The design of sub-millimeter filters follows the design methods used in the microwave region. Exacting modal matching, integral equation or finite element methods can be used for design. A major difference though is the introduction of material parameters and thicknesses tha_ may not be important in longer wavelength designs. This paper describes the design of multi-bandwidth filters operating in the I-5 micrometer wavelength range. This work follows on previous design [1,2]. In this paper extensions based on further optimization and an examination of the specific shape of the element in the periodic cell will be reported. Results from the design, manufacture and test of linear wedge filters built using micro-lithographic techniques and used ir spectral imaging applications will be presented.
Author

Bandwidth; Selective Surfaces; Near Infrared Radiation; Infrared Filters; Microwaves; Millimeter Waves; Gratings (Spectra); Electron Beams; Lithography

20050123791 Polytechnic Univ., Brooklyn, NY, USA

Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components

Jiang, Ming-Ming; Tamir, Theodor; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1742-1745; In English; See also 20050123676

Contract(s)/Grant(s): NSF ECS-95-22078; Copyright; Avail: Other Sources

Studies of wave-scattering by structures that exhibit a multilayered geometry along the vertical axis and a periodic variation along the horizontal one have recently been stimulated by problems relevant to radio-wave propagation in urban environments, light-beam processing in optoelectronic devices, antenna arrays and other areas. However, most studies have considered situations having symmetric periodicity cells only, or asymmetric cells that contain either dielectric or metallic materials, but not both. To explore a wider class of such configurations, we have extended a recently developed modal transmission line approach so that asymmetric cells that include both dielectric and metallic components can now also be treated. The metallic portions are assumed to be perfectly conducting but they can be thick and may have arbitrary forms. Our approach can address structures having any number of layers, but we shall illustrate it here by considering a geometry that models the cross-section of a building wall as shown in Fig. 1. For a plane wave incident at an angle theta, we represent the scattered fields everywhere in terms of waves that progress along z and exhibit a variation along z that is given by the rigorous modal functions in each horizontal layer region. The amplitudes of those fields are then determined by satisfying the boundary conditions at the horizontal interfaces between the various layers.
Author

Wave Scattering; Asymmetry; Dielectrics; Radio Waves; Wave Propagation; Periodic Variations; Optoelectronic Devices

20050123792 California Univ., Irvine, CA, USA

Filtering Characteristics of Thin, Planar 3D Printed Element Arrays

Contopanagos, Harry; Kyriazidou, Chryssoula; Merrill, William; Alexopoulos, Nicolaos G.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1750-1753; In English; See also 20050123676; Copyright; Avail: Other Sources

Periodic Arrays of metallic elements have been popular in printed antenna designs for the past two decades. For these applications, the elements are individually excited and thc array factor is the primary design consideration, affecting directly the radiation pattern characteristics of the array. Therefore, in these applications, the element lattice and excitation distribution is of primary importance, while the increment separations are usually kept electrically large, of the order of half-substrate wavelength. Viewing such geometries as filtering dcvices: has not been examined in such detail. For these applications, the structure operates passively, the excitation of the elements being created by an external incident field and not subject to controlled design. The response of the structure, under these conditions, can have very interesting filtering characteristics and can be thc subject of optimum design provided the corresponding EM scattering has been solved. In this work, we focus on these aspects of these arrays, and we probe the question of optimizing this response, as a function of critical dimensions of

the printed elements. In two other contributions to these proceedings, further analysis of these structures will be provided, from a couple of different view points, namely: As effective crystallic media, with effective permittivities and permeabilities beyond the Effective Medium Theory (EMT) limit[11 and regarding their scattering characteristics under excitations that can be spectrally decomposed.
Author
Antenna Radiation Patterns; Excitation; Permeability; Scattering; Antenna Design

20050123810 Wroclaw Univ., Poland
Uni-polar Scanning Method for Near-field Measurements of Antennas
Kabacik, Pawel; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1806-1809; In English; See also 20050123676; Copyright; Avail: Other Sources

Despite a variety of advantages, near-field measurements suffer from two major constraints: The construction of the scanners makes them almost immobile, and scanning on large apertures is generally infeasible. This paper presents a concept of near-field antenna measurements which involve a new scanning approach to overcome these drawbacks. Owing to their high accuracy and a compact size of the test range, near-field measurements are widely used in many antenna engineering applications. One of the many attractive features of near-field antenna measurements is the potentiality of determining the radiation patterns and polarization properties in a spherical format (3D). For this reason, the use of near-field measurements is postulated in contemporary antenna engineering. However, despite their numerous advantages, near-field measurements suffer from some constraints resulting from the scanner construction. Therefore every improvement of the scanner design is of paramount importance. This paper presents a new scanner desi_ma and a new scanning method, recently developed in our laboratory. We propose that the new method be ten'ned uni-polar. The term uni-polar method has been used here to parallel the widely known bi-polar and polar methods, though we are aware of the substantial differences among them, in spite of several common features. The proposed construction makes the scanner easily portable and fast deployable at the measuring site. Uni-polar scanners allow measurements on large planar apertures, irrespective of their orientation. One of the impairments from which the scanner concept suffers is the threat of oscillation occurrence at the top of the probe-carrying arm, as well as its vulnerabilit3, to wind blow.
Derived from text
Near Fields; Antenna Radiation Patterns; Scanning; Rangefinding; Bipolarity; Size Distribution

20050123812 Astro Aerospace Corp., Carpinteria, CA, USA
The AstroMesh Deployable Reflector
Thomson, Mark W.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1516-1519; In English; See also 20050123676; Copyright; Avail: Other Sources

The AstroMesh is a mesh reflector for large aperture space antenna systems. It embodies a new concept for deployable space structures: a pair of ring-stiffened, geodesic truss domes, in which the ring is a truss deployed by a single cable. Compared to other mesh reflectors, the AstroMesh achieves uncharacteristically low levels of total mass, stowed volume, surface distortion, cost, and program schedule duration. Several large AstroMesh reflectors are being produced for a series of U.S. built commercial geosynchronous mobile communications spacecraft; first flight is planned for eady 2000. Figure 1 depicts the AstroMesh on the Euro-African Satellite Telecommunications (EAST) System, an example of a large aperture mobile communications satellite conceived by Matra Marconi Space. Two large models have been qualified for space flight with as-manufactured shape errors of less than D(6 x 10(exp -5)) RMS, and repeatability errors below D(5 x 10(exp -5)) RMS (where D is the aperture diameter). With current materials and manufacturing techniques, the AstroMesh design can achieve a surface accuracy from all error sources, including in-orbit environments, of D(2.5 x 10(exp -5)) RMS. Large margins on a very demanding passive intermodulation (PIM) specification have been achieved consistently.
Author
Reflectors; Large Space Structures; Geosynchronous Orbits; Aerospace Systems

20050123817 Lawrence Livermore National Lab., Livermore, CA, USA
Design of a TEM Waveguide for Ultra-wideband Applications
Pao, Hsueh-Yuan; Poggio, Andrew J.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1574-1577; In English; See also 20050123676
Contract(s)/Grant(s): W-7405-eng-48; Copyright; Avail: Other Sources

Impulse launching and receiving antennas are required for ultra-wideband applications involving high-fidelity

transmitting and sensing of impulse electromagnetic fields. Due to their dispersive characteristics conventional wideband antennas, such as log-periodic arrays, spiral antennas, and ridged horn type antennas, perform poorly as high-fidelity antennas for wideband impulsive waveforms. However, a TEM horn forms a natural structure for low-dispersion launching and receiving of ultra-wideband impulses. Many systems require TEM horns that operate in an environment where the lateral sides of the horn must be conducting material. Such horns thus have only one open surface and special measures must be taken to ensure the TEM characteristic. A candidate structure that satisfies this requirement can be derived from a flared waveguide with a conducting septum. But solutions for such structures are not readily available and the development of a design methodology is therefore difficult. To facilitate design, we have chosen to increase our understanding of the behavior of wave propagation in rectangular waveguide with septum, then flared waveguide with septum, and ultimately a flared rectangular horn with septum.
Author
Electromagnetic Fields; Horn Antennas; Broadband; Dispersing; Rectangular Waveguides; Wave Propagation

20050123821 China Scientific and Technical Univ., Hofei, China
Experiment Research On MM Wavelength Radar Absorbing Materials
Chen, Zhi-Ping; Zhu, Qi; Xu, Shan-Jia; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1970-1973; In English; See also 20050123676; Copyright; Avail: Other Sources

Experiments to obtain high quality millimeter wavelengths radar absorbing materials are discussed here. In order to obtain the best mixing proportion of materials, a great number of materials had been investigated. Several absorbing coat materials achieving aims are found.
Author
Millimeter Waves; Antiradar Coatings; Electromagnetic Radiation

20050123822 Pennsylvania State Univ., University Park, PA, USA
FDTD Modeling of an Artificially-synthesized Absorbing Medium
Yu, Wen-Hua; Mittra, Raj; Werner, H.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1962-1965; In English; See also 20050123676; Copyright; Avail: Other Sources

Special attention has been recently given to the study of periodic materials and wave propagation in periodic structures. Of particular interest is the possibility of using these periodic materials to achieve low reflection over a broad frequency band. In this paper, we present a novel infinite periodic structure comprised of lossy dielectric and magnetic materials in a checkerboard-type configuration. The search for an artificial structure that exhibits a good match to free space was motivated by the fact that, to date, it has not been possible to find a real material which satisfies the criterion epsilon prime, = mu prime, and epsilon double prime, = mu double prime, --- or similar ones that present a perfect match to the free space --- as does the well-known PML medium widely used for FDTD mesh truncation. The Finite Difference Time Domain (FDTD) technique is applied in conjunction with a periodic boundary condition to calculate the scattered field from the periodic structure for normallyincident plane waves. Because the computation is carried out in the time domain, only one FDTD simulation is required to calculate the scattering parameters in the frequency range of interest.
Derived from text
Finite Difference Time Domain Method; Mathematical Models; Dielectrics; Magnetic Materials

20050123823 Gaziantep Univ., Turkey
On the Incompatibility of Chirality Parameter Alpha and Chirality Admittance xi of Chiral Media
Uckun, Savas; Ege, Tuncay; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1974-1977; In English; See also 20050123676; Copyright; Avail: Other Sources

Different sets of empirical constitutive relations for biisotropic media have been proposed and discussed in literature for a long time. In this letter, incompatibility of chirality parameter alpha of Drude-Born-Fedeorov representation and chirality admittance xi of Post-Jaggard representation for reciprocal and lossless medium is discussed through the use of wave numbers.
Author
Chirality; Electrical Impedance; Isotropic Media; Incompatibility

20050123824 California Univ., Los Angeles, CA, USA
Design and Characterization of Diagonal Horn Antennas Using UCLA Bi-Polar Near-Field Measurement and Imaging Facilities
Eberwein, Walter J.; Rahmat-Samii, Yahya; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1818-1821; In English; See also 20050123676; Copyright; Avail: Other Sources

A current study at UCLA deals with the design of various horn antennas and feeds for reflector antennas. In order to enhance the radiation performance of typical pyramidal horns, the application of a diagonal horn has been considered. The radiation pattern of this horn antenna shows almost perfect circular symmetry so that the 3 dB, 10 dB and 20 dB beam widths are very closely equal. This is true not only for the 0deg - and 90deg -cut but also in the 45deg - and 135deg -plane [1]. All cross-sections through the diagonal horn antenna are square, starting from the feeding square waveguide to the aperture. For small flare angels the mode of propagation within the horn is principally such that the electric vector is parallel to one of the diagonals. Since orthogonal polarized beams will have the same far-field characteristic, the diagonal horn is an interesting candidate for use by itself or for reflector antennas. The emphasis of this article is to investigate some of the unique features of the diagonal horn by evaluating the images of its aperture field using the measured bi-polar near-field data.
Derived from text
Reflector Antennas; Antenna Feeds; Symmetry; Waveguides; Angels (Radar)

20050123825 Nebraska Univ., Lincoln, NE, USA
Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements
Narayanan, Ram M.; Borissov, Eugene; Sullivan, Jon L.; Winter, J. Blake; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1814-1817; In English; See also 20050123676; Copyright; Avail: Other Sources

With the rapid development of mobile communication systems and novel antenna architectures, it has become important to characterize the antenna radiation characteristics and the effect of the radio equipment quickly and accurately. The universally accepted form of antenna data is the complete radiation pattern, which in principle may be obtained by sampling the electric field over the three dimensional space around the antenna. For low gain antennas, the sampling should he done over the entire solid angle of a sphere as to account for all of the radiated energy. The practical way to obtain the radiation pattern is to record the signal received by the antenna under test (AUT) through its motion in spherical coordinates while the probe antenna is kept stationary. The main requirement for the positioning system is that the pedestal and the positioning mechanism should not introduce significant reflection and absorption errors. The amount of material used for the positioning system, therefore, must be minimized. The permittivity of the material should be close to one. Furthermore the positioner should be constructed without any metallic parts, so that it will not contaminate the quiet zone at the testing range. Several measurement systems have been reported so far to fulfill these requirements. An improved measurement system designed for and used by Centurion International, Inc. for efficiency measurements is reported in this paper. Careful design of the roll over azimuth positioner minimizes distortions of the pattern by the positioning mechanism. The accuracy of the measurement with this system is at the level comparable to single axis measurements.
Derived from text
Antenna Radiation Patterns; Mobile Communication Systems; Radiation Effects; Accuracy; Electric Fields

20050123826 Michigan Univ., Ann Arbor, MI, USA
Measured Back Scattering Cross Section of Thin Wires
Liepa, Valdis V.; Chang, Seichoong; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1980-1983; In English; See also 20050123676; Copyright; Avail: Other Sources

Prof. Ralph E. Hiatt was instrumental in designing the first anechoic chamber at the Radiation Laboratory Willow Run Facility of the University of Michigan. During the nineteen sixties it was one of the largest such facilities in the world. It is therefore appropriate to describe some of the basic RCS measurements, such as these wires, carried out in this chamber. A set of back scattering patterns was measured for a thin (metallic) wire (a/lambda = 6.27 x 10--3) for l/lambda = 0.3(0.25)0.5(0.5)1.60(0.10)5.42, where a is the radius of the wire, l is the wire length, and lambda is the wavelength. From the set of patterns a number of curves were extracted showing the amplitude and phase of each back scattering lobe as a function of the wire length. These curves provide a convenient means of cross section estimation and may be used to reconstruct with reasonable accuracy the back scattering pattern for any value of l/lambda, l/lambda less than or equal to 5.42. These data have been found useful in studies dealing with scattering form composite geometrical shapes where it is often found useful to compare the back scattering patterns with those of a thin wire, especially in the resonance region. A block diagram of a CW system used for the measurement is given.
Derived from text
Backscattering; Cross Sections; Wire

20050123827 Georgia Inst. of Tech., Atlanta, GA, USA

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses

Peterson, Andrew F.; Rausch, Ekkehart O.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1844-1847; In English; See also 20050123676; Copyright; Avail: Other Sources

Rotman lenses find potential application in a variety of electronically steered antennas, including radar, communication, synthetic vision, and automobile collision avoidance systems. Traditional Rotman lens designs can be carried out following [1-3]. However, the design equations do not specify the shape of the sidewall that joins the lens focal ports to the lens array ports, and while they specify the port locations they do not specify the port widths. These parameters can substantially affect the lens performance, especially the side lobe level and insertion loss. In order to evaluate various lens designs, and to determine the effect of mutual coupling on the lens performance, numerical models have been developed to predict the N-port scattering matrix of lenses. In the course of a series of design projects, these models have been implemented for four different lens realizations: microstrip, stripline, waveguide using horizontally-oriented rectangular waveguide feeds,and waveguide using vertically-oriented feeds [4-7]. A similar analysis was originally proposed for stripline Rotman lenses by Chan[8]. Figure 1 shows a Rotman lens geometry, including feed lines used to route the signals between the input and output ports and the lens cavity. Microstrip or stripline realizations excite TEM or quasi-TEM waves in the feeds and cavity, with the electric field vertical to the ground planes defining the cavity. It is also possible to design a narrow-band lens using a higher-order parallel-plate mode of propagation within the lens cavity, where the electric field is parallel to the planes of the lens cavity [6-7]. The feed lines are tapered along their transverse dimension to provide a transition and an improved impedance match between the apertures at the cavity boundary and the connectors. To prevent higher-order modes from forming within the tapered lines, some form of power divider is often employed to split each feed line into two, creating smaller apertures. Along the sides of the lens, dummy ports may be introduced to fill out the contour, or absorber material may be placed in the lens ears to reduce reflections. A convenient description of the N-port device can be obtained in terms of a scattering matrix (S-matrix), which relates the complex-valued amplitudes of input and output signals at a single frequency. The formulation is based on a generalization of planar circuit analysis. In planar circuit analysis, the electric and magnetic fields within microstrip or stripline devices are assumed to bc invariant with respect to z (their thin dimension) which permits these devices to be modeled as two-dimensional structures. A two dimensional integral equation is used to relate the fields around the outer contour of the structure. TEM Rotman lenses were modeled this way by Chan [8], who first introduced the use of waveguide-like modes in the feed apertures, enhancing the efficiency of analysis. This presentation will describe the numerical formulation, including several extensions of Chan's original analysis, and illustrate the utility of modeling for the design of several Rotman lenses.

Derived from text

Microstrip Devices; Magnetic Fields; Mathematical Models; Electric Fields; Waveguides; Rectangular Waveguides; Numerical Analysis; Lenses; Integral Equations; Electric Networks

20050123828 Utah State Univ., Logan, UT, USA

Microstrip Antennas for Dielectric Property Measurement

Deffendol, Candace; Furse, Cynthia; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1954-1956; In English; See also 20050123676; Copyright; Avail: Other Sources

The measurement of the dielectric properties of materials is of great interest in a variety of applications including measurement of the moisture, fat, salt, or sugar content of grains and food products, measurement of human tissues or artificial phantom materials used to simulate them, and many other scientific and commercial applications. Conventional methods of measuring these properties include coaxial measuring probes or cylindrical capacitive cells. The commercial equipment available for this purpose is generally too expensive to be used 'in-line' and may be too fragile for many applications in harsh conditions. This paper describes microstrip antenna designs for the determination of dielectric properties. These antennas are designed for durability in extreme conditions and utilize a change of impedance when in direct or near contact to the sample to determine the dielectric properties.

Author

Antenna Design; Dielectric Properties; Microstrip Antennas

20050123831 Department of Agriculture, Athens, GA, USA

Density- and Structure-independent Calibration Method for Microwave Moisture Determination in Granular Materials

Trabelsi, Samir; Kraszewski, Andrzej W.; Nelson, Stuart O.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1958-1961; In English; See also 20050123676; Copyright; Avail: Other Sources

Moisture content of granular materials can be determined indirectly and nondestructively from measurements of their dielectric properties at a given frequency and a given temperature. Several sensors have been developed based on this principle and successfully used in different industries including pharmaceutical, construction, and food and agricultural products processing. However, effects of both the bulk density and structure are troublesome and cause significant errors if they are not taken into account or eliminated by defining appropriate calibration functions. It is possible to determine bulk density by an additional device, such as a gamma-detector, and compensate for its effect in the reading output of the meter. The structure, i. e., size and geometry in this instance, has a more subtle effect, and although it is known to affect the scattering and absorption properties of the material, it is not possible to quantify this effect by measurement or theoretical means, and hence it cannot be compensated for in the final meter output. The only method applied to this time requires individual calibration for each particular material and instrument. In this paper, a new method is presented for moisture determination in granular material independent of bulk density and structure. This unified calibration method is based on the combination of two concepts, i. e., density independence and structure independence, embodied in a function fully defined in terms of the dielectric properties as shown.
Derived from text
Granular Materials; Microwaves; Moisture Content; Density (Mass/Volume); Calibrating

20050123846 Wisconsin Univ., Madison, WI, USA
Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Nonpalpable Breast Tumors
Hagness, Susan C.; Taflove, Allen; Bridges, Jack E.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1886-1889; In English; See also 20050123676
Contract(s)/Grant(s): NIH-1-R43-CA67598-D1A2; Copyright; Avail: Other Sources

We are developing a confocal microwave imaging system for the detection of early-stage breast cancer. Our proposed microwave sensor represents a novel adaptation and application of the principles of ultrawideband radar technology and confocal optical microscopy. The sensor is comprised of an electronically switched monostatic antenna array that synthetically focuses a low-power pulsed microwave signal at a focal point within the breast and collects the backscattered signal. Malignant tumors have a significant scattering radar cross section due to the large dielectric contrast between malignant tumors and adjacent normal breast tissue. Therefore, the intensity of the backscattered signal increases dramatically when the focuses transmitted signal encounters a malignant tumor. Two key performance specifications for the microwave sensor are the signalto- clutter (S/C) ratio, defined as the ratio of the peak backscatter return from a tumor to the peak backscatter return from clutter, and the system dynamic range, defined as the ratio of the peak pulse power of the source to the system noise floor due to reverberations and thermal noise. Our two-dimensional FDTD simulations involving the computation of S/C ratios [1,2] have demonstrated the feasibility of detecting lesions as small as lmm in diameter. In this paper, we highlight the results of our three-dimensional simulations of an antenna-array element placed at the surface of a breast tissue half-space.
Derived from text
Antenna Arrays; Backscattering; Cancer; Finite Difference Time Domain Method; Functional Design Specifications; Microwave Imagery; Scattering Cross Sections; Three Dimensional Models

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20050092382 NASA Marshall Space Flight Center, Huntsville, AL, USA
Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup
Trinh, Huu P.; Chen, C. P.; [2005]; 21 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Ja. 2005, Reno, NV, USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

Recent experimental investigations and physical modeling studies have indicated that turbulence behaviors within a liquid jet have considerable effects on the atomization process. This study aims to model the turbulence effect in the atomization process of a cylindrical liquid jet. Two widely used models, the Kelvin-Helmholtz (KH) instability of Reitz (blob model) and the Taylor-Analogy-Breakup (TAB) secondary droplet breakup by O Rourke et al, are further extended to include turbulence effects. In the primary breakup model, the level of the turbulence effect on the liquid breakup depends on the characteristic scales and the initial flow conditions. For the secondary breakup, an additional turbulence force acted on parent drops is

modeled and integrated into the TAB governing equation. The drop size formed from this breakup regime is estimated based on the energy balance before and after the breakup occurrence. This paper describes theoretical development of the current models, called 'T-blob' and 'T-TAB', for primary and secondary breakup respectivety. Several assessment studies are also presented in this paper.
Author
Turbulence Models; Turbulence Effects; Liquid Atomization

20050109851 Reaction Engineering International, Salt Lake City, UT
Computational Fluid Dynamics Based Investigation of Sensitivity of Furnace Operational Conditions to Burner Flow Controls
Jun. 2004; In English
Report No.(s): DE2004-828894; No Copyright; Avail: National Technical Information Service (NTIS)

The goal of this project is to systematically evaluate and quantify the sensitivity of furnace operational conditions to burner air and fuel flow controls in coal fired utility boilers. The approach is to utilize computational fluid dynamic (CFD) modeling to investigate the influence of variations of burner air and fuel flows under well controlled conditions on NOx emissions, unburned carbon, furnace exit CO, particulate deposition on waterwalls and boiler heat transfer characteristics in two wall-fired PC units (front and opposed wall-fired), two corner-fired PC units and one cyclone-fired unit. The lack of available information quantifying the benefit of expensive air and fuel flow controls on furnace performance is the motivating factor for this study.
NTIS
Computational Fluid Dynamics; Furnaces; Sensitivity; Burners

20050109906 NASA Marshall Space Flight Center, Huntsville, AL, USA
Automated Extraction of Secondary Flow Features
Dorney, Suzanne M.; Haimes, Robert; [2005]; 12 pp.; In English; 43rd Aerospace Sciences Meeting and Exhibit Conference, 10-13 Jan. 2005, Reno, NV, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The use of Computational Fluid Dynamics (CFD) has become standard practice in the design and development of the major components used for air and space propulsion. To aid in the post-processing and analysis phase of CFD many researchers now use automated feature extraction utilities. These tools can be used to detect the existence of such features as shocks, vortex cores and separation and re-attachment lines. The existence of secondary flow is another feature of significant importance to CFD engineers. Although the concept of secondary flow is relatively understood there is no commonly accepted mathematical definition for secondary flow. This paper will present a definition for secondary flow and one approach for automatically detecting and visualizing secondary flow.
Author
Computational Fluid Dynamics; Secondary Flow; Vortices; Engineers

20050110012 Queensland Univ., Brisbane, Australia
Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna
Yau, Desmond; Shuley, Nicholas V.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 858-861; In English; See also 20050109927; Copyright; Avail: Other Sources

Rectangular dielectric resonator antenna (DRA) is increasingly popular in many wireless communication applications. This antenna offers advantages such as compact size, high radiation efficiency, wide bandwidth. Because of the resonator shape, it is very easy to fabricate compared to its counterparts, the cylindrical and hemispherical DRA. The antenna characteristic such as bandwidth, resonant frequency and radiation pattern can be conveniently controlled by tuning to the desired mode through adjustment of the aspect ratio. An aperture coupled DRA offers additional advantages such as economical and ease to build, compatible to MMIC fabrication, and adaptable to different mountable surfaces. far, the aperture coupled rectangular DRA has been analyzed by simple methods such as the magnetic wall model or the dielectric waveguide model (DWM), and the rigorous FDTD method. The former methods only approximate and lack accuracy; while the latter method is accurate is computationally time consuming and required large computer resources. this paper, an efficient but rigorous model based on surface integral equation (SIE) approach is proposed for the analysis of the antenna. The dielectric resonator (DR) is modeled in terms of equivalent surface electric magnetic currents using combined field integral equations (CFIE) formulation. The CFIE, the microstrip feedline and the associated coupling mechanism are formulated as a set of coupled equations in the spatial domain in the form of the mixed potential integral equations (MPIE). The coupled integral

equations are solved by use of the method of moments (MoM) using Galerkin procedure. In the microstrip region, closed-form Green's functions are employed in the calculation to enhance numerical efficiency. It will be demonstrated that the proposed model is very economical in usage of computer resources for generating accurate results for input impedance.
Derived from text
Apertures; Dielectric Waveguides; Fabrication; Method of Moments; Resonators; Rectangular Waveguides; Antenna Design; Coupled Modes

20050110354 Naval Postgraduate School, Monterey, CA USA
An Experimental Study of Steady State High Heat Flux Removal Using Spray Cooling
Fillius, James B.; Dec. 2004; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429841; No Copyright; Avail: Defense Technical Information Center (DTIC)

Spray cooling is a promising means of dissipating large steady state heat fluxes in high density power and electronic systems, such as thermophotovoltaic systems. The present study reports on the effectiveness of spray cooling in removing heat fluxes as high as 220 W/cm2. An experiment was designed to determine how the parameters of spray volumetric flow rate and droplet size influence the heat removal capacity of such a system. A series of commercially available nozzles were used to generate full cone water spray patterns encompassing a range of volumetric flow rates (3.79 to 42.32 L/h) and droplet Sauter mean diameters (17.4 to 35.5 micrometers). The non-flooded regime of spray cooling was studied, in which liquid spreading on the heater surface following droplet impact is the key phenomenon that determines the heat transfer rate. The experimental data established a direct proportionality of the heat flux with spray flow rate, and an inverse dependence on the droplet diameter. A correlation of the data was developed to predict heat flux as a function of the studied parameters over the range of values tested in this experiment.
DTIC
Cooling; Flow Velocity; Heat Flux; Sprayers; Steady State

20050110426 Army Tank-Automotive Research and Development Command, Warren, MI USA
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model
Schihl, Peter; Tasdemir, John; Bryzik, Walter; Schiele, Tom; Schwarz, Ernie; Nov. 2004; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429958; TARDEC-TR-14352; No Copyright; Avail: Defense Technical Information Center (DTIC)

One of the key challenges facing diesel engine system modelers lies in adequately predicting the fuel burning rate profile given the direct relationship between energy release and key performance parameters such as fuel economy, torque, and exhaust emissions. Current state-of-the-art combustion sub-models employed in such system simulation codes rely heavily on empiricism and successful application of such sub-models for new engine designs is highly dependent on past experience with similar combustion systems. One common approach to address this issue is to expend great effort choosing associated empirical coefficients over a range of similar combustion system designs thus improving the potential predictive capability of a given empirical model. But, continual combustion system development and design changes limit the extrapolation and application of such generic combustion system dependent coefficients to new designs due to various reasons, including advancements in fuel injection systems, engine control strategy encompassing multiple injections, and combustion chamber geometry. In order to address these very difficult challenges, an extensive effort has been applied toward developing a physically based, simplified combustion model for military-relevant diesel engines known as the Large Scale Combustion Model (LSCM). Recent effort has been spent further refining the first stage of the LSCM two stage combustion model that is known as the premixed phase sub-model. This particular sub-model has been compared with high-speed cylinder pressure data acquired from two relevant direct injection diesel engines with much success based on a user defined parameter referred to as the laminar flame speed by the combustion community.
DTIC
Burning Rate; Combustion Physics; Diesel Fuels; Flame Propagation; Flames; Laminar Flow; Premixing; Scale Models; Turbulent Flames; Turbulent Flow

20050110446
Performance of Propeller 4381 in Crashback
Chesnakas, Christopher J.; Donnelly, Martin J.; Fry, David J.; Jessup, Stuart D.; Park, Joel T.; Dec. 2004; 62 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429989; NSWCCD-50-TR-2004/010; No Copyright; Avail: Defense Technical Information Center (DTIC)

Propeller operation in crashback is technically very challenging, both computationally and experimentally. Propeller 4381 was evaluated experimentally in Carderock's 36-inch (0.91 m) water tunnel. Propeller 4381 was operated in the ahead condition for comparison. Details of the flow field were measured with 3-component laser Doppler velocimetry (LDV) and 2-component particle imaging velocimetry (PIV). Propulsion performance was measured with thrust and torque transducers. Cavitation was documented photographically with a strobe light, and flow visualization was conducted with a vertical laser light sheet for observation of the recirculation region of the propeller in crashback. Results showed that highly random cavitation occurred on the propeller in crashback on the downstream side at the leading edge, which is the trailing edge for ahead. A highly unstable recirculation zone occurred with a ring vortex near the propeller tip. The maximum variation in thrust and torque as computed from the standard deviation relative to the mean load with a value of 0.25 occurred at an advance ratio of J = -0.5. The high variation in loads appeared to correlate with the maximum total kinetic energy relative to tunnel velocity in the flow at the blade tip, which was measured by LDV as 1.5. These results indicate that vibration and wear may be reduced by minimizing operation near J = - 0.5 for this propeller.
DTIC
Flow Distribution; Fluid Flow; Marine Propulsion; Propellers

20050111470 NASA Marshall Space Flight Center, Huntsville, AL, USA
Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out
Wang, Ten-See; Droege, Alan; D'Agostino, Mark; Lee, Young-Ching; Williams, Robert; Journal of Propulsion and Power; May-June 2003; Volume 20, No. 3, pp. 385-393; In English; 36th AIAA Thermophysics Conference, 23-26 Jun. 2003, Orlando, FL, USA; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A computational heat transfer design methodology was developed to study tbe dual-engine linear aerospike plume-induced base-heating environment during one power-pack out, in ascent flight. It includes a three-dimensional, finite volume, viscous, chemically reacting, and pressure-based computational fluid dynamics formulation, a special base-bleed boundary condition, and a three-dimensional, finite volume, and spectral-line-based weighted-sum-of-gray-gases absorption computational radiation heat transfer formulation. A separate radiation model was used for diagnostic purposes. The computational methodology was systematically benchmarked. in this study, near-base radiative heat fluxes were computed, and they compared well with those measured during static linear aerospike engine tests. The base-heating environment of 18 trajectory points secected from three power-pack out scenarios was computed. The computed asymmetric base-heating physics were analyzed. The power-pack out condition has the most impact on convective base heating when it happens early in flight. The soume of its impact comes from the asymmetric and reduced base bleed.
Author
Aerospike Engines; X-33 Reusable Launch Vehicle; Base Heating; Engine Failure; Impingement

20050111588 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Transport Coefficients and Molecular Dynamics: Alternatives
Mountain, R. D.; Oct. 2004; 34 pp.; In English
Report No.(s): PB2005-102267; NISTIR-7170; No Copyright; Avail: CASI; A03, Hardcopy

The task of using molecular dynamics to determine the shear viscosity and the thermal conductivity of a model fluid is examined in detail for the Lennard-Jones fluid. The equilibrium time correlation function approach is compared with three nonequilibrium methods, Poiseuille Flow, Momentum Impulse Relaxation, and Reversed Perturbation Nonequilibrium Molecular Dynamics. The conventional wisdom is that the equilibrium approach requires very long simulation times in order to obtain statistically significant results. This study finds that only the Reversed Perturbation Nonequilibrium Molecular Dynamics method has the possibility of significantly reducing the simulation time required to obtain 'good' estimates for the thermal conductivity. All of the reliable methods examined can produce accurate estimates for the shear viscosity with shorter simulation times than are needed for the determination of the thermal conductivity.
NTIS
Molecular Dynamics; Transport Properties

20050123595 NASA Marshall Space Flight Center, Huntsville, AL, USA, Alabama Univ., Huntsville, AL, USA
Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup
Trinh, Huu; Chen, C. P.; May 05, 2004; 9 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

Recent experimental investigations and physical modeling studies have indicated that turbulence behaviors within a liquid

jet have considerable effects on the atomization process. For certain flow regimes, it has been observed that the liquid jet surface is highly turbulent. This turbulence characteristic plays a key role on the breakup of the liquid jet near to the injector exit. Other experiments also showed that the breakup length of the liquid core is sharply shortened as the liquid jet is changed from the laminar to the turbulent flow conditions. In the numerical and physical modeling arena, most of commonly used atomization models do not include the turbulence effect. Limited attempts have been made in modeling the turbulence phenomena on the liquid jet disintegration. The subject correlation and models treat the turbulence either as an only source or a primary driver in the breakup process. This study aims to model the turbulence effect in the atomization process of a cylindrical liquid jet. In the course of this study, two widely used models, Reitz's primary atomization (blob) and Taylor-Analogy-Break (TAB) secondary droplet breakup by O Rourke et al. are examined. Additional terms are derived and implemented appropriately into these two models to account for the turbulence effect on the atomization process. Since this enhancement effort is based on a framework of the two existing atomization models, it is appropriate to denote the two present models as T-blob and T-TAB for the primary and secondary atomization predictions, respectively. In the primary breakup model, the level of the turbulence effect on the liquid breakup depends on the characteristic time scales and the initial flow conditions. This treatment offers a balance of contributions of individual physical phenomena on the liquid breakup process. For the secondary breakup, an addition turbulence force acted on parent drops is modeled and integrated into the TAB governing equation. The drop size formed from this breakup regime is estimated based on the energy balance before and after the breakup occurrence. The turbulence energy is also considered in this process.
Author
Turbulence Effects; Liquid Atomization; Mathematical Models; Jet Flow

20050123596 NASA Langley Research Center, Hampton, VA, USA
Comments on the paper by Zinoviev and Bies 'On Acoustic Radiation by a Rigid Object in a Fluid Flow'
Farassat, F.; [2005]; 11 pp.; In English
Contract(s)/Grant(s): 23-781-10-33; No Copyright; Avail: CASI; A03, Hardcopy

In a recent paper by Zinoviev and Bies in this Journal, the authors have claimed that the well-known theoretical results of Curle and Ffowcs Williams and Hawkings (FW-H) are incorrect. This claim is categorically refuted below and serious errors are pointed out.
Author
Aeroacoustics; Rigid Structures; Fluid Flow

20050123602 NASA Langley Research Center, Hampton, VA, USA
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers
Gaffney, R. L., Jr.; Xiao, X.; Edwards, J. R.; Hassan, H. A.; [2005]; 13 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): FA9101-04-C-0015; NAG1-03030; 23-065-50-SL
Report No.(s): AIAA Paper 2005-1098; Copyright; Avail: CASI; A03, Hardcopy

A new turbulence model suited for calculating the turbulent Prandtl number as part of the solution is presented. The model is based on a set of two equations: one governing the variance of the enthalpy and the other governing its dissipation rate. These equations were derived from the exact energy equation and thus take into consideration compressibility and dissipation terms. The model is used to study two cases involving shock wave/boundary layer interaction at Mach 9.22 and Mach 5.0. In general, heat transfer prediction showed great improvement over traditional turbulence models where the turbulent Prandtl number is assumed constant. It is concluded that using a model that calculates the turbulent Prandtl number as part of the solution is the key to bridging the gap between theory and experiment for flows dominated by shock wave/boundary layer interactions.
Author
Prandtl Number; Turbulent Heat Transfer; Hypersonic Speed; Turbulence Models

20050123630 Clemson Univ., SC, USA
Miniature Heat Transport System for Spacecraft Thermal Control
Ochterbeck, Jay M.; Ku, Jentung, Technical Monitor; [2002]; 81 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-10367; No Copyright; Avail: CASI; A05, Hardcopy

Loop heat pipes (LHP) are efficient devices for heat transfer and use the basic principle of a closed evaporation-

condensation cycle. The advantage of using a loop heat pipe over other conventional methods is that large quantities of heat can be transported through a small cross-sectional area over a considerable distance with no additional power input to the system. By using LHPs, it seems possible to meet the growing demand for high-power cooling devices. Although they are somewhat similar to conventional heat pipes, LHPs have a whole set of unique properties, such as low pressure drops and flexible lines between condenser and evaporator, that make them rather promising. LHPs are capable of providing a means of transporting heat over long distances with no input power other than the heat being transported because of the specially designed evaporator and the separation of liquid and vapor lines. For LHP design and fabrication, preliminary analysis on the basis of dimensionless criteria is necessary because of certain complicated phenomena that take place in the heat pipe. Modeling the performance of the LHP and miniaturizing its size are tasks and objectives of current research. In the course of h s work, the LHP and its components, including the evaporator (the most critical and complex part of the LHP), were modeled with the corresponding dimensionless groups also being investigated. Next, analysis of heat and mass transfer processes in the LHP, selection of the most weighted criteria from known dimensionless groups (thermal-fluid sciences), heat transfer rate limits, (heat pipe theory), and experimental ratios which are unique to a given heat pipe class are discussed. In the third part of the report, two-phase flow heat and mass transfer performances inside the LHP condenser are analyzed and calculated for Earth-normal gravity and microgravity conditions. On the basis of recent models and experimental databanks, an analysis for condensing two-phase flow regimes, pressure gradients, and local heat transfer coefficients using ammonia, propylene, and R134, are carried out.
Author (revised)
Temperature Control; Spacecraft Temperature; Heat Pipes; Spacecraft Equipment

20050123647 NASA Langley Research Center, Hampton, VA, USA
Development of a Pulsed Combustion Actuator For High-Speed Flow Control
Cutler, Andrew D.; Beck, B. Terry; Wilkes, Jennifer A.; Drummond, J. Philip; Alderfer, David W.; Danehy, Paul M.; [2005]; 16 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): NCC1-03011
Report No.(s): AIAA Paper 2005-1084; Copyright; Avail: CASI; A03, Hardcopy

This paper describes the flow within a prototype actuator, energized by pulsed combustion or detonations, that provides a pulsed jet suitable for flow control in high-speed applications. A high-speed valve, capable of delivering a pulsed stream of reactants a mixture of H2 and air at rates of up to 1500 pulses per second, has been constructed. The reactants burn in a resonant chamber, and the products exit the device as a pulsed jet. High frequency pressure transducers have been used to monitor the pressure fluctuations in the device at various reactant injection frequencies, including both resonant and off-resonant conditions. The combustion chamber has been constructed with windows, and the flow inside it has been visualized using Planar Laser-Induced Fluorescence (PLIF). The pulsed jet at the exit of the device has been observed using schlieren.
Author
Actuators; High Speed; Pulse Detonation Engines; Combustion Chambers; Flow Regulators

20050123654 Georgia Inst. of Tech., Atlanta, GA, USA
Novel Optical Diagnostic Techniques for Studying Particle Contact and Deposition Upon a Large Cylinder in a Sheared Suspension
Rashidnia, Nasser, Technical Monitor; Yoda, Minami; [2004]; 9 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2373; No Copyright; Avail: CASI; A02, Hardcopy

The objectives of this research project were: 1) To study the fluid dynamics of sheared particle-liquid suspensions and the impact of differential particle-fluid inertia; 2) To develop new techniques for observing suspension particle contact and deposition upon solid surfaces. Dr. Yoda was supported by the NASA Office of Biological and Physical Research on a four-year grant from March 2000 through November 2004 for a ground-based study on the fluid dynamics of sheared particle-liquid suspensions and the impact of differential particle-fluid inertia on such flows. Such inertial effects can only be observed in reduced-gravity environments since they are overwhelmed by buoyancy effects on Earth. Moreover, these inertial effects will have a significant impact upon suspension flows in microgravity. Suspension dynamics are of importance in a wide variety of advanced life systems applications, including water reclamation and dust mitigation in confined habitats.
Author
Fluid Dynamics; Microgravity; Solid Suspensions; Shearing; Deposition

35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20050110170 NASA Marshall Space Flight Center, Huntsville, AL, USA

A Concept for the Inclusion of Analytical and Computational Capability in Existing Systems for Measurement of Neutron Flux

Patrick, Clinton; Cooper, Anita E.; Powers, W. T.; [2005]; 1 pp.; In English; Continuing the Voyager of Discovery, 1st Space Exploration Conference, 2-4 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

For approximately two decades, efforts have been sponsored by NASA's Marshall Space Flight Center to make possible high-speed, automated classification and quantification of constituent materials in various harsh environments. MSFC, along with the Air Force/Arnold Engineering Development Center, has led the work, developing and implementing systems that employ principles of emission and absorption spectroscopy to monitor molecular and atomic particulates in gas plasma of rocket engine flow fields. One such system identifies species and quantifies mass loss rates in H2/O2 rocket plumes. Other gases have been examined and the physics of their detection under numerous conditions were made a part of the knowledge base for the MSFC/USAF team. Additionally, efforts are being advanced to hardware encode components of the data analysis tools in order to address real-time operational requirements for health monitoring and management. NASA has a significant investment in these systems, warranting a spiral approach that meshes current tools and experience with technological advancements. This paper addresses current systems - the Optical Plume Anomaly Detector (OPAD) and the Engine Diagnostic Filtering System (EDIFIS) - and discusses what is considered a natural progression: a concept for migrating them towards detection of high energy particles, including neutrons and gamma rays. The proposal outlines system development to date, basic concepts for future advancements, and recommendations for accomplishing them.

Author

Spectrum Analysis; Neutron Flux Density; Engine Monitoring Instruments

20050110353 Nomadics, Inc., Stillwater, OK USA

Autonomous Underwater X-Ray

Dock, Matthew; Jan. 2005; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-M-0079

Report No.(s): AD-A429840; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this SBIR Phase I Nomadics documented the penetration and backscatter of an underwater X-ray system. The system consists of an X-ray source water tank and a gamma ray detector capable of sensing the high-energy scattered X-rays. Using the results of these tests the model of X-ray penetration and backscatter can be verified and used to extrapolate expected performance of the final system.

DTIC

Autonomy; X Rays

20050110365 Naval Postgraduate School, Monterey, CA USA

Battle Damage Assessment Using Inverse Synthetic Aperture Radar (ISAR)

Guan, Lim K.; Dec. 2004; 117 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429858; No Copyright; Avail: Defense Technical Information Center (DTIC)

An imaging radar, like ISAR, offers a combatant the capability to perform long range surveillance with high quality imagery for positive target identification. Extending this attractive feature to the battle damage assessment problem (BDA) gives the operator instant viewing of the target's behavior when it is hit. As a consequence, immediate and decisive action can be quickly taken (if required). However, the conventional Fourier processing adopted by most ISAR systems does not provide adequate time resolution to capture the target's dynamic responses during the hit. As a result, the radar image becomes distorted. To improve the time resolution, time-frequency transform (TFT) methods of ISAR imaging have been proposed. Unlike traditional Fourier-based processing, TFT's allows variable time resolution of the entire event that falls within the ISAR coherent integration period to be extracted as part of the imaging process. We have shown in this thesis that the use of linear Short Time-Frequency Transforms allows the translational response of the aircraft caused by a blast force to be clearly extracted. The TFT extracted images not only tell us how the aircraft responds to a blast effect but also provides additional

information about the cause of image distortion in the traditional ISAR display.
DTIC
Damage Assessment; Radar Imagery; Synthetic Aperture Radar

20050110366 Naval Postgraduate School, Monterey, CA USA
Radar Polarimetry
Yong, Siow Y.; Dec. 2004; 89 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429862; No Copyright; Avail: Defense Technical Information Center (DTIC)

Radar polarimetry is a recent development seeing active research only in the last few decades. The phenomenon that optimal (maximal power) reflected fields exist in both the co-polarized and cross polarized channels of the receiving radar antenna was first introduced by Kennaugh and Huynen. Current research efforts focus on target scattering matrices and relating them to physical attributes of the target. This thesis provides a comprehensive survey of the polarimetry theories that have been put forth by various researchers to characterize, manipulate and optimize target radar returns via polarization states. One such theory is the Target Decomposition (TD) theorem that seeks to decompose the target returns into individual scattering mechanisms. The topic of optimization of polarization states of the incident field for maximizing power return is also examined. Two models are implemented in Matlab to verify and demonstrate these polarimetry theories. The first model uses TD theorems to simulate foliage clutter and study its effect on the polarization of the incident electric field. A (simulated) static dihedral target is introduced and its effect on wave polarization is also simulated. The second model studies optimization of polarization states. Both models are able to produce the expected results for known canonical targets.
DTIC
Decomposition; Polarimetry; Radar Antennas; Targets; Theorems

20050110375 Naval Postgraduate School, Monterey, CA USA
High Responsivity Tunable Step Quantum Well Infrared Photodetector
Tiong, Yeo Hwee; Dec. 2004; 81 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429877; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this thesis, the performance of a step quantum well infrared photodetector (QWIP), which was designed to detect a laser spot at 1.05 m and IR radiation between 9.5 m to 10.5 m, was evaluated. In the far infrared (FIR), the maximum responsivity of the test detector at 10 K was measured at 1.02 A/W with a peak wavelength of 10.3 m under a negative bias of 0.83 V. The D* at background limited infrared performance (BLIP) was measured at 8.0x10(9) cm square root Hz/W with 180 degrees field of view. The BLIP temperature was found to be about 55 K. In addition, the FIR detection wavelength found shift with the amount of bias across the device. The amount of shift observed was 0.21 meV/ kvcm-1 which is due to linear Stark effect associated with the step quantum well. The quantum well infrared detectors made of square quantum wells found to have an order of magnitude lower Stark shift originated from second order effects. This suggests that the step well infrared detector can have applications in tunable wavelength infrared detectors.
DTIC
Infrared Radiation; Photometers; Quantum Wells

20050110384 Naval Postgraduate School, Monterey, CA USA
Radar Search and Detection With the CASA 212 S43 Aircraft
Borges, Jose M.; Dec. 2004; 101 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429893; No Copyright; Avail: Defense Technical Information Center (DTIC)

This research develops a detection rate model to analyze the effectiveness of the RDR 1500B search radar installed in the CASA 212 S43 aircraft belonging to Venezuelan Naval Aviation. The model is based on a search and detection mission to find a diesel submarine executing an incursion inside the Venezuelan Caribbean Sea area assumed to be intermittently operating with periscopes or masts exposed above the sea surface. The analysis obtains cumulative probability of detection vs. time based on the radar manufacturer's performance data, user inputs for aircraft search area size, search speed, and search altitude, and submarine periscope or mast exposure profile. The model can use given periscope radar cross section data, or roughly calculate radar cross section given assumptions about exposed periscope height above the sea-surface and sea-state conditions. Submarine evasion due to radar counter-detection is also modeled.
DTIC
Radar Detection; Search Radar

20050110391 Naval Research Lab., Washington, DC USA

Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2

Steinhurst, Daniel A.; Lynch, James A.; Gottuk, Daniel T.; Owrutsky, Jeffrey C.; Nelson, Herbert H.; Jan. 2005; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429902; NRL/MR/6110--05-8856; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Advanced Volume Sensor Project is one element of the ONR Advanced Damage Countermeasures FNC program. The Volume Sensor Project is developing new methods for remote situational awareness and damage control event detection using conventional video cameras and other techniques. The Spectral-Based Volume Sensor (SBVS) Testbed uses a suite of single-element optical detectors operating outside the visible region. Event detection algorithms were developed to make use of the data generated by the SBVS Testbed. These algorithms detect flaming and smoldering sources both within and outside the SBVS Testbed's field of view (FOV). A positive nuisance classification algorithm was also developed for arc welding and similar nuisance events, which detected all welding events with extremely few false alarms. The developed algorithms were tested against data collected during the Volume Sensor Test Series 2, July to November 2003. Comparable performance to COTS OFDs was achieved for FOV flaming sources, and superior performance was demonstrated for partially or completely obscured flaming sources.

DTIC

Algorithms; Damage; Detection; Optical Measurement; Spectra

20050110401 Southwest Missouri State Univ., Springfield, MO USA

Multiple Strategy Bio-Detection Sensor Platforms Made from Carbon and Polymer Materials

Giedd, Ryan; Ghosh, Kartik; Curry, Matt; Patel, Rishi; Durham, Paul; Jan. 2005; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NOOO14-03-1-O893

Report No.(s): AD-A429916; No Copyright; Avail: Defense Technical Information Center (DTIC)

The goal of this project is to develop a new class of biosensors using carbon and polymer based micro electromechanical systems (CPMEMS) and a platform that incorporates multiple biodetection strategies. This report discusses the progress to date on the biosensors made from CPMEMS and the multiple strategy biodetection sensor platforms that incorporate these CPMEMS. An alternative sacrificial layer in the individual CPMEMS layer processing in being developed using a thermal release polymer. Development of a test lithography mask set and a wafer level packaging scheme in underway. Advancements in the areas of active technology in the form of sense and release experiments and the molecular bridge preparation of the CPMEMS surface have been made.

DTIC

Biological Effects; Carbon; Detection

20050110447 Army Aeromedical Research Lab., Fort Rucker, AL USA

Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators

VAN DE Pol, Corina; Bissette, Gina M.; Estrada, Arthur; Brown, Bryan D.; Jan. 2005; 38 pp.; In English

Report No.(s): AD-A429992; USAARL-2005-02; No Copyright; Avail: CASI; A03, Hardcopy

U.S. Army aviators have been authorized to wear contact lenses for aviation duties with special waiver since 1991. The authorized contact lens modality is the single-vision soft contact lens that corrects for 20/20 distance and near. As aviators become presbyopic, they often have to return to bifocal spectacle wear or readers over their distance contact lenses in order to complete their aviation duties. Spectacles introduce interface problems with head-mounted displays and night vision goggles. This pilot study evaluated the potential utility of multifocal contact lenses to provide adequate visual and flight performance for presbyopic aviators. Bifocal spectacles or readers provide better levels of visual performance than any of the three multifocal contact lenses evaluated. Flight performance in a UH-60 simulator under daytime conditions was not decremented with the multifocal contact lenses evaluated in this study; however, this study did not evaluate night flight, interface with head-mounted displays or night vision goggle flight performance. Studies specific to the Apache flight environment are being considered since visual performance remained within norms and Apache pilots are faced with greater interface problems with bifocal spectacles and head-mounted displays and protection mask configurations than pilots in other aviation platforms. Many Apache pilots have been permanently Wounded or converted to other platforms due to the onset of presbyopia and spectacle compatibility issues in the cockpit Multifocal contact lenses, when fit to specific parameters, may

be an option under special circumstances where spectacles would lead to reduced performance.
DTIC
Aircraft Pilots; Contact Lenses; Flight Characteristics; Visual Acuity; Visual Flight

20050110470 Army Research Lab., Aberdeen Proving Ground, MD USA
Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion
Oberle, William F.; Davis, Lawrence; Feb. 2005; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430020; ARL-TR-3407; No Copyright; Avail: Defense Technical Information Center (DTIC)

An approach and architecture to incorporate data integration and fusion of laser radar (ladar) and stereo data to generate high resolution, ladar-quality three-dimensional world models is described. Our primary interest involves complex environments that have proved difficult for traditional stereo algorithms to produce accurate information. The principal novelty of our work is the use of ladar information as a priori disparity information. Initial results verify the validity of the approach. Improvement in the identification of occluded regions and reduction of the error in disparities are observed.
DTIC
Data Integration; Data Management; High Resolution; Laser Range Finders; Multisensor Fusion; Optical Radar; Three Dimensional Models

20050110472 Naval Research Lab., Washington, DC USA
Coherent Seeker Guided Antiship Missile Performance Analysis
Genova, James J.; Jan. 2005; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430023; NRL/FR/5760--05-10090; No Copyright; Avail: Defense Technical Information Center (DTIC)

The performance capability of an antiship missile's radar guidance system can be rated by the ratio of the processed signal level to the interference or noise level. In this report, the general performance capability is evaluated for missiles guided via noncoherent radar and for missiles guided via coherent radar. The contribution of several coherent aspects are compared including interpulse, intrapulse, and beam sharpening. Potential improvement of as much as 15 to 20 dB are indicated. A brief derivation of a useful representation of the processed signals is presented that describes the potential usefulness of Space-Time Adaptive Processing.
DTIC
Antiship Missiles; Coherent Radar; Homing Devices; Missiles; Reliability Analysis

20050110496 Air Force Research Lab., Rome, NY USA
Knowledge-Based Generalized Likelihood Ratio Test (KB-GLRT): Exploiting Knowledge of the Clutter Ridge in Airborne Radar
De Maio, Antonio; Farina, Alfonso; Wicks, Michael; Dec. 2004; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-517R
Report No.(s): AD-A430052; AFRL-SN-RS-TR-2004-358; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this paper we address knowledge-based radar detection for STAP applications. To this end we exploit, at the design stage, the characteristic structure of the clutter ridge and devise two decision rules according to the Generalized Likelihood Ratio Test (GLRT) and the two-step GLRT criteria. We first focus on the case of a clutter ridge with integer slope and then discuss the more general framework of a non-integer slope parameter. With reference to this last case we only provide approximate GLRT detectors due to the analytical difficulties connected with the exact solution of the problem. The performance analysis shows that the new knowledge-based systems achieve a performance level very close to the optimum detector which assumes the perfect knowledge of the clutter covariance matrix and can outperform some previously proposed adaptive detection schemes.
DTIC
Airborne Radar; Clutter; Knowledge Based Systems; Likelihood Ratio

20050110512 National Defense Univ., Washington, DC USA
Shedding Light on the Battlefield: Tactical Applications of Photonic Technology
Mait, Joseph N.; Haney, Michael M.; Goossen, Keith W.; Christensen, Marc P.; Nov. 2004; 28 pp.; In English
Report No.(s): AD-A430073; No Copyright; Avail: Defense Technical Information Center (DTIC)

The availability of tactical sensor technology places great demands on bandwidth for the battlefield. To relieve some of

the bandwidth congestion, we consider using light or more properly, photons as opposed to electrons to transmit information. The key advantage of photonics over electronics is the ability of light beams to cross, which allows photonic systems to be more volume efficient than electronic systems. Photonics is a key enabling technology for the military's global information grid, but it has many other applications. We highlight the advantages of photonics in three applications on a single sensor platform: off-platform communications, thin optical sensors, and on-platform communications. Direct laser communications can provide high-speed, secure communications with an unmanned aerial vehicle using less volume than standard radio frequency technologies. This is due primarily to the smaller wavelength. Further, compact sensors for imaging are possible because photonic and electronic devices can be fabricated using the same conventional fabrication techniques. For economic reasons, now is the time for the government to take full advantage of photonics. The downfall with the communications sector of the economy at the turn of the century means a large commercial infrastructure is currently underutilized. Capacity, technology, and intellectual property can be leveraged at relatively low cost by the government. To facilitate the government's leveraging commercial technology, we recommend that the Director of Defense Research and Engineering re-establish the Department of Defense's Photonics conference, which is presently defunct. To facilitate the transition of photonic technology, program managers and others from the acquisition community need to be aware of the technology presently available in the private sector.
DTIC
Military Technology; Optical Measuring Instruments; Photons; Warfare

20050110513 Purdue Univ., West Lafayette, IN USA
Hybrid Molecular and Spin-Semiconductor Based Research
Datta, S.; Reifenberger, R.; Janes, D.; Bhattacharya, P.; Steel, D.; Feb. 2005; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0198
Report No.(s): AD-A430078; 630-1285-1617/IR3; ARO-39832.25-EL-MUR; No Copyright; Avail: Defense Technical Information Center (DTIC)

This project has three thrusts. Thrust I is entitled 'Integrated Bacteriorhodopsin-Based Photodetectors' and its objective is to enable a new class of optoelectronic devices by combining the versatility of genetically engineered biomolecules with the power of microelectronics. Thrust II is entitled 'Spintronics and Magnetoelectronics' and its objective is to enable a new class of semiconductor-based spintronic devices. Thrust III is entitled 'Molecular Electronics' and its objective is to develop, characterize and model organic/inorganic heterostructures and to identify novel device structures based on these systems. The most important results and publications are summarized in this report.
DTIC
Bacteria; Magnetization; Microelectronics; Molecular Electronics; Photometers; Photoreceptors; Proteins; Semiconductors (Materials)

20050110531 Tulane Univ., New Orleans, LA USA
Integrated Bioenvironmental Hazards Research Program
Jan. 2004; 78 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-99-1-0763
Report No.(s): AD-A430104; No Copyright; Avail: Defense Technical Information Center (DTIC)

Beginning in April 1999, the Center for Bioenvironmental Research (CBR) at Tulane and Xavier Universities has received funding from the Office of Naval Research to continue its Bioenvironmental Hazards Research Program (BHRP). This funding has supported a suite of complementary research projects that address the impacts of bioenvironmental hazards on environmental signaling from molecular to ecosystem levels and makes connections between these impacts. The research ranges from basic research on proteomics to applied technology development of biosensors and autonomous underwater vehicles for monitoring. The BHRP program includes mechanisms for the effective communication of this information for resolution of Department of Defense problems and for the educational training of future scientists.
DTIC
Biological Effects; Detection; Ecosystems; Hazards; Molecules

20050111538 NASA Langley Research Center, Hampton, VA, USA
Comparison of Fiber Optic Strain Demodulation Implementations
Quach, Cuong C.; Vazquez, Sixto L.; March 2005; 16 pp.; In English
Contract(s)/Grant(s): WU 23-728-30-11
Report No.(s): NASA/TM-2005-213521; L-19071; No Copyright; Avail: CASI; A03, Hardcopy

NASA Langley Research Center is developing instrumentation based upon principles of Optical Frequency-Domain Reflectometry (OFDR) for the provision of large-scale, dense distribution of strain sensors using fiber optics embedded with Bragg gratings. Fiber Optic Bragg Grating technology enables the distribution of thousands of sensors immune to moisture and electromagnetic interference with negligible weight penalty. At Langley, this technology provides a key component for research and development relevant to comprehensive aerospace vehicle structural health monitoring. A prototype system is under development that includes hardware and software necessary for the acquisition of data from an optical network and conversion of the data into strain measurements. This report documents the steps taken to verify the software that implements the algorithm for calculating the fiber strain. Brief descriptions of the strain measurement system and the test article are given. The scope of this report is the verification of software implementations as compared to a reference model. The algorithm will be detailed along with comparison results.

Author

Demodulation; Fiber Optics; Systems Health Monitoring; Computer Programs; Structural Strain

20050123593 NASA Glenn Research Center, Cleveland, OH, USA

Neural Network for Image-to-Image Control of Optical Tweezers

Decker, Arthur J.; Anderson, Robert C.; Weiland, Kenneth E.; Wrbanek, Susan Y.; July 2004; 18 pp.; In English; 2004 Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 22-708-04-04

Report No.(s): NASA/TM-2004-213201; E-14710; No Copyright; Avail: CASI; A03, Hardcopy

A method is discussed for using neural networks to control optical tweezers. Neural-net outputs are combined with scaling and tiling to generate 480 by 480-pixel control patterns for a spatial light modulator (SLM). The SLM can be combined in various ways with a microscope to create movable tweezers traps with controllable profiles. The neural nets are intended to respond to scattered light from carbon and silicon carbide nanotube sensors. The nanotube sensors are to be held by the traps for manipulation and calibration. Scaling and tiling allow the 100 by 100-pixel maximum resolution of the neural-net software to be applied in stages to exploit the full 480 by 480-pixel resolution of the SLM. One of these stages is intended to create sensitive null detectors for detecting variations in the scattered light from the nanotube sensors.

Author

Neural Nets; Image Processing; Nanotechnology; Light Modulators; Spatial Resolution

20050123661 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps

Knowlton, Kelly; October 28, 2004; 1 pp.; In English; Proceedings of High Spatial Resolution Commercial Imagery Workshop, 8-10 Nov. 2004, Reston, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0030; No Copyright; Avail: CASI; A01, Hardcopy

This experiment measured the reflectance of tarps with ground instruments in order to check radiometric calibration, validate atmospheric correction, and predict at-sensor radiance for satellite instruments. The procedure of this experiment is as follows: 1) Assemble laboratory apparatus to duplicate ground reference measurement geometry and satellite measurement geometry; 2) Measure spectral radiance with Optronics OL 750 double monochromator/spectroradiometer; 3) Measure radiance of NIST-calibrated Spectralon panel irradiated by collimated light at incidence angle of calibrated reflectance (20 deg, 30 deg, 40 deg, or 50 deg), viewing normal to panel surface; 4) Measure radiance of Spectralon panel irradiated at incidence angle equal to solar zenith angle at time of overpass; 5) Calculate reflectance of Spectralon panel irradiated at solar zenith angle, viewing normal to panel surface (ground geometry).

Author (revised)

Radiometric Correction; Ground Tests; Calibrating; Bidirectional Reflectance; Spectroradiometers; Fabrics; Analogs

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20050110370 Naval Postgraduate School, Monterey, CA USA
A Low-Cost, Man-Portable, Free-Space Optics Communications Device for Ethernet Applications
Perera, Janaka P.; Dec. 2004; 70 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429871; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis sought to design and implement a low-cost, portable, Free-Space Optics (FSO) communications device for Ethernet applications. Under some circumstances such a device would have utility at a Combat Operations Center (COC), a Field Artillery Position, or wherever else fiber optic cable is used in garrison or field. The design was based on commercial off the shelf components originally designed for fiber optic applications. Based on a 155 megabits per second (Mbps) media converter, the design used two fiber optic transceivers, coupled to collimating lenses to pass data over free-space. Sustained data rate of 100 Mbps was achieved with full network functionality on the optical bench with a low-power (0.5mW) laser diode transmitter without focusing optics on the receiver. The laser diode power(mounted on device), was measured with acceptable losses up to 300 ft during testing using a photodiode with focusing optics. The findings indicate that the system with proper collecting optics could be optimized for free-space communication at short to moderate ranges.
DTIC
Communication Equipment; Ethernet; Fiber Optics; Low Cost; Semiconductor Lasers; Transmission Lines

20050110395 Naval Postgraduate School, Monterey, CA USA
The Adaptive Control of Optical Beam Jitter
Watkins, R. J.; Dec. 2004; 188 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429907; No Copyright; Avail: Defense Technical Information Center (DTIC)

Acquisition, Tracking and Pointing (ATP) of space and airborne optical beams is becoming an important research topic as the requirements for the control of the beam are increasing. Arc-second accuracy and nano-radian jitter coupled with stringent pointing requirements test the limits of control systems. A unique Laser Jitter Control Test Bed was built to study means to correct disturbances in a laser relay system. A new technique, the Adaptive Bias Filter (ABF), applies a compensating bias to the reference signal for the adaptive filter, allowing rapid convergence in correcting narrowband disturbances. A second technique, the Adaptive Delay Filter (ADF), was applied in a new way to the adaptive control systems to better correlate the error signal with the reference signal. Experiments using these techniques effectively demonstrated the usefulness of the new control methods, including the use of a combination Linear Quadratic Regulator (LQR) and LMS/ABF filter to remove disturbances caused by colored noise injected into an optical beam. The combination controller results in a 38 dB decrease in jitter caused by a 50 Hz vibration and a 10 dB decrease in an 87 Hz vibration of the supporting platform, and an overall 75% improvement in the broadband jitter experienced by the optical beam.
DTIC
Adaptive Control; Convergence; Laser Beams; Light Beams; Test Stands; Vibration

20050110423 Illinois Univ., Urbana, IL USA
Research Instrumentation for Measurements of High-Speed Separated Flows
Dutton, J. C.; Feb. 2002; 9 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0692
Report No.(s): AD-A429954; AROD-42795.1-EG-RI; No Copyright; Avail: Defense Technical Information Center (DTIC)

The purpose of this instrumentation grant was to purchase equipment to be used in conjunction with an ongoing ARO-funded research grant entitled 'Experimental Studies of High-Speed Separated Flows.' The research efforts of this program are focused on experimental investigation of the fluid dynamic mechanisms and interactions within separated flow regions embedded in high-speed compressible flows. The fundamental objective is to improve understanding of the detailed flow processes in the near-wake of missile and projectile-type base flows with the long-term goal of optimizing and controlling these flows to derive flight vehicle performance benefits. The funds were used to repair the heads of two Nd:YAG lasers that are used heavily in particle image velocimetry, Rayleigh/Mie scattering, and planar laser-induced fluorescence (PLIF) experiments. These replacements/repairs will extend the lives of these lasers for at least 5 years. The department also used the equipment funds to purchase an intensified CCD array camera system that may be used for experiments with low signal levels

(e.g., for ongoing acetone PLIF experiments). Finally, funds were used to purchase a state-of-the-art pressure transducer calibration dead-weight tester. In all cases, purchase of this equipment will help to maintain and strengthen the department's ability to make significant contributions to the research area of compressible, separated flows, which is of significant importance to the U.S. Army. The specific pieces of equipment, vendors, and purchase prices are detailed.
DTIC
Base Flow; Boundary Layer Separation; Compressible Flow; High Speed; Separated Flow

20050110501 University of Central Florida, Orlando, FL USA
Cryo Power and Heat Transfer
Chow, L. C.; Bass, M.; Du, J.; Lin, Y.; Chung, T.; Sep. 2004; 155 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-96-C-2681; Proj-1651
Report No.(s): AD-A430061; AFRL-PR-WP-TR-2004-2135; No Copyright; Avail: Defense Technical Information Center (DTIC)

Over the past eight years, researchers at the University of Central Florida have studied high flux heat transfer by flow boiling, pool boiling and spray cooling. These techniques are targeted for cooling high power density devices such as power MOSFETs and diode lasers arrays at both cryogenic and room temperatures. Seven tasks were included. The results of flow boiling and pool boiling with liquid nitrogen were included in earlier annual reports for this contract and therefore are not reported here. This final report includes a study on the simulation and testing of power MOSFETs, thermal management of diode laser arrays, development of compact spray nozzles, and fluid management of spray cooling with multiple nozzles for large surface areas. Several examples of the significant achievements include the development of a microstereolithography apparatus so that micro spray nozzles can be made with great precision; a new way of packaging diode laser arrays which is vastly superior to the state of the art; and a unique and effective way to solve the flooding problems associated with multiple nozzle spray cooling.
DTIC
Cryogenics; Field Effect Transistors; Heat Flux; Heat Transfer; Semiconductor Lasers; Semiconductors (Materials)

20050110524 Air Force Research Lab., Kirkland AFB, NM USA
The Measurement of Gain in a Supersonic, Combustion-Driven Generator for NCl(a1Delta)
Manke, Gerald C.; Feb. 2005; 52 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-4866
Report No.(s): AD-A430093; AFRL-DE-PS-TR-2004-1138; No Copyright; Avail: Defense Technical Information Center (DTIC)

The measurement of positive small signal gain on the 1.315 micron spin orbit transition of atomic iodine following energy transfer from chemically generated NCl(a1delta) is reported. Previous instances of gain produced by energy transfer from NC1(a1delta) used DC discharges to generate F and Cl atoms: this report describes recent progress towards a true chemical laser device which uses a high temperature chemical combustor and a supersonic reactor to generate NCl(a1delta). Theses improvements represents a significant step towards the development and demonstration of a scalable All Gas-phase Iodine Laser (AGIL) device.
DTIC
Chemical Lasers; Chemical Oxygen-Iodine Lasers; Supersonic Combustion

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20050092416 Ford Motor Co., Dearborn, MI, USA, General Motors Research Labs., Warren, MI, USA, Pacific Northwest National Lab., Richland, WA, USA
Dynamometer Evaluation of Plasma-Catalyst for Diesel NOX Reduction
Hoard, J. W.; Schmieg, S. J.; Brooks, D. J.; Peden, C. H. F.; Barlow, S. E.; Aug. 2003; In English
Report No.(s): DE2004-829848; No Copyright; Avail: National Technical Information Service (NTIS)

A three-stage plasma-catalyst system was developed and tested on an engine dynamometer. Previous laboratory testing

suggested high NOx efficiency could be obtained. With hexene reductant added to the exhaust, over 90% NOx reduction was observed. However, with diesel or Fischer-Tropsch reductant the catalyst efficiency rapidly dropped off. Heating the catalyst in air removed brown deposit from the surface and restored conversion efficiency. Following the engine tests, the used catalysts were evaluated. BET surface area decreased, and TPD revealed significant storage. This storage appears to be partly unburned diesel fuel that can be removed by heating to around 250-300 degrees C, and partly hydrocarbons bonded to the surface that remain in place until 450-500 degrees C. Laboratory testing with propene reductant demonstrated that the catalyst regains efficiency slowly even when operating temperature does not exceed 300 degrees C.
NTIS
Catalysts; Diesel Engines; Nitrogen Oxides

20050092420 PUREM Abgassysteme G.m.b.H, Menden, Germany
SCR Systems for Heavy Duty Trucks: Process Towards Meeting EURO 4 Emission Standards in 2005
Frank, W.; Huthwohl, G.; Maurer, B.; 2003; In English
Report No.(s): DE2004-829825; No Copyright; Avail: National Technical Information Service (NTIS)

Emissions of diesel engines contain some components, which support the generation of smog and which are classified hazardous. Exhaust gas aftertreatment is a powerful tool to reduce the NOx and Particulate emissions. The NOx-emission can be reduced by the SCR technology. SCR stands for Selective Catalytic Reduction. A reduction agent has to be injected into the exhaust upstream of a catalyst. On the catalyst the NOx is reduced to N2 (Nitrogen) and H2O (Water). This catalytic process was developed in Japan about 30 years ago to reduce the NOx emission of coal-fired power plants. The first reduction agent used was anhydrous ammonia (NH3). SCR technology was used with diesel engines starting mid of the 80s. First applications were stationary operating generator-sets. In 1991 a joint development between DaimlerChrysler, MAN, IVECO and Siemens was started to use SCR technology for the reduction of heavy duty trucks. Several fleet tests demonstrated the durability of the systems. To day, SCR technology is the most promising technology to fulfill the new European Regulations EURO 4 and EURO 5 being effective Oct. 2005 and Oct. 2008.
NTIS
Exhaust Emission; Diesel Engines; Catalysts

20050092425 Southwest Research Inst., San Antonio, TX
Diesel Engine Alternatives
Ryan, T.; Feb. 2002; In English
Report No.(s): DE2004-829804; No Copyright; Avail: National Technical Information Service (NTIS)

There are basically three different modes of combustion possible for use in reciprocating engines. These include, diffusion burning, as occurs in current diesel engines, flame propagation combustion such as used in conventional SI engines, and homogeneous combustion such as is used in the SwRI HCCI engine. Diesel engines currently offer significant fuel consumption benefits relative to other powerplants for on and off road applications; however, costs and efficiency may become problems as the emissions standards become even more stringent. This presentation presents a discussion of the potentials of HCCI and flame propagation engines as alternatives to the diesel engines. It is suggested that as the emissions standards become more and more stringent, the advantages of the diesel may disappear. The potential for HCCI is limited by the availability of the appropriate fuel. The potential of flame propagation engines is limited by several factors including knock, EGR tolerance, high BMEP operation, and throttling. These limitations are discussed in the context of potential for improvement of the efficiency of the flame propagation engine.
NTIS
Diesel Engines; Combustion; Fuel Consumption

20050092426 Daimler-Benz Aerospace A.G., Stuttgart, Germany
State-of-the-Art and Emerging Truck Engine Technologies for Optimized Performance, Emissions and Life Cycle Costs
Schittler, M.; 2002; In English
Report No.(s): DE2004-829810; No Copyright; Avail: National Technical Information Service (NTIS)

The challenge for truck engine product engineering is not only to fulfill increasingly stringent emission requirements, but also to improve the engines economical viability in its role as the backbone of our global economy. While societal impact and therefore emission limit values are to be reduced in big steps, continuous improvement is not enough but technological quantum leaps are necessary. The introduction and refinement of electronic control of all major engine systems has already

been a quantum leap forward. Maximizing the benefits of these technologies to customers and society requires full use of parameter optimization and other enabling technologies. The next big step forward will be widespread use of exhaust aftertreatment on all transportation related diesel engines. While exhaust gas aftertreatment has been successfully established on gasoline (Otto cycle) engines, the introduction of exhaust aftertreatment especially for heavy-duty diesel engines will be much more demanding.
NTIS
Diesel Engines; Trucks; Exhaust Emission

20050092440 California Univ., Riverside, CA, USA
Internal Combustion Engine (ICE) Air Toxic Emissions
Zhu, X.; Durbin, T. D.; Norbeck, J. M.; Cocker, D.; Jul. 2004; 178 pp.; In English
Report No.(s): PB2005-102234; No Copyright; Avail: CASI; A09, Hardcopy

The emission rates of gas-phase airborne toxic compounds, as well as particulate matter (PM), have steadily been reduced during the past decade as a result of the introduction of reformulated gasoline and diesel fuel, advances in engine design and fuel metering systems, and the implementation of highly efficient exhaust after-treatment control devices. As regulatory standards have gotten increasingly stringent, it is important to understand how air toxic emission rates have changed over the years in order to gauge the expected improvement in air quality. In this work, the available literature for studies dealing with the air toxic, PM, and PAH emissions from on-road, off-road, and stationary diesel, gasoline, and natural gas internal combustion engines (ICEs) is reviewed and evaluated. This review focuses on toxic emission studies using typical dynamometer source testing methods, and near-source ambient sampling (e.g., tunnel studies) of ICE emissions.
NTIS
Internal Combustion Engines; Exhaust Emission; Air Quality

20050109807 Clarkson Univ., Potsdam, NY, USA
Thermoelectrical Energy Recovery from the Exhaust of a Light Truck
Karri, M. A.; Thacher, E. F.; Helenbrook, B. T.; Compeau, M. S.; Aug. 2003; In English
Report No.(s): DE2004-828947; No Copyright; Avail: National Technical Information Service (NTIS)

A team formed by Clarkson University is engaged in a project to design, build, model, test, and develop a plan to commercialize a thermoelectric generator (TEG) system for recovering energy from the exhaust of light trucks and passenger cars.
NTIS
Thermoelectric Generators; Trucks; Exhaust Emission; Generators

20050109814 ATK-Thiokol Propulsion, Brigham City, UT, USA
Bond Testing for Effects of Silicone Contamination
Plaia, James; Evans, Kurt; [2005]; 3 pp.; In English; 28th Annual Meeting of The Adhesion Society, 13-16 Feb. 2005, Mobile, AL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail: CASI; A01, Hardcopy

In 2003 ATK Thiokol discovered that the smocks and coveralls worn by its operations personnel for safety and contamination control were themselves contaminated with a silicone defoamer and a silicone oil. As a growing list of items have been identified as having this form of contamination, it was desirable to devise a test method to determine if the contamination level detected could cause subsequent processing concerns. The smocks and coveralls could potentially contact bonding surfaces during processing so the test method focused on dry transfer of the silicone from the clothing to the bonding surface.
Derived from text
Bonding; Contamination; Silicones; Protective Clothing; Adhesion Tests

20050109819 Wisconsin Univ., Madison, WI, USA
Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation
Stetter, J.; Ghandhi, J.; Forster, N.; Foster, D.; 2003; In English
Report No.(s): DE2004-828946; No Copyright; Avail: National Technical Information Service (NTIS)

Detailed exhaust emission data have been taken from a Cummins N-14 single cylinder research engine in which the oil

consumption was varied by different engine modifications. Low sulfur fuel was used, and oil consumption was varied by modifying the intake valve stem seals, the exhaust valve stem seals, the oil control ring and combinations of these modifications. Detailed measurements of exhaust gas particle size distributions and chemical composition were made for the various oil consumption configurations for a range of engine loads and speeds. The particulate mass was measured with TEOM and traditional gravimetric filter methods. Filter data for EC/OC, sulfates and trace metals have been taken and analyzed. The trace metals in the particulate mass serve as the basis for assessing oil consumption at the different operating conditions. The data indicate that the oil consumption for the steady state testing done here was approximately an order of magnitude below oil consumption values cited in the literature. We did measure changes in the details of the chemical composition of the particulate for the different engine operating conditions, but it did not correlate with changes in the oil consumption. Furthermore, the data indicate that the particle size distribution is not strongly impacted by low level oil consumption variations observed in this work.
NTIS
Chemical Composition; Diesel Engines; Exhaust Emission; Exhaust Gases; Oils; Particle Size Distribution

20050109827 Thermo-Systems, Inc., Saint Louis, MO, USA, Tartu State Univ., USSR
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements
Johnson, T.; Caldow, R.; Pocher, A.; Mirme, A.; Kittelson, D. B.; 2003; In English
Report No.(s): DE2004-828953; No Copyright; Avail: National Technical Information Service (NTIS)

There has been increased interest in obtaining size distribution data during transient engine operation where both particle size and total number concentrations can change dramatically. Traditionally, the measurement of particle emissions from vehicles has been a compromise based on choosing between the conflicting needs of high time resolution or high particle size resolution for a particular measurement. Currently the most common technique for measuring submicrometer particle sizes is the Scanning Mobility Particle Sizer (SMPSTM) system. The SMPS system gives high size resolution but requires an aerosol to be stable over a long time period to make a particle size distribution measurement. A Condensation Particle Counter (CPC) is commonly used for fast time response measurements but is limited to measuring total concentration only. This paper describes a new instrument, the Engine Exhaust Particle SizerTM (EEPSTM) spectrometer, which has high time resolution and a reasonable size resolution. The EEPS was designed specifically for measuring engine exhaust and, like the SMPS system, uses a measurement based on electrical mobility. Particles entering the instrument are charged to a predictable level, then passed through an annular space where they are repelled outward by the voltage from a central column. When the particles reach electrodes on the outer cylindrical (a column of rings), they create a current that is measured by an electrometer on one or more of the rings. The electrometer currents are measured multiple times per second to give high time resolution. A sophisticated realtime inversion algorithm converts the currents to particle size and concentration for immediate display.
NTIS
Particle Emission; Exhaust Emission; Engine Parts; Particle Size Distribution

20050109858 Tennessee Univ., Knoxville, TN, USA
Energy Efficient Thermal Management for Natural Gas Engine Aftertreatment via Active Flow Control
Irick, D. K.; Nguyen, K.; Apr. 2004; In English
Report No.(s): DE2004-829611; No Copyright; Avail: National Technical Information Service (NTIS)

The project is focused on the development of an energy efficient aftertreatment system capable of reducing NOx and methane by 90% from lean-burn natural gas engines by applying active exhaust flow control. Compared to conventional passive flow-through reactors, the proposed scheme cuts supplemental energy by 50%-70%. The system consists of a Lean NOx Trap (LNT) system and an oxidation catalyst. Through alternating flow control, a major amount of engine exhaust flows through a large portion of the LNT system in the absorption mode, while a small amount of exhaust goes through a small portion of the LNT system in the regeneration or desulfurization mode. By periodically reversing the exhaust gas flow through the oxidation catalyst, a higher temperature profile is maintained in the catalyst bed resulting in greater efficiency of the oxidation catalyst at lower exhaust temperatures. The project involves conceptual design, theoretical analysis, computer simulation, prototype fabrication, and empirical studies.
NTIS
Natural Gas; Catalysts; Gas Flow; Air Pollution

20050109905 NASA Marshall Space Flight Center, Huntsville, AL, USA

Unraveling the Material Processing Conditions for Optimizing FSW Process

Schneider, Judy; Nunes, Arthur C., Jr.; [2005]; 1 pp.; In English; The Minearals, Metals and Materials Society Annual Meeting, 13-16 Feb. 2005, San Francisco, CA, USA

Contract(s)/Grant(s): NNM04AA14A; Copyright; Avail: Other Sources; Abstract Only

In friction stir welding (FSW), a rotating threaded pin tool is inserted into a weld seam and literally stirs the edges of the seam together. This environmentally friendly, solid-state technique has been successfully used in the joining of materials that are difficult to fusion weld. To determine optimal processing parameters for producing a defect free weld a better understanding of the resulting metal deformation flow path and velocity is required. In this study the metal flow fields are marked by the use of thin (0.001? tungsten) wires embedded in the weld seam at various locations. X-ray radiographs record the position and segmentation of the wire and are used to elucidate the flow field. Microstructures observed in a FSW cross-section in an aluminum alloy are related to their respective strain-strain rate-temperature histories along their respective flow trajectories. Two kinds of trajectories, each subjecting the weld metal to a distinct thermomechanical process and imparting a distinct microstructure, can be differentiated within the weld structure.

Author

Friction Stir Welding; Optimization; Mechanical Properties; Seams (Joints)

20050110403 Maine Univ., Orono, ME USA

Influence of Stress Relaxation in Hybrid Composite/Metal Bolted Connections

Pelletier, Keith N.; Caccese, Vincent; Berube, Keith A.; Jan. 2005; 95 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0916

Report No.(s): AD-A429921; UH-MACH-RPT-01-02; No Copyright; Avail: Defense Technical Information Center (DTIC)

An experimental investigation of the influence of stress relaxation on watertight integrity of hybrid composite-to-metal bolted connections is presented. This study focuses on the effects of bolt reloading, use of tapered-head bolts versus protruding-head bolts, and briefly addresses environmental effects. All tests were conducted for a time period of at least three months, in order to estimate primary and secondary stress relaxation effects. The reloading tests show that some of the preload in the connections can be maintained with periodic retightening of the bolts. In a limited amount of testing it was observed that temperature shifts caused more rapid stress relaxation rates. Little difference in relaxation was observed when comparing tapered-head bolts with protruding-head bolts, given that roughly equal stress relaxation rates were observed. Further research on this area is required.

DTIC

Bolts; Hybrid Composites; Stress Relaxation

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20050110194 NASA Marshall Space Flight Center, Huntsville, AL, USA

Vehicle Integrated Performance Analysis, the VIPA Experience: Reconnecting with Technical Integration

McGhee, David S.; [2005]; 1 pp.; In English; AIAA Continuing the Voyage of Discoery, 1st Space Exploration Conference, 2-4 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

Today's NASA is facing significant challenges and changes. The Exploration initiative indicates a large increase in projects with limited increase in budget. The Columbia report has criticized NASA for its lack of insight and technical integration impacting its ability to provide safety. The Aldridge report is advocating NASA find new ways of doing business. Very early in the Space Launch Initiative (SLI) program a small team of engineers at MSFC were asked to propose a process for performing a system level assessment of a launch vehicle. The request was aimed primarily at providing insight and making NASA a 'smart buyer.' Out of this effort the VIPA team was created. The difference between the VIPA effort and many integration attempts is that VIPA focuses on using experienced people from various disciplines and a process which focuses them on a technically integrated assessment. Most previous attempts have focused on developing an all encompassing software tool. In addition, VIPA anchored its process formulation in the experience of its members and in early developmental Space Shuttle experience. The primary reference for this is NASA-TP-2001-210092, 'Launch Vehicle Design Process: Characterization, Technical Integration, and Lessons Learned,' and discussions with its authors. The foundations of VIPA's process are described. The VIPA team also recognized the need to drive detailed analysis earlier in the design process.

Analyses and techniques typically done in later design phases, are brought forward using improved computing technology. The intent is to allow the identification of significant sensitivities, trades, and design issues much earlier in the program. This process is driven by the T-model for Technical Integration described in the aforementioned reference. VIPA's approach to performing system level technical integration is discussed in detail. Proposed definitions are offered to clarify this discussion and the general systems integration dialog. VIPA's capabilities and process can now be used to significantly enhance the development and monitoring of realizable project requirements. This is done through the use of VIPA's V-model. Starting with a given concept, VIPA's assessment validates the concept's stated performance, identifies significant issues either with the concept or the requirements, and then re-integrates these issues to determine impacts. This process is discussed along with a description of how it may be integrated into a program's insight and review process. The VIPA process has been employed successfully on several projects including SLI, Orbital Space Plane (OSP), and several heavy lift concepts for Exploration. It has also been proposed for use on the Jupiter Icy Moon (JIMO) spacecraft. The VIPA process has gained favor with both engineering and project organizations for being responsive and insightful. Selected results from these assessments will be presented.
Author
Aerospace Safety; Reliability Analysis

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20050109913 NASA Langley Research Center, Hampton, VA, USA
A Prototype Actuator Concept for Membrane Boundary Vibration Control
Solter, Micah J.; February 2005; 88 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC1-01017; 23-762-55-MK
Report No.(s): NASA/CR-2005-213252; No Copyright; Avail: CASI; A05, Hardcopy

In conjunction with the research in ultra-lightweight deployable spacecraft and membrane structures is an underlying need for shape and vibration control. For thin film membrane structures, fundamental modes of vibration for the membrane can be excited through station keeping, attitude adjustments, orbital maneuvers, or contact with space junk or micrometeorites. In order to maintain structural integrity as well as surface shape contour, which may be essential for inflatable antennas, reflective surfaces, or solar sails; vibration damping is a necessary component. This paper discusses development of an actuator attached at the membrane boundary, containing two types of piezoelectric elements, which can be used to perform active control of vibration from the boundary of a membrane. The actuator is designed to control the membrane out-of-plane displacement and in-plane tension by varying the boundary conditions. Results from an initial experimental evaluation of the concept are presented with bench tests of the actuator alone, and with the actuator connected to a large membrane.
Author
Boundary Conditions; Membrane Structures; Shape Control; Vibration Damping; Active Control

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20050110431 Naval Research Lab., Stennis Space Center, MS USA
Compilation of Data Sources Used to Construct Bottom-Sediment Province Maps for the USA East Coast Continental Shelf from Cape Kennedy to Cape Hatteras and for Various Indonesian Waters
Vaughan, W. C.; Bowles, Frederick A.; Chatelain, Joshua W.; Dec. 2004; 19 pp.; In English
Report No.(s): AD-A429967; NRL/MR/7430--04-8842; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this report is to document the data sources used to construct maps and digital databases of bottom-sediment type for a portion of the continental shelf off the eastern USA and for Indonesian waters. The east coast mapping region extends from approximately 28 deg-30 min N (Cape Canaveral) to 35 deg-30 min N (Cape Hatteras). Mapping

of the Indonesian waters includes the Banda, Ceram, Molucca, Halmahera, and Flores Seas (see the attached figures showing the approximate boundaries of the mapped areas).
DTIC
Coasts; Continental Shelves; Sediments; United States

20050110452 Naval Research Lab., Stennis Space Center, MS USA
Moving-Map Composers System Version 3.4P Acceptance Test Procedures Developed for the Finnish Air Force Modification for FIAF MMC System Without DMUI/DMU
Trenchard, Michael E.; Myrick, Stephanie A.; Lohrenz, Maura C.; Gendron, Marlin L.; Watkins, Jessica L.; Nov. 2004; 27 pp.; In English
Report No.(s): AD-A429998; NRL/MR/7440--04-8831; No Copyright; Avail: CASI; A03, Hardcopy

This document provides detailed Acceptance Test Procedures (ATP) to be followed during the final test and evaluation of the FiAF (Finnish Air Force) Moving-Map Composer (MMC) System version 3.4P developed for the FiAF. This ATP is specifically designed to test the primary functions of the FiAF system that has been delivered and installed at FiAF Headquarters in Tikkokoski, Finland on April 24-25,2003. Please note that the delivered MMC system does not include the Digital Memory Unit (DMU) or its interface and those functions are not included as part of this ATP.
DTIC
Acceptability; Adenosine Triphosphate; Computer Programs

20050111511 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products
Pagnutti, Mary; Holekamp, Kara; Ryan, Robert E.; Vaughan, Ronand; Russell, Jeff; Prados, Don; Stanley, Thomas; January 27, 2005; 2 pp.; In English; 3rd International Workshop, 16-18 May 2005, Biloxi,MS, USA
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0036; No Copyright; Avail: CASI; A01, Hardcopy

Remotely sensed ground reflectance is the foundation of any interoperability or change detection technique. Satellite intercomparisons and accurate vegetation indices, such as the Normalized Difference Vegetation Index (NDVI), require the generation of accurate reflectance maps (NDVI is used to describe or infer a wide variety of biophysical parameters and is defined in terms of near-infrared (NIR) and red band reflectances). Accurate reflectance-map generation from satellite imagery relies on the removal of solar and satellite geometry and of atmospheric effects and is generally referred to as atmospheric correction. Atmospheric correction of remotely sensed imagery to ground reflectance has been widely applied to a few systems only. The ability to obtain atmospherically corrected imagery and products from various satellites is essential to enable widescale use of remotely sensed, multitemporal imagery for a variety of applications. An atmospheric correction approach derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) that can be applied to high-spatial-resolution satellite imagery under many conditions was evaluated to demonstrate a reliable, effective reflectance map generation method. Additional information is included in the original extended abstract.
Author
Commercial Spacecraft; Satellite Imagery; Atmospheric Correction; MODIS (Radiometry)

20050123915 NASA Goddard Space Flight Center, Greenbelt, MD, USA
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004
Manney, G. L.; Santee, M. L.; Livesey, N. J.; Froidevaux, L.; Read, W. G.; Pumphrey, H. C.; Waters, J. W.; Pawson, S.; [2005]; 7 pp.; In English; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

Observations from the Microwave Limb Sounder (MLS) on NASA's new Aura satellite give an unprecedentedly detailed picture of the spring Antarctic polar vortex breakup throughout the stratosphere. HCl is a particularly valuable tracer in the lower stratosphere after chlorine deactivation. MLS HCl, N2O, H2O broke up in the upper stratosphere by early October, in the midstratosphere by early November, and in the lower stratosphere by late December. The subvortex broke up just a few days later than the lower stratospheric vortex. Vortex remnants persisted in the midstratosphere through December, but only through early January 2005 in the lower stratosphere. MLS N2O observations show diabatic descent continuing throughout November, with evidence of weak ascent after late October in the lower stratospheric vortex core.
Author
Antarctic Regions; Vortices; Earth Observing System (EOS); Microwave Sounding; Polar Regions

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*; and *28 Propellants and Fuels*.

20050110516 Analytic Power Corp., Boston, MA USA

Clean Gas Reformer - A Compact Fuel Reformer for Undersea Vehicle Fuel Cells

Feb. 2005; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-M-0300

Report No.(s): AD-A430081; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report summarizes our work on the Phase I Navy STTR N04-T034 entitled Clean Gas Reformer - A Compact Fuel Reformer for Undersea Vehicle Fuel Cells. The report details the progress towards obtaining a suitable tri-layer structure to separate hydrogen from reformed diesel fuel at high temperature. Since the glass separation membrane operates at reformer conditions there are no thermodynamic losses, and therefore the process is more efficient as compared to existing technologies such as palladium separators.

DTIC

Fuel Cells; Fuels; Underwater Vehicles

20050110519 California Inst. of Tech., Pasadena, CA USA

Solid Acid Based Fuel Cells

Haile, Sossina M.; Jan. 2005; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0192

Report No.(s): AD-A430084; No Copyright; Avail: Defense Technical Information Center (DTIC)

High power density fuel cells based on solid acid electrolytes have been demonstrated. In particular, a fuel cell with a 25 micron thick CsH2PO4 membrane was fabricated and yielded a power density of 425 mW/cm2 at 26O C (H2/O2) without pressurization. In this configuration, the thin-film fuel cell is supported on a porous stainless steel gas diffusion layer and the electrocatalyst and electrolyte layers are spray-deposited. In parallel with these efforts, new, water-insoluble electrolytes have been developed. In particular, the new series of compounds Ba3-xKxHx(PO4)2 were prepared and shown to have conductivities of 3 x 10^-5 S/cm at 250 C. Although not as high as the conductivity of CsH2PO4, this result demonstrates the feasibility of obtaining proton transport via dynamic oxyanion reorientation in insoluble compounds. In addition, we have shown that it is possible to exchange out the Li in silicate salts such as LiLa9(SiO4)6O2, using a relatively weak acid (e.g. H3PO4) to once again produce proton conducting water insoluble compounds.

DTIC

Fuel Cells; Solid Electrolytes

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20050092406 Delaware Univ., Newark, DE, USA

Verification of Ship Emission Estimates with Monitoring Measurements to Improve Inventory and Modeling

Corbett, J. J.; Nov. 2004; 56 pp.; In English

Report No.(s): PB2005-102232; No Copyright; Avail: CASI; A04, Hardcopy

This research evaluates accuracy of current marine vessel emissions estimation methods. Pollutants that are addressed in this study include: NOx, SO2, PM, CO2, CO, and HC. This project contributes to research seeking to reconcile apparent differences between inventory estimation methodologies, atmospheric predictions, and field observations. Current emissions inventory methodologies are applied to two different marine vessels, the Sine Maersk, 6600 TEU container vessel built in 1998, and the New Spirit, a 26,562 gross ton (48,183 deadweight ton) bulk carrier built in 2002. Direct monitoring of engine stack emissions was conducted on the Sine Maersk in February 2004, and an aircraft plume study of the New Spirit was conducted as part of a 2002 international atmospheric science experiment. The agreement between emissions calculated using published emissions rates and monitored stack test results is relatively good. The results show that improved emission inventories are consistent with monitoring results; however, emissions rates derived from in-plume observations demonstrated

greater disagreement with published emissions rates. Nonetheless, good agreement between monitoring and modeling emissions rates helps confirm that differences between inventory estimates and in-plume observations are likely a result of complex chemical processing within ship plumes.
NTIS
Atmospheric Chemistry; Nitrogen Oxides; Sulfur Dioxides; Atmospheric Physics; Exhaust Emission

20050092407 California Univ., San Francisco, CA, USA
Health Impact of Nitric Oxide: Effects on Lung Function and Cellular and Biochemical Processes in Healthy Humans
Lazarus, S. C.; May 2001; 72 pp.; In English
Report No.(s): PB2005-102231; No Copyright; Avail: CASI; A04, Hardcopy

Epidemiological studies have reported associations between ambient concentrations of nitrogen dioxide (NO2) and morbidity, but human exposure studies with ambient concentrations of NO2 have not shown significant effects. Since a significant concentration of nitric oxide (NO) is often present in ambient air, the epidemiological findings attributed to NO2 COuld be due to NO. This literature survey addressed whether an ambient air quality standard for NO was warranted, and/or whether there was evidence that inhalation of ambient NO has health effects that should be investigated further. While it is clear that NO is biologically active throughout the body, and that ambient NO could induce health effects, the review concludes that currently there is insufficient evidence to warrant an ambient air quality standard for NO. The review concludes that NO can be both beneficial and injurious, and suggests that ambient concentrations of NO could affect cardiopulmonary regulation, pulmonary inflammation, asthma and other inflammatory lung diseases, host defense, immune responses and platelet function. Suggested areas for further research include: (1) biochemical and/or cellular changes in the lungs indicative of pulmonary inflammation; (2) effects on asthma and other inflammatory diseases; (3) whether environmental NO is beneficial; (4) effects on platelet function; (5) effects on endogenous NO production; (6) effect on ventilation/perfusion (VA/Q) miSmatching; and (7) the role of NO in epidemiological findings attributed to NO2, carbon monoxide (CO) and particulate matter (PM).
NTIS
Air Quality; Nitric Oxide; Physiological Responses

20050092422 Thermo-Systems, Inc., Saint Louis, MO, USA, Minnesota Univ., Duluth, MN, USA
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements
Johnson, T.; Caldow, R.; Pocher, A.; Mirme, A.; Kittelson, D. B.; 2002; In English
Report No.(s): DE2004-829823; No Copyright; Avail: National Technical Information Service (NTIS)

There has been increased interest in obtaining size distribution data during transient engine operation where both particle size and total number concentrations can change dramatically. Traditionally, the measurement of particle emissions from vehicles has been a compromise based on choosing between the conflicting needs of high time resolution or high particle size resolution for a particular measurement. Currently the most common technique for measuring submicrometer particle sizes is the Scanning Mobility Particle Sizer (SMPS(TM)) system. The SMPS system gives high size resolution but requires an aerosol to be stable over a long time period to make a particle size distribution measurement. A Condensation Particle Counter (CPC) is commonly used for fast time response measurements but is limited to measuring total concentration only. This paper describes a new instrument, the Engine Exhaust Particle Sizer(TM) (EEPS(TM)) spectrometer, which has high time resolution and a reasonable size resolution. The EEPS was designed specifically for measuring engine exhaust and, like the SMPS system, uses a measurement based on electrical mobility. Particles entering the instrument are charged to a predictable level, then passed through an annular space where they are repelled outward by the voltage from a central column. When the particles reach electrodes on the outer cylindrical (a column of rings), they create a current that is measured by an electrometer on one or more of the rings. The electrometer currents are measured multiple times per second to give high time resolution. A sophisticated realtime inversion algorithm converts the currents to particle size and concentration for immediate display.
NTIS
Particle Emission; Particle Size Distribution; Exhaust Emission; Exhaust Gases

20050092424 Minnesota Univ., Duluth, MN, USA, Wisconsin Univ., Madison, WI, USA, Paul Scherrer Inst., Villigen, Switzerland
Gasoline Vehicle Exhaust Particle Sampling Study
Kittelson, D. B.; Watts, W. F.; Johnson, J. P.; Zarling, D.; Schauer, J. J.; Aug. 2003; In English
Report No.(s): DE2004-829821; No Copyright; Avail: National Technical Information Service (NTIS)

The University of Minnesota collaborated with the Paul Scherrer Institute, the University of Wisconsin (UWI) and Ricardo, Inc to physically and chemically characterize the exhaust plume from recruited gasoline spark ignition (SI) vehicles. The project objectives were: (1) Measure representative particle size distributions from a set of on-road SI vehicles and compare these data to similar data collected on a small subset of light-duty gasoline vehicles tested on a chassis dynamometer with a dilution tunnel using the Unified Drive Cycle, at both room temperature (cold start) and 0 C (cold-cold start). (2) Compare data collected from SI vehicles to similar data collected from Diesel engines during the Coordinating Research Council E-43 project. (3) Characterize on-road aerosol during mixed midweek traffic and Sunday midday periods and determine fleet-specific emission rates. (4) Characterize bulk- and size-segregated chemical composition of the particulate matter (PM) emitted in the exhaust from the gasoline vehicles.
NTIS
Gasoline; Exhaust Gases; Sampling

20050092429 Radian International, Austin, TX, USA
Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, June 2000
Blythe, G.; Miller, S.; Richardson, C.; Searcy, K.; Jun. 2000; 52 pp.; In English
Report No.(s): DE2004-829670; No Copyright; Avail: Department of Energy Information Bridge
The U.S. Department of Energy and EPRI are co-funding this project to improve the control of mercury emissions from coal-fired power plants equipped with wet flue gas desulfurization (FGD) systems. The project is investigating catalytic oxidation of vapor-phase elemental mercury to a form that is more effectively captured in wet FGD systems. If successfully developed, the process could be applicable to over 90,000 MW of utility generating capacity with existing FGD systems, and to future FGD installations. Field tests are being conducted to determine whether candidate catalyst materials remain active towards mercury oxidation after extended flue gas exposure. Catalyst life will have a large impact on the cost effectiveness of this potential process. A mobile catalyst test unit is being used to test the activity of four different catalysts for a period of up to six months at each of three utility sites. Catalyst testing at the first site, which fires Texas lignite, was completed in December 1998. Testing at the second test site, which fires a Powder River Basin subbituminous coal, was completed in the fall of 1999, and testing at the third site, which fires a high-sulfur bituminous coal, will begin in 2000. This technical note reports results from Site 2; results from Site 1 were reported in a previous technical note. At Site 2, catalysts were tested in several forms, including powders dispersed in sand bed reactors and in commercial forms such as extruded beads and coated honeycomb structures. This technical note presents results from Site 2 for both the sand bed reactors and commercial catalyst forms. Field testing is being supported by laboratory tests to screen catalysts for activity at specific flue gas compositions, to investigate catalyst deactivation mechanisms and to investigate methods for regenerating spent catalysts. Laboratory results related to the Site 2 field effort are also included and discussed in this technical note. Preliminary economics, based on Site 2 results, are also presented for a catalyst-based mercury removal process for a plant with an existing FGD system.
NTIS
Flue Gases; Mercury (Metal); Desulfurizing

20050092430 Radian International, Austin, TX, USA
Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000
Blythe, G.; Miller, S.; Richardson, C.; Searcy, K.; Feb. 2000; 52 pp.; In English
Report No.(s): DE2004-829671; No Copyright; Avail: Department of Energy Information Bridge
The U.S. Department of Energy and EPRI are co-funding this project to improve the control of mercury emissions from coal-fired power plants equipped with wet flue gas desulfurization (FGD) systems. The project is investigating catalytic oxidation of vapor-phase elemental mercury to a form that is more effectively captured in wet FGD systems. If successfully developed, the process could be applicable to over 90,000 MW of utility generating capacity with existing FGD systems, and to future FGD installations. Field tests are being conducted to determine whether candidate catalyst materials remain active towards mercury oxidation after extended flue gas exposure. Catalyst life will have a large impact on the cost effectiveness of this potential process. A mobile catalyst test unit is being used to test the activity of four different catalysts for a period of up to six months at each of three utility sites. Catalyst testing at the first site, which fires Texas lignite, was completed in December 1998. Testing at the second test site, which fires a Powder River Basin subbituminous coal, was completed in the fall of 1999, and testing at the third site, which fires a high-sulfur bituminous coal, will begin in early 2000. This technical note reports results from Site 2; results from Site 1 were reported in a previous technical note. At Site 2, catalysts were tested in several forms, including powders dispersed in sand bed reactors and in more commercially viable forms such as extruded beads and coated honeycomb structures. This technical note presents results from Site 2 for both the sand bed reactors and commercial catalyst forms. Site 3 results are not yet available, but should be available late in the year 2000. Field testing is

being supported by laboratory tests to screen catalysts for activity at specific flue gas compositions, to investigate catalyst deactivation mechanisms and to investigate methods for regenerating spent catalysts. Laboratory results related to the Site 2 field effort are also included and discussed in this technical note. Preliminary economics, based on Site 2 results, are also presented for a catalyst-based mercury removal process for a plant with an existing FGD system.
NTIS
Mercury (Metal); Active Control; Desulfurizing; Vapor Phases; Pollution Control

20050092432 Siemens Westinghouse Power Corp., Pittsburgh, PA, USA, National Energy Technology Lab., Morgantown, WV, USA
Advanced Second Generation Ceramic Candle Filters
Alvin, M. A.; Jan. 2002; In English
Report No.(s): DE2004-829652; No Copyright; Avail: National Technical Information Service (NTIS)

Through sponsorship from the Department of Energy's National Energy Technology Laboratory (DOE/NETL), development and manufacture of advanced second generation candle filters was undertaken in the early 1990s. Efforts were primarily focused on the manufacture of fracture toughened, 1.5 m, continuous fiber ceramic composite (CFCC) and filament wound candle filters by 3M, McDermott, DuPont Lanxide Composites, and Techniweave. In order to demonstrate long-term thermal, chemical, and mechanical stability of the advanced second generation candle filter materials, Siemens Westinghouse initiated high temperature, benchscale, corrosion testing of 3M's CVI-SiC and DuPont's PRD-66 mini-candles, and DuPont's CFCC SiCSiC and IF&P Fibrosic coupons under simulated, pressurized fluidized-bed combustion (PFBC) conditions. This effort was followed by an evaluation of the mechanical and filtration performance of the advanced second generation filter elements in Siemens Westinghouse's bench-scale PFBC test facility in Pittsburgh, Pennsylvania. Arrays of 1.4-1.5 m 3M CVI-SiC, DuPont PRD-66, DuPont SiCSiC, and IF&P Fibrosic candles were subjected to steady state process operating conditions, increased severity thermal transients, and accelerated pulse cycling test campaigns which represented approx. 1760 hours of equivalent filter operating life.
NTIS
Filtration; Ceramics; High Temperature Gases

20050092442 National Inst. for Occupational Safety and Health, Washington, DC, USA
Microbiological Air Contamination from Machining Fluids
Reponen, T.; Dec. 20, 2004; 18 pp.; In English
Report No.(s): PB2005-103141; No Copyright; Avail: CASI; A03, Hardcopy

Workers exposed to machining fluid aerosols may have an increased risk in developing a variety of respiratory and skin diseases, such as allergies, asthma, hypersensitivity pneumonitis, and dermatitis. About 1.2 million workers in the USA are occupationally exposed to metalworking fluids (MWFs). Microbial contamination of water-based MWFs is one of the suspected causes for respiratory diseases but the exposure-response relationship is not well understood. One reason for this knowledge cap is that insufficient information has been available so far on the composition and concentration of airborne microorganisms at metalworking sites. We have studied the aerosolization of microorganisms and mist with a laboratory-scale set-up, which allows investigating one variable at a time. As a major part of this study, a laboratory-scale grinding simulator was developed and tested. It was experimentally proven that the microbial concentration in the MWF or the MWF type did not affect the aerosolization potential of microorganisms. Hydrophobic microorganisms were found to be easier to aerosolize from MWFs than hydrophilic ones and increasing microorganism size resulted in decreasing the aerosolization potential. When MWF was contaminated with bacteria the aerosolization of fine and ultrafine (0. 2 - 1 micrometers) particles was found to increase by a factor of 25 for a soluble oil and by a factor of 50 for a semisynthetic fluid. Endotoxin analysis confirmed that fine particles contained microbial cell wall fragments. Field test showed that the concentrations obtained in the laboratory simulated realistic field situations and that fine and ultrafine particles can easily migrate from production areas to other areas in the plant.
NTIS
Aerosols; Microorganisms; Contamination

20050109766 Department of Energy, Washington, DC, Science Applications International Corp., Arlington, VA, USA
Regulatory Approaches for Solid Radioactive Waste Storage in Russia
Griffith, A.; Testov, S.; Diashev, A.; 2003; 18 pp.; In English
Report No.(s): DE2004-826373; No Copyright; Avail: Department of Energy Information Bridge

The Russian Navy under the Arctic Military Environmental Cooperation (AMEC) Program has designated the Polyarninsky Shipyard as the regional recipient for solid radioactive waste (SRW) pretreatment and storage facilities. Waste storage technologies include containers and lightweight modular storage buildings. The prime focus of this paper is solid radioactive waste storage options based on the AMEC mission and Russian regulatory standards. The storage capability at the Polyarninsky Shipyard in support of Mobile Pretreatment Facility (MPF) operations under the AMEC Program will allow the Russian Navy to accumulate/stage the SRW after treatment at the MPF. It is anticipated that the MPF will operate for 20 years. This paper presents the results of a regulatory analysis performed to support an AMEC program decision on the type of facility to be used for storage of SRW. The objectives the study were to: analyze whether a modular storage building (MSB), referred in the standards as a lightweight building, would comply with the Russian SRW storage building standard, OST 95 10517-95; analyze the Russian SRW storage pad standard OST 95 10516-95; and compare the two standards, OST 95 10517-95 for storage buildings and OST 95 10516-95 for storage pads.
NTIS
Radioactive Wastes; Solid Wastes

20050109769 Eastern Research Group, Inc., Morrisville, NC
Urban Air Toxics Monitoring Program (UATMP), 2003
Jul. 2004; In English
Report No.(s): PB2005-103472; EPA-454/R-04-003; No Copyright; Avail: National Technical Information Service (NTIS)

This report presents the results and conclusions from the ambient air monitoring conducted as part of the 2003 Urban Air Toxics Monitoring Program (UATMP) a program designed to characterize the magnitude and composition of potentially toxic air pollution in, or near, urban locations. The 2003 UATMP included 53 monitoring stations that collected 24-hour air samples, typically on a 6- or 12-day schedule. Forty-eight sites analyzed ambient air samples for concentrations of 59 volatile organic compounds (VOC) and 16 carbonyl compounds. Nine sites also analyzed for 80 speciated nonmethane organic compounds (SNMOC). One site analyzed for 19 semivolatile compounds (SVOC). Nine sites analyzed metal compounds, while two sites analyzed hexavalent chromium. Overall, nearly 118,600 ambient air concentrations were measured during the 2003 UATMP. The summary presented in this report uses various graphical, numerical, and statistical analyses to put the vast amount of ambient air monitoring data collected into perspective. Not surprisingly, the ambient air concentrations measured during the program varied significantly from city to city and from season to season. This report describes and interprets these spatial and temporal variations separately for halogenated hydrocarbons, hydrocarbons, polar compounds, and carbonyls.
NTIS
Air Pollution; Air Sampling; Environmental Monitoring

20050109777 Lawrence Livermore National Lab., Livermore, CA
Pre/Post-Strike Atmospheric Assessment System (PAAS)
Peglow, S. G.; Molitoris, J. D.; Feb. 1997; 20 pp.; In English
Report No.(s): DE2004-16134; UCRL-JC-126733; No Copyright; Avail: Department of Energy Information Bridge

The Pre/Post-Strike Atmospheric Assessment System was proposed to show the importance of local meteorological conditions in the vicinity of a site suspected of storing or producing toxic agents and demonstrate a technology to measure these conditions, specifically wind fields. The ability to predict the collateral effects resulting from an attack on a facility containing hazardous materials is crucial to conducting effective military operations. Our study approach utilized a combination of field measurements with dispersion modeling to better understand which variables in terrain and weather were most important to collateral damage predictions. To develop the PAAS wind-sensing technology, we utilized a combination of emergent and available technology from micro-Doppler and highly coherent laser systems. The method used for wind sensing is to probe the atmosphere with a highly coherent laser beam. As the beam probes, light is back-scattered from particles entrained in the air to the lidar transceiver and detected by the instrument. Any motion of the aerosols with a component along the beam axis leads to a Doppler shift of the received light.
NTIS
Meteorological Parameters; Toxicity; Velocity Distribution; Hazardous Materials

20050109779 Environmental Protection Agency, Research Triangle Park, NC
Developing Spatially Interpolated Surfaces and Estimating Uncertainty
Eberly, S.; Swall, J.; Holland, D.; Cox, B.; Baldridge, E.; Nov. 2004; In English
Report No.(s): PB2005-103146; EPA-454/R-04-004; No Copyright; Avail: National Technical Information Service (NTIS)

The need for spatial interpolation models in the regulatory environment has grown in the past few years. The EPA is using these models to review decisions on monitoring network design and to predict the efficacy of emission control programs. Due to the limited number of monitoring sites across the country for ambient concentrations of ozone and fine particles, there is a need to use spatial interpolation to predict ambient concentrations in unmonitored locations. Support for these methods has emerged from scientists and state/local/EPA agencies in recent workshops. The general consensus is that it is now possible to model the spatial dependence of air pollution data to reliably predict concentrations in unmonitored locations along with associated uncertainties for use in developing regulatory policy. EPA recognizes the merits of these methods, more specifically kriging, for use in the modeled attainment tests for the 8-hour ozone and PM 2.5 National Ambient Air Quality Standards attainment demonstrations. These methods provide environmental decision makers the opportunity to show important gradients of air pollution, review the location of monitoring networks and refine the definition of non-attainment boundaries. The purpose of this document is to provide an overview and better understanding of spatial interpolation methods.
NTIS
Air Quality; Ambience; Interpolation; Pollution Monitoring

20050109780 Environmental Protection Agency, Research Triangle Park, NC, USA
Using Non-Thermal Plasma to Control Air Pollutants
Feb. 2005; 26 pp.; In English
Report No.(s): PB2005-103471; EPA-456/R-05-001; No Copyright; Avail: CASI; A03, Hardcopy

The Clean Air Technology Center (CATC) serves as a resource on all areas of emerging and existing air pollution prevention and control technologies, and provides public access to data and information on their use, effectiveness and cost. In addition, the CATC will provide technical support, including access to EPA's knowledge base, to government agencies and others, as resources allow, related to the technical and economic feasibility, operation and maintenance of these technologies.
NTIS
Air Pollution; Air Quality; Pollution Control; Thermal Plasmas

20050109784 RTI International, Rsearch Triangle Park, NC, USA
Economic Impact Analysis of Final Iron and Steel Foundries NESHAP
Gallaher, M. P.; Depro, B. M.; Clayton, L.; Aug. 2003; 144 pp.; In English
Report No.(s): PB2005-103143; No Copyright; Avail: CASI; A07, Hardcopy

The U.S. Environmental Protection Agency (EPA) is developing a maximum achievable control technology (MACT) standard to reduce hazardous air pollutants (HAPs) from the iron and steel foundries source category. To support this rulemaking, EPAs Innovative Strategies and Economics Group (ISEG) has conducted an economic impact analysis (EIA) to assess the potential costs of the rule. This report documents the methods and results of this EIA. In 1997, the USA shipped over 12 million short tons of iron and steel castings. These castings are used in a variety of industries including automotive, aerospace, construction, appliances, and hardware.
NTIS
Air Pollution; Economic Impact; Environment Protection

20050109795 Sunflower Electric Power Corp., Hays, KS, USA, Energy and Environmental Research Corp., Irvine, CA, USA
Achieving New Source Performance Standards (NSPS) Emission Standards Through Integration of Low-No(x) Burners with an Optimization Plan for Boiler Combustion. Quarterly Technical Progress Report for January 2003 - March 2003
Penrod, W.; Moyeda, D.; Apr. 2003; In English
Report No.(s): DE2004-827045; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of this project is to demonstrate the use of an Integrated Combustion Optimization System to achieve NO(x) emissions levels in the range of 0.15 to 0.22 lb/MMBtu while simultaneously enabling increased power output. The project consists of the integration of low-NO(x) burners and advanced overfire air technology with various process measurement and control devices on the Holcomb Station Unit 1 boiler. The project includes the use of sophisticated neural networks or other artificial intelligence technologies and complex software that can optimize several operating parameters, including NO(x) emissions, boiler efficiency, and CO emissions. The program is being performed in three phases. In Phase I, the boiler is being equipped with sensors that can be used to monitor furnace conditions and coal flow to permit improvements in boiler operation. In Phase II, the boiler will be equipped with burner modifications designed to reduce NO(x) emissions and

automated coal flow dampers to permit on-line fuel balancing. In Phase III, the boiler will be equipped with an overfire air system to permit deep reductions in NO(sub x) emissions to be achieved.
NTIS
Balancing; Burners; Combustion; Pollution Control; Exhaust Emission

20050109804 Argonne National Lab., IL
Site-Specific Analysis of a Spent Nuclear Fuel Transportation Accident
Biwer, B. M.; Chen, S. Y.; 2003; In English
Report No.(s): DE2004-826259; No Copyright; Avail: National Technical Information Service (NTIS)

The number of spent nuclear fuel (SNF) shipments is expected to increase significantly during the time period that the USA inventory of SNF is sent to a final disposal site. Prior work estimated that the highest accident risks of a SNF shipping campaign to the proposed geologic repository at Yucca Mountain were in the corridor states, such as Illinois. The largest potential human health impacts would be expected to occur in areas with high population densities such as urban settings. Thus, our current study examined the human health impacts from the most plausible severe SNF transportation accidents in the Chicago metropolitan area. The RISKIND 2.0 program was used to model site-specific data for an area where the largest impacts might occur. The results have shown that the radiological human health consequences of a severe SNF rail transportation accident on average might be similar to one year of exposure to natural background radiation for those persons living and working in the most affected areas downwind of the actual accident location.
NTIS
Accidents; Spent Fuels; Transportation; Nuclear Fuels; Radiation Dosage

20050109806 Oak Ridge National Lab., TN, Southwest Research Inst., Dayton, OH, USA
Demonstration of Potential for Selective Catalytic Reduction and Diesel Particulate Filters
McGill, R.; Khair, M. K.; Sharp, C. A.; 2002; In English
Report No.(s): DE2004-828944; No Copyright; Avail: National Technical Information Service (NTIS)

This project addresses the potential for Selective Catalytic Reduction (SCR) devices (using urea as reductant) together with Diesel Particulate Filters (DPF) and low-pressure loop exhaust gas recirculation (EGR) to achieve future stringent emissions standards for heavy-duty engines powering Class 8 vehicles. Two emission control systems consisting of the three technologies (EGR, SCR, and DPF) were calibrated on a Caterpillar C-12 heavy -duty diesel engine. Results of these calibrations showed good promise in meeting the 2010 heavy-duty emission standards as set forth by the Environmental Protection Agency (EPA). These two emission control systems were developed to evaluate a series of fuels that have similar formulations except for their sulfur content. Additionally, one fuel, code-named BP15, was also evaluated. This fuel was prepared by processing straight -run distillate stocks through a commercial, single stage hydrotreater employing high activity catalyst at maximum severity. An additional goal of this program is to provide data for an on-going EPA technology review that evaluates progress toward meeting 2007/2010 emission standards. These emissions levels were to be achieved not only on the transient test cycles but in other modes of operation such as the steady-state Euro-III style emission test known as the OICA (Organisation Internationale des Compagnies d'Automobiles) or the ESC (European Stationary Cycle). Additionally, hydrocarbon and carbon monoxide emissions standards are to be met.
NTIS
Diesel Engines; Catalysts; Fluid Filters; Particulates

20050109809 RTI International, Research Triangle Park, NC, USA
Economic Impact Analysis (EIA) for the Proposed Stationary Combustion Turbines NSPS
Gallaher, M.; Depro, B.; Feb. 2005; 106 pp.; In English
Report No.(s): PB2005-103172; No Copyright; Avail: CASI; A06, Hardcopy

;Table of Contents: Introduction; Combustion Turbine Technologies and Costs; Background on Health Affects and Regulatory Alternatives; Projection of Units and Facilities in Affected Sectors; Profile of the Electric Utility Industry; Economic Analysis Methods; Economic Impact Analysis; Small Entity Impacts; References; Appendix A; Overview of the Market Model and Appendix B: Assumptions; Sensitivity Analysis; List of Figures; List of Tables and Select List of Acronyms and Abbreviations.
NTIS
Economic Impact; Turbines; Economic Analysis

20050109817 Florida International Univ., Miami, FL, USA

Demonstration and Evaluation of Potential High Level Waste Melter Decontamination Technologies for Savannah River Site

Weger, H.; Kodanda, R. T. M.; Mazumdar, A.; 2003; 14 pp.; In English

Report No.(s): DE2004-826201; No Copyright; Avail: Department of Energy Information Bridge

Four hand-held tools were tested for failed high-level waste melter decontamination and decommissioning (D&D). The forces felt by the tools during operation were measured using a tri-axial accelerometer since they will be operated by a remote manipulator. The efficiency of the tools was also recorded. Melter D&D consists of three parts: (1) glass fracturing: removing from the furnace the melted glass that can not be poured out through normal means, (2) glass cleaning: removing the thin layer of glass that has formed over the surface of the refractory material, and (3) K-3 refractory breakup: removing the K-3 refractory material. Surrogate glass, from a formula provided by the Savannah River Site, was melted in a furnace and poured into steel containers. K-3 refractory material, the same material used in the Defense Waste Processing Facility, was utilized for the demonstrations. Four K-3 blocks were heated at 1150 C for two weeks with a glass layer on top to simulate the hardened glass layer on the refractory surface in the melter. Tools chosen for the demonstrations were commonly used D&D tools, which have not been tested specifically for the different aspects of melter D&D. A jackhammer and a needle gun were tested for glass fracturing; a needle gun and a rotary grinder with a diamond face wheel (diamond grinder) were tested for glass cleaning; and a jackhammer, diamond grinder, and a circular saw with a diamond blade were tested for refractory breakup. The needle gun was not capable of removing or fracturing the surrogate glass. The diamond grinder only had a removal rate of 3.0 x 10-4 kg/s for K-3 refractory breakup and needed to be held firmly against the material. However, the diamond grinder was effective for glass cleaning, with a removal rate of 3.9 cm2/s. The jackhammer was successful in fracturing glass and breaking up the K-3 refractory block. The jackhammer had a glass-fracturing rate of 0.40 kg/s. The jackhammer split the K-3 refractory block into two pieces: one weighing 12.7 kg and the other 16.8 kg. However, it was not capable of fracturing smaller pieces off the block except when the chisel was applied at the edges of the block or at the fissure of the split. The circular saw successfully cut the K-3 refractory material at a rate of 0.29 cm3/s or a line at 4.1 cm/s. A Fourier transform was performed on the acceleration data to obtain the frequency domain results.

NTIS

Decontamination; Decommissioning

20050109820 Reaction Engineering International, Salt Lake City, UT

Oxidation of Mercury Across SCR Catalysts in Coal-Fired Power Plants Burning Low Rank Fuels. Quarterly Progress Report April 1, 2004-June 30, 2004

Senior, C.; Jul. 2004; In English

Report No.(s): DE2004-829540; No Copyright; Avail: National Technical Information Service (NTIS)

This is the sixth Quarterly Technical Report for DOE Cooperative Agreement No: DE-FC26- 03NT41728. The objective of this program is to measure the oxidation of mercury in flue gas across SCR catalyst in a coal-fired power plant burning low rank fuels using a slipstream reactor containing multiple commercial catalysts in parallel. The Electric Power Research Institute (EPRI) and Argillon GmbH are providing co-funding for this program. This program contains multiple tasks and good progress is being made on all fronts. During this quarter, a review of the available data on mercury oxidation across SCR catalysts from small, laboratory-scale experiments, pilot-scale slipstream reactors and full-scale power plants was carried out. Data from small-scale reactors obtained with both simulated flue gas and actual coal combustion flue gas demonstrated the importance of temperature, ammonia, space velocity and chlorine on mercury oxidation across SCR catalyst. SCR catalysts are, under certain circumstances, capable of driving mercury speciation toward the gas-phase equilibrium values at SCR temperatures. Evidence suggests that mercury does not always reach equilibrium at the outlet. There may be other factors that become apparent as more data become available.

NTIS

Catalysts; Oxidation; Power Plants; Coal; Mercury (Metal)

20050109826 Battelle Pacific Northwest Labs., Richland, WA, USA

Global Climate Change and the Transportation Sector: An Update on Issues and Mitigation Options

Geffen, C. A.; Dooley, J. J.; Kim, S. H.; 2002; In English

Report No.(s): DE2004-828935; No Copyright; Avail: National Technical Information Service (NTIS)

It is clear from numerous energy/economic modeling exercises that addressing the challenges posed by global climate change will eventually require the active participation of all industrial sectors and all consumers on the planet. Yet, these and similar modeling exercises indicate that large stationary CO(sub 2) point sources (e.g., refineries and fossil- fired electric

power plants) are often the first targets considered for serious CO(sub 2) emissions mitigation. Without participation of all sectors of the global economy, however, the challenges of climate change mitigation will not be met. Because of its operating characteristics, price structure, dependence on virtually one energy source (oil), enormous installed infrastructure, and limited technology alternatives, at least in the near-term, the transportation sector will likely represent a particularly difficult challenge for CO(sub2) emissions mitigation. Our research shows that climate change induced price signals (i.e. putting a price on carbon that is emitted to the atmosphere) are in the near term insufficient to drive fundamental shifts in demand for energy services or to transform the way these services are provided in the transportation sector. We believe that a technological revolution will be necessary to accomplish the significant reduction of greenhouse gas emissions from the transportation sector. This paper presents an update of ongoing research into a variety of technological options that exist for decarbonizing the transportation sector and the various tradeoffs among them.
NTIS
Climate Change; Transportation; Exhaust Emission; Carbon Dioxide

20050109828 Environmental Protection Agency, Research Triangle Park, NC, USA
RACT/BACT/LAER Clearinghouse (RBLC) Clean Air Technology Center Annual Report for 2003
Steigerwald, J. E.; Feb. 2004; In English
Report No.(s): PB2005-103147; EPA-456/R-04-001; No Copyright; Avail: National Technical Information Service (NTIS)
This RACT/BACT/LAER Clearinghouse (RBLC) annual report contains information on the 402 permits entered and the 473 permits modified in the Clearinghouse from January 2003 to December 2003 and provides an overview of data entry activity over the last five years. It summarizes this activity in terms of EPA Regions, States, and industrial processes; discusses trends over the past five years; and presents plans for additions and improvements to the clearinghouse.
NTIS
Air Quality; Pollution Control; Data Acquisition

20050109839 California Univ., Davis, CA, USA
Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB-1493 Rulemarking
Sperling, D.; Abeles, E.; Chen, B.; Kurani, K.; Turentine, T.; Oct. 2004; 460 pp.; In English
Report No.(s): PB2005-102235; No Copyright; Avail: CASI; A20, Hardcopy
On July 22, 2002, Governor Gray Davis signed AB 1493 into law. This law requires that the California Air Resources Board (CARB) propose rules that would reduce greenhouse gas emissions of light duty vehicles in California. The goal of this study was to provide insight into industry and consumer response to government regulations, especially as they might relate to future regulations that reduce greenhouse gas emissions from vehicles. This report addresses industry and consumer behavior with respect to emissions, safety, and energy use in the U.S. and Europe over the past few decades. We created and analyzed a large data set of vehicle characteristics, sales, and prices, vehicle financing practices, and exogenous factors such as income, for the period 1975- 2003, and supplemented the data analysis with case studies of the introduction of oxidation and three-way catalysts, air bags, and hybrid electric vehicles in the US; and diesel cars in Europe.
NTIS
Exhaust Emission; Greenhouse Effect; Speed Regulators

20050109841 Oak Ridge National Lab., TN
Guide to Low-Emission Boiler and Combustion Equipment Selection
Oland, C. B.; 2002; 176 pp.; In English
Report No.(s): PB2005-102954; ORNL/TM-2002/19; No Copyright; Avail: CASI; A09, Hardcopy
Contents include the following: List of figures; List of tables; Acronyms; Acknowledgments; Executive Summary; Introduction; Industrial, Commercial, and Institutional Boilers; Fuels, Emissions, and Efficiency; Emissions Standards and Compliance Issues; Emission Control Techniques; Selection Considerations; Selected Bibliography; Glossary and Appendix A. New Source Performance Standards Under Title IV of the Clean Air Act.
NTIS
Boilers; Emission; Combustion Control

20050109844 Praxis Engineers, Inc., Milpitas, CA, USA

On-Line Integrated Control System for Reducing Coal Costs and Coal-Related Emissions: Coal Blend Automation System (CBAS)

Maxson, J. A.; Sehgal, R.; Shea, S.; Jul. 1997; 18 pp.; In English

Report No.(s): DE2004-16964; No Copyright; Avail: Department of Energy Information Bridge

In 1995, TransAlta Utilities and Dairyland Power agreed to participate in a project funded by the U.S. Department of Energy to demonstrate a power plant optimization software product developed by Praxis Engineers, Inc. The product, the Plant Environmental and Cost Optimization System (PECOS), considers the power plant in its entirety from coal receipts and yard management to solid by-products and emissions. Its basic goal is to minimize the controllable costs of power generation. PECOS does so by performing an on-line analysis of all operations and their co-optimization to achieve a minimum generation cost. The software acts as an advisor to the plant operators and computes settings that achieve this goal.

NTIS

Automatic Control; Coal; Cost Reduction; Computer Programs

20050109845 Agence Nationale pour la Gestion des Dechets Radioactifs, Paris, France

Differences and Similarities in Andra's Assessment of Activities Carried Out by Radioactive Waste Generators and Affecting the Quality of IL-LL Short-Lived Waste Packages and HL-IL Long-Lived Waste Packages

Trentesaux, C.; Cairon, P.; 2003; 16 pp.; In English

Report No.(s): DE2004-827055; No Copyright; Avail: Department of Energy Information Bridge

In both cases of packages for either low-level and intermediate-level short-lived (LL-IL/SL) or high-level and intermediate-level long-lived (HL-IL/LL) radioactive waste, Andra has defined a quality reference system, manages it, follows up its appropriate implementation in production plants and verifies its effectiveness in production. The purpose of such a reference system is to ensure, in the first case, that waste packages comply with the Centre de l'Aube's acceptance criteria and, in the second case, that the characteristics submitted by the waste generators to Andra as input data for the deep geological repository project reflect the actual production conditions. In that context, the three management steps of the quality reference system include differences due to the fact that HL-IL/SL packages have not been submitted yet to any technical acceptance criterion. Compliance with any such criterion should be the subject of a characterisation report during the qualification phase and of a examination during the verification phase. The management of the quality reference system also involves similarities that facilitate the joint work carried out by Andra with the waste generators, especially in the facilities where both package types are produced.

NTIS

Radioactive Wastes; Management Systems; Data Bases; Packaging

20050109847 Fluor Daniel Hanford, Inc., Richland, WA, USA, Science Applications International Corp., Richland, WA, USA

Disposal of True Waste from the Plutonium Finishing Plant in Pipe Overpack Containers to WIPP Including New Security Requirements

Hopkins, A. M.; Sutter, C.; Hulse, G.; 2003; 14 pp.; In English

Report No.(s): DE2004-827069; No Copyright; Avail: Department of Energy Information Bridge

The Department of Energy is responsible for the safe management and cleanup of the DOE complex. As part of the cleanup and closure of the Plutonium Finishing Plant (PFP) located on the Hanford site, the nuclear material inventory was reviewed to determine the appropriate disposition path. Based on the nuclear material characteristics, the material was designated for stabilization and packaging for long term storage and transfer to the Savannah River Site or, a decision for discard was made. The discarded material was designated as waste material and slated for disposal to the Waste Isolation Pilot Plant (WIPP). Prior to preparing any residue wastes for disposal at the WIPP, several major activities need to be completed. As detailed a processing history as possible of the material including origin of the waste must be researched and documented. A technical basis for termination of safeguards on the material must be prepared and approved.

NTIS

Waste Disposal; Plutonium; Residues; Cleaning

20050109848 Envirocare of Utah, Inc., Salt Lake City, UT, USA

Envirocare of Utah: Expanding Waste Acceptance Criteria to Provide Low-Level and Mixed Waste Disposal Options

Rogers, B.; Loveland, K.; 2004; 14 pp.; In English

Report No.(s): DE2004-827149; No Copyright; Avail: Department of Energy Information Bridge

Envirocare of Utah operates a low-level radioactive waste disposal facility 80 miles west of Salt Lake City in Clive, Utah. Accepted waste types includes NORM, 11e2 byproduct material, Class A low-level waste, and mixed waste. Since 1988, Envirocare has offered disposal options for environmental restoration waste for both government and commercial remediation projects. Annual waste receipts exceed 12 million cubic feet. The waste acceptance criteria (WAC) for the Envirocare facility have significantly expanded to accommodate the changing needs of restoration projects and waste generators since its inception, including acceptable physical waste forms, radiological acceptance criteria, RCRA requirements and treatment capabilities, PCB acceptance, and liquids acceptance. Additionally, there are many packaging, transportation, and waste management options for waste streams acceptable at Envirocare. Many sub-contracting vehicles are also available to waste generators for both government and commercial activities.
NTIS
Environmental Monitoring; Waste Management; Radioactive Wastes; By-Products

20050109849 North Carolina Univ., Chapel Hill, NC, USA
Modeling the Transport and Chemical Evolution on Onshore and Offshore Emissions and Their Impact on Local and Regional Air Quality Using a Variable-Grid-Resolution Air Quality Model
Alapaty, K.; Dec. 2003; In English
Report No.(s): DE2004-828880; No Copyright; Avail: National Technical Information Service (NTIS)
This document, the project's first semiannual report, summarizes the research performed from 04/17/2003 through 10/16/2003. Portions of the research in several of the project's eight tasks were completed, and results obtained are briefly presented. We have tested the applicability of two different atmospheric boundary layer schemes for use in air quality model simulations. Preliminary analysis indicates that a scheme that uses sophisticated atmospheric boundary physics resulted in better simulation of atmospheric circulations. We have further developed and tested a new surface data assimilation technique to improve meteorological simulations, which will also result in improved air quality model simulations. Preliminary analysis of results indicates that using the new data assimilation technique results in reduced modeling errors in temperature and moisture. Ingestion of satellite-derived sea surface temperatures into the mesoscale meteorological model led to significant improvements in simulated clouds and precipitation compared to that obtained using traditional analyzed sea surface temperatures. To enhance the capabilities of an emissions processing system so that it can be used with our variable-grid-resolution air quality model, we have identified potential areas for improvements. Also for use in the variable-grid-resolution air quality model, we have tested a cloud module offline for its functionality, and have implemented and tested an efficient horizontal diffusion algorithm within the model.
NTIS
Algorithms; Atmospheric Boundary Layer; Atmospheric Physics; Chemical Evolution; Environment Models; Exhaust Emission

20050109856 Pennsylvania State Univ., University Park, PA, USA, Continental Oil Co., Houston, TX, USA
Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control
Boehman, A.; Alam, M.; Song, J.; Acharya, R.; Szybist, J.; Aug. 2003; In English
Report No.(s): DE2004-828945; No Copyright; Avail: National Technical Information Service (NTIS)
This paper describes work under a U.S. DOE sponsored Ultra Clean Fuels project entitled 'Ultra Clean Fuels from Natural Gas,' Cooperative Agreement No. DE-FC26- 01NT41098. In this study we have examined the incremental benefits of moving from low sulfur diesel fuel and ultra low sulfur diesel fuel to an ultra clean fuel, Fischer-Tropsch diesel fuel produced from natural gas. Blending with biodiesel, B100, was also considered. The impact of fuel formulation on fuel injection timing, bulk modulus of compressibility, in-cylinder combustion processes, gaseous and particulate emissions, DPF regeneration temperature and urea-SCR NOx control has been examined. The primary test engine is a 5.9L Cummins ISB, which has been instrumented for in-cylinder combustion analysis and in-cylinder visualization with an engine videoscope. A single-cylinder engine has also been used to examine in detail the impacts of fuel formulation on injection timing in a pump-line-nozzle fueling system, to assist in the interpretation of results from the ISB engine.
NTIS
Clean Fuels; Combustion Physics; Exhaust Emission; Fuel Injection

20050109860 New York City Transit Authority, Brooklyn, NY, USA
Comparison of Clean Diesel Buses to CNG Buses
Lowell, D. M.; Parsley, W.; Bush, C.; Zupo, D.; 2002; In English
Report No.(s): DE2004-829622; No Copyright; Avail: National Technical Information Service (NTIS)

Using previously published data on regulated and unregulated emissions, this paper will compare the environmental performance of current generation transit buses operated on compressed natural gas (CNG) to current generation transit buses operated on ultra low sulfur diesel fuel (ULSD) and incorporating diesel particulate filters (DPF). Unregulated emissions evaluated include toxic compounds associated with adverse health effects (carbonyl, PAH, NPAH, benzene) as well as PM particle count and size distribution. For all regulated and unregulated emissions, both technologies are shown to be comparable. DPFequipped diesel buses and CNG buses have virtually identical levels of PM mass emissions and particle number emissions. DPF-equipped diesel buses have lower HC and CO emissions and lower emissions of toxic substances such as benzene, carbonyls and PAHs than CNG buses. CNG buses have lower NOx emissions than DPF-equipped buses, though CNG bus NOx emissions are shown to be much more variable.
NTIS
Diesel Fuels; Natural Gas

20050109861 Agency for Environment and Energy Management, France
Comparative Study on Exhaust Emissions from Diesel- and CNG-Powered Urban Buses
Coroller, P.; Plassat, G.; 2003; In English
Report No.(s): DE2004-829628; No Copyright; Avail: National Technical Information Service (NTIS)
Couple years ago, ADEME engaged programs dedicated to the urban buses exhaust emissions studies. The measures associated with the reduction of atmospheric and noise pollution has particular importance in the sector of urban buses. In many cases, they illustrate the city's environmental image and contribute to reinforcing the attractiveness of public transport. France's fleet in service, presently put at about 14,000 units, consumes about 2 per cent of the total energy of city transport. It causes about 2 per cent of the HC emissions and from 4 to 6 per cent of the NOx emissions and particles. These vehicles typically have a long life span (about 15 years) and are relatively expensive to buy, about 150.000 euros per unit. Several technical solutions were evaluated to quantify, on a real condition cycle for buses, on one hand pollutants emissions, fuel consumption and on the other hand reliability, cost in real existing fleet.
NTIS
Exhaust Emission; Diesel Fuels; Natural Gas

20050111516 Environmental Protection Agency, Washington, DC, USA, Occupational Safety and Health Administration, Washington, DC, USA
EPA Chemical Accident Investigation Report: Tosco Avon Refinery Martinez, California
Nov. 1998; 110 pp.; In English
Report No.(s): PB2005-103660; EPA/550/R-98/009; No Copyright; Avail: CASI; A06, Hardcopy
On January 21, 1997, an explosion and fire occurred at the Hydrocracker Unit of the Tosco Refinery at Martinez, California, resulting in one death, 46 worker injuries and precautionary sheltering-in-place for the surrounding community. The accident involved the release and autoignition of a mixture of flammable hydrocarbons and hydrogen under high temperature and pressure. EPA undertook an investigation into the causes and underlying circumstances associated with this accident because of its serious consequences (fatality, injuries and offsite concern), the potential for greater impacts, and the opportunity to learn from this accident how similar accidents could be prevented.
NTIS
Accident Investigation; Spontaneous Combustion

20050111517 Environmental Protection Agency, Washington, DC, USA, Occupational Safety and Health Administration, Washington, DC, USA
EPA Chemical Accident Investigation Report: Surpass Chemical Co., Inc., Albany, NY
Sep. 1998; 54 pp.; In English
Report No.(s): PB2005-103659; EPA/550/R-98/01; No Copyright; Avail: CASI; A04, Hardcopy
On Tuesday, April 8, 1997, a 5,700-gallon hydrochloric acid (HCl) storage tank ruptured while being filled at the Surpass Chemical Co., Inc. The spill of HCl, a corrosive and toxic chemical, resulted in injuries to employees and members of the public, as well as public evacuations. EPA and OSHA considered the impacts of the tank failure with respect to the MOU criteria and the potential for lessons-learned and decided to initiate a joint investigation. The scope of the investigation was to determine the immediate and root causes of the tank failure and to make recommendations that could assist Surpass and others to prevent similar accidents from occurring in the future.
NTIS
Accident Investigation; Injuries

20050111522 Environmental Protection Agency, Washington, DC, USA, Occupational Safety and Health Administration, Washington, DC, USA

EPA Chemical Accident Investigation Report: Shell Chemical Company, Deer Park, Texas

Jun. 1998; 88 pp.; In English

Report No.(s): PB2005-103658; EPA/550/R-98/005; No Copyright; Avail: CASI; A05, Hardcopy

An explosion and fire took place at the Shell Chemical Company Complex in Deer Park, Texas, on June 22, 1997, resulting in injuries, public sheltering, closure of transportation routes, and property damage both on and off site. EPA and OSHA undertook an investigation of this accident because of its severity, its effects on workers and the public, the desire to identify those root causes and contributing factors of the event that may have broad applicability to industry, and the potential to develop recommendations and lessons learned to prevent future accidents of this type. This investigation was conducted in conjunction with an investigation by OSHA to determine if violations of occupational safety and health laws had occurred. NTIS

Accident Investigation; Injuries; Health

20050111526 US Chemical Safety and Hazard Investigation Board, Washington, DC, USA

U.S. Chemical Safety and Hazard Investigation Board Case Study. Explosion at Biochemical Facility: Liquid Nitric Oxide Release: ISOTEC, Miami Township, Ohio, September 21, 2003

Aug. 2004; 24 pp.; In English

Report No.(s): PB2005-103656; REPT-2003-15-C-OH; No Copyright; Avail: CASI; A03, Hardcopy

This Case Study describes an explosion in a cryogenic nitric oxide (NO) distillation process at the Isotec facility in Miami Township, Ohio. Remarkably, only one employee was injured. More than 2,000 local residents were evacuated for 24 hours. The key issues are: process hazards analysis, incident investigation, land use management, and emergency response. NTIS

Accident Investigation; Explosions; Nitric Oxide; Hazards; Cryogenics; Biochemistry

20050111527 Environmental Protection Agency, Washington, DC, USA

How to Prevent Runaway Reactions. Case Study: Phenol-Formaldehyde Reaction Hazards

Aug. 1999; 10 pp.; In English

Report No.(s): PB2005-103655; EPA/550/F-99/004; No Copyright; Avail: CASI; A02, Hardcopy

Approximately 10:42 a.m. on Wednesday, Sept. 10, 1997, an explosion occurred in a resins production unit at Georgia-Pacific Resins, Inc. in Columbus, Ohio. The blast was reported to be felt at least 2 miles and possibly as far as 7 miles away according to various news accounts and other reports. As a result of the explosion, one worker was killed and four others injured. The explosion extensively damaged the plant. Local news reported that a vocational school and several homes and businesses within a 3/4-mile radius were evacuated as a precaution by the local fire department for several hours The explosion also resulted in the release of a large quantity of liquid resin and smaller quantities of other chemicals within the facility. Three fire fighters were injured during the response, treated for first-degree chemical burns, and released. Under a 1997 Memorandum of Understanding (MOU) to investigate chemical accidents and report on the lessons learned, EPA and the Occupational Safety and Health Administration (OSHA) collaborated to analyze the evidence. The purpose of this effort was to understand the circumstances associated with the accident to prevent a recurrence at this and other facilities. NTIS

Chemical Reactors; Hazards; Phenol Formaldehyde

20050111565 Environmental Business International, Inc., San Diego, CA, USA

Economic Contribution of the California Air Pollution Control Industry

Killion, M.; Ferrier, G.; Oct. 2004; 230 pp.; In English

Report No.(s): PB2005-102271; No Copyright; Avail: CASI; A11, Hardcopy

The purpose of this study is to profile the California Air Pollution Control (APC) Industry. Little economic research has been performed on this industry, and few tools exist to estimate the impact air quality policy has had on this industry. After developing an industry definition, a database of companies was constructed, surveys were performed and results were modeled into a comprehensive set of industry statistics. In 2001, the California APC Industry generated $6.2 billion in revenues representing 0.5% of the economy, and employing 32,000 Californians. The APC industry can be divided into two subsets: a 'Core APC Industry' directly addressing air quality issues; and a 'Clean Air Products Industry' making less-emitting products, vehicles or energy sources. The APC industry has grown from $450 million in 1970 to $6.2 billion in 2001, a

compounded annual growth rate of 9%. Growth is expect to continue, although at a more modest rate, and ample opportunities exist for California APC businesses around the world. ARB programs are responsible for a considerable portion of revenues derived by APC companies. California is reasonably well positioned in the 'Core APC Industry,' but a potentially much larger opportunity exists of becoming leaders in the emerging 'Clean Air Products Industry.' Future policies can play a greater role in preserving air quality but also in stimulating the evolution of the APC industry.
NTIS
Air Quality; Economics; Industries; Air Pollution

20050123559 Nevada Commission on Nuclear Projects, Carson City, NV, USA
Rail Access to Yucca Mountain: Critical Issues
Halstead, R. J.; Dilger, F.; Moore, R. C.; Feb. 2003; 18 pp.; In English
Report No.(s): DE2004-826409; No Copyright; Avail: Department of Energy Information Bridge

The proposed Yucca Mountain repository site currently lacks rail access. The nearest mainline railroad is almost 100 miles away. Absence of rail access could result in many thousands of truck shipments of spent nuclear fuel and high-level radioactive waste. Direct rail access to the repository could significantly reduce the number of truck shipments and total shipments. The U.S. Department of Energy (DOE) identified five potential rail access corridors, ranging in length from 98 miles to 323 miles, in the Final Environmental Impact Statement (FEIS) for Yucca Mountain. The FEIS also considers an alternative to rail spur construction, heavy-haul truck (HHT) delivery of rail casks from one of three potential intermodal transfer stations. The authors examine the feasibility and cost of the five rail corridors, and DOE's alternative proposal for HHT transport. The authors also address the potential for rail shipments through the Las Vegas metropolitan area.
NTIS
Radioactive Wastes; Rail Transportation

20050123560 Tennessee Valley Authority, Chattanooga, TN, USA, Electric Power Research Inst., Chattanooga, TN, USA, SFA Pacific, Inc., Mountain View, CA, USA
Economic Evaluation of CO2 Storage and Sink Enhancement Options
2003; In English
Report No.(s): DE2004-826435; No Copyright; Avail: National Technical Information Service (NTIS)

This project developed life-cycle costs for the major technologies and practices under development for CO2 storage and sink enhancement. The technologies evaluated included options for storing captured CO2 in active oil reservoirs, depleted oil and gas reservoirs, deep aquifers, coal beds, and oceans, as well as the enhancement of carbon sequestration in forests and croplands. The capture costs for a nominal 500 MWe integrated gasification combined cycle plant from an earlier study were combined with the storage costs from this study to allow comparison among capture and storage approaches as well as sink enhancements.
NTIS
Carbon; Life Cycle Costs

20050123569 National Energy Technology Lab., Morgantown, WV, USA, Science Applications, Inc., Morgantown, WV, USA
Decontamination Technologies for Facility Reuse
Bossart, S. J.; Blair, D. M.; 2003; In English
Report No.(s): DE2004-826198; No Copyright; Avail: National Technical Information Service (NTIS)

As nuclear research and production facilities across the U.S. Department of Energy (DOE) nuclear weapons complex are slated for deactivation and decommissioning (D&D), there is a need to decontaminate some facilities for reuse for another mission or continued use for the same mission. Improved technologies available in the commercial sector and tested by the DOE can help solve the DOE's decontamination problems. Decontamination technologies include mechanical methods, such as shaving, scabbling, and blasting; application of chemicals; biological methods; and electrochemical techniques. Materials to be decontaminated are primarily concrete or metal. Concrete materials include walls, floors, ceilings, bio-shields, and fuel pools. Metallic materials include structural steel, valves, pipes, gloveboxes, reactors, and other equipment. Porous materials such as concrete can be contaminated throughout their structure, although contamination in concrete normally resides in the top quarter-inch below the surface. Metals are normally only contaminated on the surface. Contamination includes a variety of alpha, beta, and gamma-emitting radionuclides and can sometimes include heavy metals and organic contamination regulated by the Resource Conservation and Recovery Act (RCRA). This paper describes several advanced mechanical,

chemical, and other methods to decontaminate structures, equipment, and materials.
NTIS
Decontamination; Concretes

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20050109866 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Detection of the Same Hot Plasma in the Corona: During a CME and Later at Ulysses
Suess, S. T.; Poletto, G.; [2004]; 1 pp.; In English; American Geophysical Union 2004 Fall Annual Meeting, 13-17 Dec. 2004, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

We show direct evidence for the same very hot plasma being detected remotely from SOHO in the corona and subsequently, at Ulysses in the solar wind. This is, to our knowledge, the first time that such an unambiguous identification has been made in the case of hot plasma. This detection complements studies correlating other plasma and field properties observed to the properties measured at the source in the corona. This observation takes advantage of a SOHO-Sun-Ulysses quadrature, during which the Sun-Ulysses included angle is 90° and it is possible to observe with Ulysses instruments the same plasma that has previously been remotely observed with SOHO instruments in the corona on the limb of the Sun. The identification builds on an existing base of separate SOHO and interplanetary detections of hot plasma. SOHO/UVCS has found evidence for very hot coronal plasma in current sheets in the aftermath of CMEs in the [Fe XVIII] λ \AA\ line, implying a temperature on the order of $6\times 10(exp 6)$ K. This temperature is unusually high even for active regions, but is compatible with the high temperature predicted in current sheets. In the solar wind, ACE data from early 1998 to middle 2000 revealed high frozen-in Fe charge state in many cases to be present in interplanetary plasma.
Author
High Temperature Plasmas; Solar Wind; Coronas; Charged Particles; Plasma Currents; Ulysses Mission

20050109895 NASA Marshall Space Flight Center, Huntsville, AL, USA
Liquid Between Macromolecules in Protein Crystals: Static Versus Dynamics
Chernov, A. A.; [2005]; 1 pp.; In English; 5th International Surface Science Workshop, 19-27 Feb. 2005, Sofia, Bulgaria
Contract(s)/Grant(s): NAS8-02096; Copyright; Avail: Other Sources; Abstract Only

Protein crystals are so fragile that they often can not be handled by tweezers. Indeed, measurements of the Young modulus, E, of lysozyme crystals resulted in E approx. equals 0.1 - 1 GPa, the lower figures, 0.1 - 0.5 GPa, being obtained from triple point bending of as-grown and not cross-linked crystals sitting in solution. The bending strength was found to be approx.10(exp -2) E. On the other hand, ultrasound speed and Mandelstam-Raman-Brilloin light scattering experiments led to much higher figures, E approx. equals 2.7 GPa. The lower figures for E were found from static or low frequency crystal deformations measurements, while the higher moduli are based on high frequency lattice vibrations, 10(exp 7) - 10(exp 10) 1/s. The physical reason for the about an order of magnitude discrepancy is in different behavior of water filling space between protein molecules. At slow lattice deformation, the not-bound intermolecular water has enough time to flow from the compressed to expanded regions of the deformed crystal. At high deformation frequencies in the ultra- and hypersound waves, the water is confined in the intermolecular space and, on that scale, behaves like a solid, thus contributing to the elastic crystal moduli. In this case, the reciprocal crystal modulus is expected to be an average of the water protein and water compressibilities (reciprocal compressibilities): the bulk modulus for lysozyme is 26 GPa, for water it is 7 GPa. Anisotropy of the crystal moduli comes from intermolecular contacts within the lattice while the high frequency hardness comes from the bulk of protein molecules and water bulk moduli. These conclusions are based on the analysis of liquid flow in porous medium to be presented.
Author
Proteins; Crystals; Macromolecules; Lysozyme; Light Scattering; Deformation

20050109936 University of Central Florida, Orlando, FL, USA
On-orbit Calibration of the Seawinds Scatterometer Antennas
Zec, Josko; Jones, W. Linwood; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1036-1039; In English; See also 20050109927; Copyright; Avail: Other Sources

Measurements of ocean, sea-ice and terrain geophysical parameters can be remotely sensed using an active microwave sensor known as the microwave scatterometer. Satellite scatterometers are spaceborne radars that measure the absolute backscattered power from the earth's surface; and from this measurement, the normalized radar cross-section (sigma(sup 0)) of that surface is determined. Scatterometers calculate sigma(sup 0) of a measurement cell by inverting the radar equation [1]: where: R is range to the cell center, P(sub t) is transmitted power, lambda is transmitted wavelength, L is total path loss, G(sub A) is peak antenna gain, A(sub c) is cell area, and c is a pre-computed factor due to the approximation of the radar equation for extended area targets.
Derived from text
Remote Sensing; Sea Ice; Terrain; Oceans; Microwave Sensors; Antenna Gain; Backscattering; Calibrating

20050110156 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Utility of Auroral Image-based Activities Metrics
Germany, G.; Spann, J.; Deverapalli, C.; Hung, C.-C.; [2004]; 1 pp.; In English; Fall AGU 2004 Meeting, 13-17 Dec. 2004, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

Auroral activity indices such as Hemispheric Power and Auroral Boundary are currently key data products used for space weather predictions and nowcasting. However, these products are necessarily based on limited observations which must be extrapolated to provide global coverage. The advent of routine space-based auroral imaging in the last decade offers the seeming advantage of more detailed measures of auroral activity. Examples of image-derived products include energy deposition maps, oval location, cap size, and morphological classification. However, activity metrics derived from auroral images have shortcomings, as well. For example, limited fields-of-view and orbital motion prevent full coverage of the auroral regions. This paper will examine the utility of activity metrics derived h m auroral images for operational purposes. The eight-year collection of Polar UVI images databased in the UVI Online Search Tool (OST) will be used to illustrate the advantages and shortcomings of auroral activity metrics. The potential role of other currently-active imaging missions will also be examined and correlative studies to date using auroral imaging will be summarized.
Author
Auroral Zones; Imaging Techniques; Space Weather

20050110217 NASA Marshall Space Flight Center, Huntsville, AL, USA
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications
Ramachandran, N.; Ray, C. S.; Rogers, J. R.; [2004]; 1 pp.; In English; Materials Research Society: Materials for Space Applications, 29 Nov. - 3 Dec. 2004, Boston, MA, USA
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

The long-term exploration goals of NASA include developing human habitation on Mars and conducting scientific investigations on Mars and other planetary bodies. In situ resource processing is a key objective in this area. We focus on the possibility of making magnetic glasses in situ for potential applications development. The paper will focus on ongoing work at NASA Marshall Space Flight Center on making magnetic glass from Mars soil simulants and its characterization. Analysis of the glass morphology, strength, chemistry and resulting magnetic properties will provide a fundamental understanding of the synthesized material that can be used for potential applications development. in an effort to characterize the magnetic properties of the Mars glasses, a series of tests were performed at NASA MSFC. Preliminary tests indicated that the glasses were attracted to a magnet and also had a small amount of residual magnetism. They were opaque (almost black in color). As the first step, a sample of Mars 1 glass (approx.1 mm x 1 mm x 5 mm length) was machined, weighed and its hysteresis curve was measured using a Vibration Sample Magnetometer (VSM). Next, a small furnace was designed and built and the sample was baked in a graphite (reducing agent) crucible at 800 C in an Argon atmosphere for 3 hours in the presence of a uniform, transverse (transverse to the 5mm length of the sample) magnetic field of 0.37 Tesla. The treated sample showed reddening on the outside and showed substantially increased residual magnetism. This sample was again analyzed in the VSM. The data clearly showed that some chemical change occurred during the heat treatment (color change) and that both the glasses have useful magnetic properties. Although no orientation effects of the magnetic field were considered, the data showed the following: 1. Both glass samples are primarily soft magnets and display ferromagnetic behavior (hysteresis, saturation, etc.) 2. The treated glass has improved saturation magnetism (order of magnitude increase), retentivity (factor of 6 increase) and susceptibility (order of magnitude increase) compared to the untreated glass 3. The untreated sample has higher coercivity (approx.50% that of Nickel) than the treated sample 4. Both samples have similar energy density. Results from a systematic study to quantify the effects of processing conditions such as heat treatment, atmosphere, containerless processing (by electrostatic levitation), and applications of external magnetic fields of different strengths will be discussed. Efforts on optimizing the magnetic properties of the product and the feasibility of using it for a couple of specific magnetic applications

such as heat generation using an ac field and for electro forming will also be covered. The latter is an in situ manufacturing technique being studied for in-space fabrication applications at MSFC.
Author
Ferromagnetic Materials; Magnetic Properties; Alternating Current; Electric Fields; Electrostatics; Glass; Magnets

20050110222 Oregon State Univ., Corvallis, OR, USA
Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics
Goldfinger, Chris; Meigs, Andrew; Meigs, Andrew; Kaye, Grant D.; VanLaningham, Sam; February 2005; 9 pp.; In English
Contract(s)/Grant(s): NAG5-11404
Report No.(s): NS1270; No Copyright; Avail: CASI; A02, Hardcopy

Subduction zones that are capable of generating great (Mw greater than 8) earthquakes appear to have a common assemblage of forearc morphologic elements. Although details vary, each have (from the trench landward), an accretionary prism, outer arc high, outer forearc basin, an inner forean: basin, and volcanic arc. This pattern is common in spite of great variation in forearc architecture. Because interseismic strain is known to be associated with a locked seismogenic plate interface, we infer that this common forearc morphology is related, in an unknown way, to the process of interseismic Strain accumulation and release in great earthquakes. To date, however, no clear relationship between the subduction process and the common elements of upper plate form has emerged. Whereas certain elements of the system, i.e. the outer arc high, are reasonably well- understood in a structural context, there is little understanding of the structural or topographic evolution of the other key elements like the inner arc and inner forearc basin, particularly with respect to the coupled zone of earthquake generation. This project developed a model of the seismologic, topographic, and uplift/denudation linkages between forearc topography and the subduction system by: 1) comparing geophysical, geodetic, and topographic data from subduction margins that generate large earthquakes; 2) using existing GPS, seismicity, and other data to model the relationship between seismic cycles involving a locked interface and upper-plate topographic development; and 3) using new GPS data and a range-scale topographic, uplift, and denudation analysis of the presently aseismic Cascadia margin to constrain topographic/plate coupling relationships at this poorly understood margin.
Author
Test Equipment; Spatial Resolution; Tectonics; Topography; Volcanoes; Subduction (Geology)

20050110345 Naval Postgraduate School, Monterey, CA USA
Improvement of an Acoustic Sounder Device Used to Measure Atmospheric Turbulence
Liu, Jeng-Shiung; Dec. 2004; 71 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429825; No Copyright; Avail: Defense Technical Information Center (DTIC)

Optical turbulence plays an important role in the propagation of electromagnetic waves through the atmosphere because it broadens and distorts the optical beam. A variety of optical, thermal, and acoustic instruments are used to detect the atmospheric turbulence and an acoustic echosounder has proven to be a valuable tool to probe the fine dynamic structure of atmospheric turbulence within first hundred meters above the surface. The first planar acoustic echosounder constructed at the Naval Postgraduate School was by Weingartner and Wroblewski, under Walters supervision. Moxcey later modified this design by reducing the number of drivers from 25 to 19 and placing the drivers closer together into a hexagonal, close-packed array. This thesis explored the potential sources of the transducer ringing and implemented solutions to the problem. Additionally, we also improved the receiving sensitivity of the echosounder and lowered the electronics noise when receiving. Finally, we applied these techniques to another array assembled with new drivers to improve its performance compared to the previous echosounder array, while measuring and quantifying the level of improvement achieved.
DTIC
Atmospheric Circulation; Atmospheric Turbulence; Audio Equipment; Electromagnetic Wave Transmission; Sounding

20050110421 Crete Univ., Crete, Greece
Radio Wave Studies of Irregular Ionospheric Phenomena at Midlatitude
Haldoupis, Cristos; Dec. 2004; 11 pp.; In English
Contract(s)/Grant(s): FA8655-03-1-3028
Report No.(s): AD-A429951; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking University of Crete as follows: The contractor will investigate irregular plasma physical processes in the mid-latitude ionosphere. Proposed research will focus on four topics: i) Formation and morphology of sporadic E layers (Es). 2) Plasma physics of instabilities and irregularities inside Es. 3) The role of unstable sporadic E in

the generation of mid-latitude Spread F. 4) A new VLF experiment in Crete to perform measurements and studies of lightning-induced precipitation in the ionosphenc D region over Europe.
DTIC
Radio Waves; Temperate Regions

20050110499 Naval Research Lab., Washington, DC USA
Improved Approximations for Wave Structure Functions in a Turbulent Atmosphere
Lucke, Robert L.; Jan. 2005; 19 pp.; In English
Report No.(s): AD-A430057; NRL/FR/7218--05-10; 104; No Copyright; Avail: Defense Technical Information Center (DTIC)

The effect of a turbulent atmosphere on a plane wave propagating through it is described by the plane wave structure function. Its standard form is 6.88(r/r sub 0) sup 5/3, but this does not include the effect of a finite outer scale of turbulence and is 35% too large when r is 1% of the outer scale. There are much better approximations in the literature. In this report, they are rederived, extended, and presented in a convenient form for plane and spherical waves and for Kolmogorov and von Karman spectral densities of turbulence. The results are useful for propagation problems when outer scales are relatively small and for imaging systems with short exposure times. The effect of a finite outer scale on the structure function of the atmosphere's index of refraction is also addressed.
DTIC
Approximation; Atmospheric Turbulence; Turbulence; Wave Functions

20050111534 NASA Marshall Space Flight Center, Huntsville, AL, USA
IMAGE-POLAR Concurrent Plasmapause Observations
Adrian, M. L.; Gallagher, D. L.; Craven, P. D.; [2004]; 1 pp.; In English; Fall AGU 2004 Meeting, 13-17 Dec. 2004, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

Two critical issues that influence the quantitative scientific value of the IMAGE Ultraviolet Camera (EUV) are: (1) the accuracy with which EUV imaging can be used to determine the position/location of the plasmapause; and (2) the sensitivity threshold of the EUV instrument. These issues are addressed through analysis of concurrent observations of the plasmasphere/plasmapause made remotely using IMAGE EUV and in-situ with the Polar/TIDE/EFI instruments. Preliminary results are presented with regards to the validity of the extraction of the plasmapause using EUV and initial in-flight, in-situ estimates of the EUV sensitivity threshold.
Author
Extreme Ultraviolet Radiation; Plasmapause; Satellite Observation; Ultraviolet Imagery

20050123573 Ohio State Univ., Columbus, OH, USA, Technical Univ. of Denmark, Lyngby, Denmark
Coupled Gravity and Elevation Measurement of Ice Sheet Mass Change
Jezek, K. C.; Baumgartner, F.; February 28, 2005; 15 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG5-13665
Report No.(s): OSU-744640; No Copyright; Avail: CASI; A03, Hardcopy

During June 2003, we measured surface gravity at six locations about a glaciological measurement site located on the South-central Greenland Ice. We operated a GPS unit for 90 minutes at each site -the unit was operated simultaneously with a base station unit in Sondrestrom Fjord so as to enable differential, post-processing of the data. We installed an aluminum, accumulation-rate-pole at each site. The base section of the pole also served as the mount for the GPS antenna. Two gravimeters were used simultaneously at each site. Measurements were repeated at each site with at time lapse of at least 50 minutes. We measured snow physical properties in two shallow pits The same measurement sites were occupied in 1981 and all were part of a hexagonal network of geodetic and glaciological measurements established by The Ohio State University in 1980. Additional gravity observations were acquired at three of the sites in 1993 and 1995. Gravity data were collected in conjunction with Doppler satellite measurements of position and elevation in 1981 and global positioning system measurements subsequently. The use of satellite navigation techniques permitted reoccupation of the same sites in each year to within a few 10 s of meters or better. After detrending the gravity data, making adjustments for tides and removing the residual effects of local spatial gradients in gravity, we observe an average secular decrease in gravity of about 0.01 milligal/year, but with tenths of milligal variations about the mean trend. The trend is consistent with a nearly linear increase in surface elevation of between 7 to 10 c d y r (depending on location) as measured by repeated airborne laser altimeter, surface Doppler satellite and GPS elevation measurements. Differences between the residual gravity anomalies after free air correction may be attributable to local mass changes. This project is a collaboration between the Byrd Polar Research Center of the Ohio

State University and the Arctic Technology Center of the Danish Technical University.
Author
Ice; Elevation; Global Positioning System; Gravimeters; Gravitation

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20050092379 NASA Marshall Space Flight Center, Huntsville, AL, USA
Lightning Contribution to Improvement of Passive Microwave Vertical Structure and Rainfall Estimation
Boccippio, Dennis; Cecil, D.; Petersen, W. A.; [2005]; 1 pp.; In English; American Meteorological Society 85th Annual Meeting/Conference, 9-13 Jan. 2005, San Diego, CA, USA
Report No.(s): Paper-86040; No Copyright; Avail: Other Sources; Abstract Only

Joint observations from the TRMM mission are used to examine the contribution which lightning observations can make towards estimation of vertical structure and rainfall from passive microwave data. Passive microwave (TMI) observations are binned into distinct vertical structure categories based on cluster analysis of radar (PR) vertical profiles and convective/stratiform (C/S) classifiers. TMI rain estimates are high-biased relative to radar for stratiform and mixed convective/stratiform vertical structures and low-biased relative to radar for convective structures. Significant ambiguity exists in the TMI brightness temperature space between midlevel stratiform and convective profile types which are primary contributors to tropical rainfall. The ambiguity is worst for convective profile types with radar echo tops within and just above the mixed-phase region. The ability of TMI data (including all low and high frequency polarized brightness temperatures; 19V, 19H, 21V, 37V, 37H, 85V, 85H) to predict vertical structure is assessed. The incremental benefit of including TMI convective/stratiform (C/S) classifiers (both 85 GHz polarization and 19, 37 and 85 GHz texture-based) and LZS lightning observations is then considered. The use of all parameters (brightness temperatures, TMI C/S classifiers, lightning data, predicted vertical structure) to reduce TMI/PR rainfall estimate scatter is demonstrated. For both vertical structure and rainfall estimation, inclusion of C/S classifiers and lightning observations provide statistical skill improvements but do not completely alleviate critical midlevel profile C/S ambiguity and related rain estimate errors.
Author (revised)
Lightning; Rain; Estimates

20050092393 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Climate-Driven Deformation of the Solid Earth from GRACE and GPS
Davis, J. L.; Elosegui, P.; Mitrovica, J. X.; Tamisiea, M. E.; Geophysical Research Letters; 2004; ISSN 0094-8276; Volume 31; In English
Contract(s)/Grant(s): NNG04GF09G; NNG04GL69G; NAG5-13748; Copyright; Avail: Other Sources

GRACE data indicate large seasonal variations in gravity that are assumed to be related to climate-driven fluxes of space water. Seasonal redistribution of surface mass should deform the Earth, and our calculations using GRACE data suggest vertical deformations of approx. 13 mm in the region of greatest flux, the Amazon River Basin. To test the GRACE gravity-hydrology connection, we analyzed GPS data acquired from sites in this region. After accounting for degree 1 variations not observable with GRACE, we find that annual deformation measured with GPS correlates highly with predictions calculated from GRACE measurements. These results confirm the variations in surface water sensed by GRACE, which are significantly larger than those predicted by some hydrology models. The results also demonstrate that GRACE can be an important tool for monitoring deformation of the Earth, and suggest that combined analysis of GRACE and GPS may be a useful approach for estimation of geocenter variations.
Author
Climate; Annual Variations; Geodetic Surveys; Hydroclimatology

20050092396 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Constraints of Melting, Sea-Level and the Paleoclimate from GRACE
Davis, James L.; March 2005; 20 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNG04GF09G; No Copyright; Avail: CASI; A03, Hardcopy

To gauge the accuracy of the GRACE data, we have undertaken a study to compare deformations predicted by GRACE inferences of seasonal water loading to crustal position variations determined from GRACE data. Two manuscripts that

resulted from this study are attached. We found a very high correlation between the GRACE and GPS determinations for South America [Duvis et al., 2004]. We also developed a statistical approach for choosing which Stokes coefficients to include. This approach proves to be somewhat more accurate than the traditional Gaussian filter [Duvis et al., 2005].
Author
Measuring Instruments; Statistical Analysis; Sea Level; Deformation; Crusts; Global Positioning System; Correlation; Melting

20050092411 Swedish Defence Research Establishment, Linkoeping
Semi-Empirical IR Signature Model for Tilted Surfaces
Hermansson, P.; Dec. 2003; In English
Report No.(s): PB2005-101909; FOI-R-1092-SE; No Copyright; Avail: National Technical Information Service (NTIS)

In this document the authors present the further development that has been made of a previously presented semi-empirical model for calculation of thermal IR signatures from background elements. An improved modeling of non-horizontal surfaces has been included in the semi-empirical model. The model has been tested by curve-fitting the model to time histories of measured LWIR radiance from two flat, tilted panels. The two panels have different coatings with significantly different emissivities in the infrared. The correspondence between the curve-fitted model and measurements is very good for both panels during the entire time period for which we have measurements. For the purpose of future evaluation, the authors also present simple models for latent heat and precipitation which may have been included in the semi-empirical model. It is concluded that the developed semi-empirical model could be a useful tool in several applications of IR-signature prediction and simulation. It is also noted that a continued development and, in particular, validation of the model would be of value.
NTIS
Infrared Signatures; Surfaces

20050110500 Naval Research Lab., Bay Saint Louis, MS USA
Evaluations of Global Wind Prediction at Fleet Numerical Meteorology and Oceanography Center: from the Perspective of a Wave Modeler
Rogers, W. E.; Wang, David; Hsu, Larry; Wittmann, Paul; Clancy, Michael; Nov. 2004; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430059; NRL/MR/7320--04-8823; No Copyright; Avail: Defense Technical Information Center (DTIC)

This study describes the validation of winds fields used in a companion study ('Evaluation of global wave prediction at Fleet Numerical Meteorology and Oceanography Center,' submitted for review). During this validation, it is found that conventional methods of estimating the distribution of bias across wind speeds can produce widely misleading conclusions. This is demonstrated, and a simple solution (histogram comparisons without geographic interpolation) is presented.
DTIC
Meteorology; Oceanography; Wind Velocity

20050110544 Naval Research Lab., Washington, DC USA
Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model
Hoppel, William A.; Caffrey, Peter; Frick, Glendon M.; Jan. 2005; 41 pp.; In English
Report No.(s): AD-A430126; NRL/MR/7228-05-8852; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the method used to include large-scale vertical motions, such as subsidence and lifting in the 1-D (dimensional) NRL aerosol model (MARBLES), in which all aerosol sources, sinks, and transformation processes take place within the horizontal layers defined as cells. The large-scale convergences and divergences'in the wind field responsible for the vertical motion must be generated externally, such as by the Navy's 3-D mesoscale model COAMPS (Coupled Ocean Atmosphere Meteorological Prediction System). The aerosol model is run along an air-mass trajectory generated from the output of COAMPS that includes vertical profiles of meteorological data required by the aerosol model. The 1-D aerosol model can be visualized as a Lagrangian column moving with a mean horizontal wind speed. Tests are used to illustrate the performance of the model, and the conditions under which the 1-D (horizontally homogeneous) solution is valid are discussed.
DTIC
Aerosols; Atmospheric Composition; Atmospheric Models; Meteorological Parameters; Trace Contaminants; Trace Elements

20050110547 Naval Research Lab., Bay Saint Louis, MS USA
Modeling Ocean Deep Convection
Canuto, V. M.; Howard, A.; Hogan, Patrick J.; Cheng, Y.; Dubovikov, M. S.; Jan. 2004; 22 pp.; In English
Report No.(s): AD-A430133; NRL/JA/7320-03-106; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this study is to assess models for Deep Convection with special emphasis on their use in coarse resolution ocean general circulation models. A model for deep convection must contain both vertical transport and lateral advection by mesoscale eddies generated by baroclinic instabilities. The first process operates mostly in the initial phases while the second dominates the final stages. Here the emphasis is on models for vertical mixing. When mesoscales are not resolved, they are treated with the Gent and McWilliams parameterization. The model results are tested against the measurements of Lavender, Davis and Owens, 2002 (LDO) in the Labrador Sea. Specifically, we shall inquire whether the models are able to reproduce the region of 'deepest convection,' which we shall refer to as DC (mixed layer depths 800-1300m). The region where it was measured by Lavender et al. (2002) will be referred to as the LDO region.
DTIC
Convection; Oceans

20050111525 National Climatic Data Center, Asheville, NC, USA
USA Climate Normals, 1971-2000. State, Regional, and National Monthly Heating Degree Days Weighted by Population (2000 Census) 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 5-1
2004; 20 pp.; In English
Report No.(s): PB2005-103635; No Copyright; Avail: CASI; A03, Hardcopy

Historical Climatography Series (HCS) 4-1,2,3 and 5-1,2 include normals and standard deviations for the five 30-year normals periods and the 70-year period between 1931-2000 for U.S. States, regions, and the conterminous USA. Statistics are based on weighted divisional data from Climatography of the USA, Number 85 for U.S. States, and in turn from these state values for regional and national computations. Two sets of regions are included: (1) U.S. Census Bureau regions, excluding Hawaii and Alaska from the Western Region; and (2) NCDC regions used for climate monitoring (Karl and Koss, 1984). HCS 4-1,2, and 3 provide area-weighted temperature and precipitation statistics, while HCS 5-1,2 provide population-weighted degree day statistics. Population weights are based on the 2000 U.S. Census. Both area and population weights are provided on pages 4 and 5. The normals and standard deviations include values for each of the 12 calendar months and an annual value, plus 4 seasonal averages in HCS 4-3. The data are presented by abbreviation/name and number for a state, region, or the conterminous U.S. State data for the conterminous USA are presented alphabetically, followed by data for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Pacific trust territories, followed by regional/national data. Data elements include time of observation-corrected mean temperature (deg F), precipitation (inches), and heating and cooling degree days (base 65 deg F).
NTIS
Climate; Precipitation (Meteorology); Atmospheric Temperature

20050111528 National Climatic Data Center, Asheville, NC, USA
State Monthly Temperature, Precipitation, and Degree Days 1971-2000 (and Previous Normals Periods). Section 2: State Maps, 1931-2000. Historical Climatography Series No. 4 and 5
2004; In English
Report No.(s): PB2005-103637; No Copyright; Avail: National Technical Information Service (NTIS)

The maps showing both mean and standard deviations, by element and by month (or annual value), are provided for the 48 contguous USA, plus Alaska and Hawaii where available. Puerto Rico, the U.S. Virgin Islands, and Pacific trust territories are not mapped. Each map page has a description at the bottom of the page indicating the month (or annual period), period of record (either 1971-2000 or 1931-2000), and element (either mean temperature (degrees F), precipitation (inches), and heating and cooling degree days (base 65 degrees F)). The legend to the immediate left of the maps provide data range/color relationships, which correspond to the tabular information presented in this product. Slight variations in color display and printouts between the legend and maps are possible. Long term (1931-2000) statistics are not available for Hawaii.
NTIS
Climatology; Temperature; Precipitation (Meteorology)

20050111529 National Climatic Data Center, Asheville, NC, USA
State Monthly Temperature, Precipitation, and Degree Days 1971-2000 (and Previous Normals Periods). Section 1: State Maps, 1971-2000. Historical Climatography Series No. 4 and 5
2004; In English
Report No.(s): PB2005-103638; No Copyright; Avail: National Technical Information Service (NTIS)

The mMaps showing both mean and standard deviations, by element and by month (or annual value), are provided for the 48 contguous USA, plus Alaska and Hawaii where available. Puerto Rico, the U.S. Virgin Islands, and Pacific trust

territories are not mapped. Each map page has a description at the bottom of the page indicating the month (or annual period), period of record (either 1971-2000 or 1931-2000), and element (either mean temperature (degrees F), precipitation (inches), and heating and cooling degree days (base 65 degrees F)). The legend to the immediate left of the maps provide data range/color relationships, which correspond to the tabular information presented in this product. Slight variations in color display and printouts between the legend and maps are possible. Long-term (1931-2000) statistics are not available for Hawaii.
NTIS
Temperature; Precipitation (Meteorology); Climatology

20050111530 National Climatic Data Center, Asheville, NC, USA
USA Climate Normals, 1971-2000. State, Regional, and National Monthly Temperature and Precipitation Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-3
2004; 22 pp.; In English
Report No.(s): PB2005-103634; No Copyright; Avail: CASI; A03, Hardcopy

Historical Climatography Series (HCS) 4-1,2,3 and 5-1,2 include normals and standard deviations for the five 30-year normals periods and the 70-year period between 1931-2000 for U.S. States, regions, and the conterminous USA. Statistics are based on weighted divisional data from Climatography of the USA, Number 85 for U.S. States, and in turn from these state values for regional and national computations. Two sets of regions are included: (1) U.S. Census Bureau regions, excluding Hawaii and Alaska from the Western Region; and (2) NCDC regions used for climate monitoring (Karl and Koss, 1984). HCS 4-1,2, and 3 provide area-weighted temperature and precipitation statistics, while HCS 5-1,2 provide population-weighted degree day statistics. Population weights are based on the 2000 U.S. Census. Both area and population weights are provided. The normals and standard deviations include values for each of the 12 calendar months and an annual value, plus 4 seasonal averages in HCS 4-3. The data are presented by abbreviation/name and number for a state, region, or the conterminous U.S. State data for the conterminous USA are presented alphabetically, followed by data for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Pacific trust territories, followed by regional/national data. Data elements include time of observation-corrected mean temperature (deg F), precipitation (inches), and heating and cooling degree days (base 65 deg F).
NTIS
Climatology; Precipitation (Meteorology); Temperature

20050111531 National Climatic Data Center, Asheville, NC, USA
USA Climate Normals, 1971-2000. State, Regional, and National Monthly Temperature Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-1
2004; 22 pp.; In English
Report No.(s): PB2005-103632; No Copyright; Avail: CASI; A03, Hardcopy

Historical Climatography Series (HCS) 4-1,2,3 and 5-1,2 include normals and standard deviations for the five 30-year normals periods and the 70-year period between 1931-2000 for U.S. States, regions, and the conterminous USA. Statistics are based on weighted divisional data from Climatography of the USA, Number 85 for U.S. States, and in turn from these state values for regional and national computations. Two sets of regions are included: (1) U.S. Census Bureau regions, excluding Hawaii and Alaska from the Western Region; and (2) NCDC regions used for climate monitoring. HCS 4-1,2, and 3 provide area-weighted temperature and precipitation statistics, while HCS 5-1,2 provide population-weighted degree day statistics. Population weights are based on the 2000 U.S. Census. Both area and population weights are provided. The normals and standard deviations include values for each of the 12 calendar months and an annual value, plus 4 seasonal averages in HCS 4-3. The data are presented by abbreviation/name and number for a state, region, or the conterminous U.S. State data for the conterminous USA are presented alphabetically, followed by data for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Pacific trust territories, followed by regional/national data. Data elements include time of observation-corrected mean temperature (deg F), precipitation (inches), and heating and cooling degree days (base 65 deg F).
NTIS
Atmospheric Temperature; Precipitation (Meteorology); Climate

20050111532 National Climatic Data Center, Asheville, NC, USA
USA Climate Normals, 1971-2000. State, Regional, and National Monthly Precipitation Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-2
2004; 22 pp.; In English
Report No.(s): PB2005-103633; No Copyright; Avail: CASI; A03, Hardcopy

Historical Climatography Series (HCS) 4-1,2,3 and 5-1,2 include normals and standard deviations for the five 30-year normals periods and the 70-year period between 1931-2000 for U.S. States, regions, and the conterminous USA. Statistics are based on weighted divisional data from Climatography of the USA, Number 85 for U.S. States, and in turn from these state values for regional and national computations. Two sets of regions are included: (1) U.S. Census Bureau regions, excluding Hawaii and Alaska from the Western Region; and (2) NCDC regions used for climate monitoring (Karl and Koss, 1984). HCS 4-1,2, and 3 provide area-weighted temperature and precipitation statistics, while HCS 5-1,2 provide population-weighted degree day statistics. Population weights are based on the 2000 U.S. Census. Both area and population weights are provided. The normals and standard deviations include values for each of the 12 calendar months and an annual value, plus 4 seasonal averages in HCS 4-3. The data are presented by abbreviation/name and number for a state, region, or the conterminous U.S. State data for the conterminous USA are presented alphabetically, followed by data for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Pacific trust territories, followed by regional/national data. Data elements include time of observation-corrected mean temperature (deg F), precipitation (inches), and heating and cooling degree days (base 65 deg F).
NTIS
Climatology; Precipitation (Meteorology); Atmospheric Temperature

20050111533 National Climatic Data Center, Asheville, NC, USA
USA Climate Normals, 1971-2000. State, Regional, and National Monthly Cooling Degree Days Weighted by Population (2000 Census) 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 5-2
2004; 20 pp.; In English
Report No.(s): PB2005-103636; No Copyright; Avail: CASI; A03, Hardcopy

Historical Climatography Series (HCS) 4-1,2,3 and 5-1,2 include normals and standard deviations for the five 30-year normals periods and the 70-year period between 1931-2000 for U.S. States, regions, and the conterminous USA. Statistics are based on weighted divisional data from Climatography of the USA, Number 85 for U.S. States, and in turn from these state values for regional and national computations. Two sets of regions are included: (1) U.S. Census Bureau regions, excluding Hawaii and Alaska from the Western Region; and (2) NCDC regions used for climate monitoring. HCS 4-1,2, and 3 provide area-weighted temperature and precipitation statistics, while HCS 5-1,2 provide population-weighted degree day statistics. Population weights are based on the 2000 U.S. Census. Both area and population weights are provided on pages 4 and 5. The normals and standard deviations include values for each of the 12 calendar months and an annual value, plus 4 seasonal averages in HCS 4-3. The data are presented by abbreviation/name and number for a state, region, or the conterminous U.S. State data for the conterminous USA are presented alphabetically, followed by data for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Pacific trust territories, followed by regional/national data. Data elements include time of observation-corrected mean temperature (deg F), precipitation (inches), and heating and cooling degree days (base 65 deg F).
NTIS
Atmospheric Temperature; Precipitation (Meteorology); Standard Deviation; Climate

20050111536 National Climatic Data Center, Asheville, NC, USA
Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 1: Temperature. Climatography of the USA No. 85
Jun. 2002; 74 pp.; In English
Report No.(s): PB2005-103622; No Copyright; Avail: CASI; A04, Hardcopy

This Climatography includes normals and standard deviations for the five 30-year normals periods and the 70-year period between 1931-2000 for each climate division. A climate division represents a region within a state that is as climatically homogeneous as possible. The divisional data are used for research applications in hydrology, agriculture, energy supply, etc., where data averaged over an area rather than for a point (station) is needed. Divisional data are used to assess large-scale climatic features with respect to a long period (i.e., decadal, 30-year period, etc.). There are 344 climate divisions in the conterminous U.S., with additional divisions in Alaska, Hawaii, Puerto Rico, the U.S. Virgin Islands, and Pacific trust territories. Divisional boundaries generally coincide with county boundaries except in the western U.S., where they are based largely on drainage basins. The normals and standard deviations include values for each of the 12 calendar months and an annual value. The divisional data are displayed by name and number for a state or territory. Data for the conterminous USA are presented alphabetically, followed by data for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Pacific trust territories. The data elements, presented in separate sections, include time of observation-corrected mean temperature (degrees F), precipitation (inches), and heating and cooling degree days (base 65 degrees F).
NTIS
Precipitation (Meteorology); Standard Deviation; Temperature Gradients

20050111537 National Climatic Data Center, Asheville, NC, USA

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 2: Precipitation. Climatography of the USA No. 85

Jun. 2002; 76 pp.; In English

Report No.(s): PB2005-103621; No Copyright; Avail: CASI; A05, Hardcopy

This Climatography includes normals and standard deviations for the five 30-year normals periods and the 70-year period between 1931-2000 for each climate division. A climate division represents a region within a state that is as climatically homogeneous as possible. The divisional data are used for research applications in hydrology, agriculture, energy supply, etc., where data averaged over an area rather than for a point (station) is needed. Divisional data are used to assess large-scale climatic features with respect to a long period (i.e., decadal, 30-year period, etc.). There are 344 climate divisions in the conterminous U.S., with additional divisions in Alaska, Hawaii, Puerto Rico, the U.S. Virgin Islands, and Pacific trust territories. Divisional boundaries generally coincide with county boundaries except in the western U.S., where they are based largely on drainage basins. The normals and standard deviations include values for each of the 12 calendar months and an annual value. The divisional data are displayed by name and number for a state or territory. Data for the conterminous USA are presented alphabetically, followed by data for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Pacific trust territories. The data elements, presented in separate sections, include time of observation-corrected mean temperature (degrees F), precipitation (inches), and heating and cooling degree days (base 65 degrees F).

NTIS

Temperature Gradients; Standard Deviation; Precipitation (Meteorology); Cooling; Heating

20050111540 National Climatic Data Center, Asheville, NC, USA

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 5: Divisional Maps, 1971-2000. Climatography of the USA No. 85

Jun. 2002; In English

Report No.(s): PB2005-103618; No Copyright; Avail: National Technical Information Service (NTIS)

Maps showing both mean and standard deviations, by element and by month (or annual value), are provided for the 344 climate divisions in the conterminous U.S., plus climate divisions in Alaska and Hawaii. Puerto Rico, the U.S. Virgin Islands, and Pacific trust territories are not mapped. Each map page has a description at the bottom of the page indicating the month (or annual period), period of record (either 1971-2000 or 1931-2000), and element (either mean temperature (degrees F), precipitation (inches), and heating and cooling degree days (base 65 degrees F)). The legend to the immediate left of the maps provide data range/color relationships, which correspond to the tabular information presented in this product. Slight variations in color display and printouts between the legend and maps are possible. The number of normals stations by climate division are provided. The number of stations, where low, can yield spatially anomalous standard deviations. Long-term (1931-2000) statistics are not available for Hawaii.

NTIS

Precipitation (Meteorology); Cooling; Heating; Standard Deviation; Temperature Gradients

20050111541 National Climatic Data Center, Asheville, NC, USA

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 6: Divisional Maps, 1931-2000. Climatography of the USA No. 85

Jun. 2002; In English

Report No.(s): PB2005-103617; No Copyright; Avail: National Technical Information Service (NTIS)

Maps showing both mean and standard deviations, by element and by month (or annual value), are provided for the 344 climate divisions in the conterminous U.S., plus climate divisions in Alaska and Hawaii. Puerto Rico, the U.S. Virgin Islands, and Pacific trust territories are not mapped. Each map page has a description at the bottom of the page indicating the month (or annual period), period of record (either 1971-2000 or 1931-2000), and element (either mean temperature (degrees F), precipitation (inches), and heating and cooling degree days (base 65 degrees F)). The legend to the immediate left of the maps provide data range/color relationships, which correspond to the tabular information presented in this product. Slight variations in color display and printouts between the legend and maps are possible.

NTIS

Climatology; Mapping; Heating

20050111542 National Climatic Data Center, Asheville, NC, USA

USA Climate Normals, 1971-2000. Annual Degree Days to Selected Bases, 1971-2000. Climatography of the USA No. 81. Supplement No. 2

Jun. 2002; 86 pp.; In English

Report No.(s): PB2005-103616; No Copyright; Avail: CASI; A05, Hardcopy

This Climatography includes annual degree days totals derived from the 1971-2000 normals. A degree day is defined as the difference between the average daily temperature (calculated by adding the maximum and minimum temperature then dividing by 2) and some base temperature value. This publication presents annual heating degree day normals to the following bases (in degrees F): 65, 60, 57, 55, 50, 45, and 40, and annual cooling degree day normals to the following bases (in degrees F): 70, 65, 60, 57, 55, 50, and 45. The values are summarized alphabetically by station within each state or territory. The states are listed alphabetically for the contiguous USA, followed by Alaska, Hawaii, Puerto Rico, the Virgin Islands, and the Pacific Trust Territories. If the average daily temperature is below the base value, the difference is considered to be that many heating degree days. If the average daily temperature is above the base value, it is treated as cooling degree days. If the average daily temperature is equal to the base value, there are no heating or cooling degree days. For example, suppose one day the average temperature is 61 degrees F. If the base temperature is 65 degrees F, then this day has accumulated 4 heating degree days. If the next day averaged 72 degrees F, then this day accumulated 7 cooling degree days. The degree days are cumulative, so it is possible to have a large number of heating degree days and a significant number of cooling degree days (or vice versa) during a given month. Degree days can be calculated to any base, depending on the application.

NTIS

Cooling; Heating; Climatology

20050111544 National Climatic Data Center, Asheville, NC, USA

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 3: Heating Degree Days. Climatography of the USA No. 85

Jun. 2002; 74 pp.; In English

Report No.(s): PB2005-103620; No Copyright; Avail: CASI; A04, Hardcopy

This Climatography includes normals and standard deviations for the five 30-year normals periods and the 70-year period between 1931-2000 for each climate division. A climate division represents a region within a state that is as climatically homogeneous as possible. The divisional data are used for research applications in hydrology, agriculture, energy supply, etc., where data averaged over an area rather than for a point (station) is needed. Divisional data are used to assess large-scale climatic features with respect to a long period (i.e., decadal, 30-year period, etc.). There are 344 climate divisions in the conterminous U.S., with additional divisions in Alaska, Hawaii, Puerto Rico, the U.S. Virgin Islands, and Pacific trust territories. Divisional boundaries generally coincide with county boundaries except in the western U.S., where they are based largely on drainage basins. The normals and standard deviations include values for each of the 12 calendar months and an annual value. The divisional data are displayed by name and number for a state or territory. Data for the conterminous USA are presented alphabetically, followed by data for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Pacific trust territories. The data elements, presented in separate sections, include time of observation-corrected mean temperature (degrees F), precipitation (inches), and heating and cooling degree days (base 65 degrees F).

NTIS

Climatology; Hydrology; Drainage; Heating

20050111545 National Climatic Data Center, Asheville, NC, USA

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 4: Cooling Degree Days. Climatography of the USA No. 85

Jun. 2002; 74 pp.; In English

Report No.(s): PB2005-103619; No Copyright; Avail: CASI; A04, Hardcopy

This Climatography includes normals and standard deviations for the five 30-year normals periods and the 70-year period between 1931-2000 for each climate division. A climate division represents a region within a state that is as climatically homogeneous as possible. The divisional data are used for research applications in hydrology, agriculture, energy supply, etc., where data averaged over an area rather than for a point (station) is needed. Divisional data are used to assess large-scale climatic features with respect to a long period (i.e., decadal, 30-year period, etc.). There are 344 climate divisions in the conterminous U.S., with additional divisions in Alaska, Hawaii, Puerto Rico, the U.S. Virgin Islands, and Pacific trust territories. Divisional boundaries generally coincide with county boundaries except in the western U.S., where they are based largely on drainage basins. The normals and standard deviations include values for each of the 12 calendar months and an

annual value. The divisional data are displayed by name and number for a state or territory. Data for the conterminous USA are presented alphabetically, followed by data for Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Pacific trust territories. The data elements, presented in separate sections, include time of observation-corrected mean temperature (degrees F), precipitation (inches), and heating and cooling degree days (base 65 degrees F).
NTIS
Precipitation (Meteorology); Temperature Dependence; Standard Deviation; Climate; Cooling; Heating

20050111549 National Climatic Data Center, Asheville, NC, USA
USA Climate Normals, 1971-2000. Monthly Precipitation Probabilities and Quintiles, 1971-2000. Climatography of the USA No. 81. Supplement No. 1
Jun. 2002; 70 pp.; In English
Report No.(s): PB2005-103615; No Copyright; Avail: CASI; A04, Hardcopy

This Climatography includes selected precipitation probabilities derived from the 1971-2000 normals. Precipitation quintiles, divided into six classes by the five probability levels 0.2, 0.4, 0.6, and 0.8, are also provided. Precipitation probabilities at the 0.1, 0.5, and 0.9 levels are also presented. This publication includes precipitation probabilities and quintiles for first-order stations; all other stations are available through an accompanying digital data set associated with Climatography of the USA, No. 81. The precipitation probabilities are the monthly precipitation totals that correspond to the indicated probability levels. The probability levels are based on the 1971-2000 historical sequential monthly precipitation. The historical precipitation data are the adjusted values from the monthly normals as presented in Climatography of the USA No. 81.
NTIS
Climatology; Precipitation (Meteorology)

20050123567 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Orbital 'Virtual Radar' from TRMM Passive Microwave and Lightning Observations
Boccippio, Dennis J.; [2004]; 2 pp.; In English; American Geophysical Union Fall Meeting 2004, 13-17 Dec. 2004, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The retrieval of vertical structure from joint passive microwave and lightning observations is demonstrated. Three years of data from the TRMM (Tropical Rainfall Measuring Mission) are used as a training dataset for regression and classification neural networks; the TMI (TRMM Microwave Imager) and LIS (Lightning Imaging Sensor) provide the inputs, the PR (Precipitation Radar) provides the training targets. Both vertical reflectivity profile categorization (into 9 convective, 7 stratiform, 2 mixed and 6 anvil types) and geophysical parameters (surface rainfall, vertically integrated liquid (VIL), ice water content (IWC) and echo tops) are retrieved. Retrievals are successful over both land and ocean surfaces. The benefit of using lightning observations as inputs to these retrievals is quantitatively demonstrated; lightning essentially provides an additional convective/stratiform discriminator, and is most important for isolation of midlevel (tops in the mixed phase region) convective profile types (this is because high frequency passive microwave observations already provide good convective/stratiform discrimination for deep convective profiles). This is highly relevant as midlevel convective profiles account for an extremely large fraction of tropical rainfall, and yet are most difficult to discriminate from comparable-depth stratiform profile types using passive microwave observations alone.
Author
TRMM Satellite; Meteorological Radar; Lightning; Microwaves; Vertical Distribution

20050123571 California Inst. of Tech., Pasadena, CA, USA
A Mechanism For Solar Forcing of Climate: Did the Maunder Minimum Cause the Little Ice Age?
Yung, Yuk L.; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NAG5-10901; No Copyright; Avail: CASI; A01, Hardcopy

The mechanism we wish to demonstrate exploits chemical, radiative, and dynamical sensitivities in the stratosphere to affect the climate of the troposphere. The sun, while its variability in total radiative output over the course of the solar cycle is on the order of 0.1%, exhibits variability in the UV output on the order of 5%. We expect to show that a substantially decreased solar UV output lessened the heating of the Earth's stratosphere during the Maunder Minimum, through decreased radiative absorption by ozone and oxygen. These changes in stratospheric heating would lead to major changes in the stratospheric zonal wind pattern which would in turn affect the propagation characteristics of planetary-scale waves launched in the winter hemisphere. Until recently, there was no quantitative data to relate the changes in the stratosphere to those at the surface. There is now empirical evidence from the NCEP Reanalysis data that a definitive effect of the solar cycle on climate

in the troposphere exists. Our recent work is summarized as follows (see complete list of publications in later part of this report).
Author
Climate Change; Solar Activity Effects; Troposphere; Solar Cycles

20050123874 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Contributions of TRMM to Our Understanding of Precipitation Processes and Climate Variability
Adler, Robert F.; [2005]; 1 pp.; In English; GEWEX Conference, 19-25 Jun. 2005, Los Angeles, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Tropical Rainfall Measuring Mission (TRMM), a joint U.S./Japan effort, has completed seven and a half years in orbit. This successful research mission studying precipitation processes and climatology has also become a key element in the routine monitoring of global precipitation. The package of rain measuring instrumentation, including the first rain radar and microwave radiometer combination in space, continues to function perfectly, and the satellite has the capability to operate for a number of additional years, providing a unique, long-term record of global tropical precipitation characteristics. A summary of research highlights will be presented covering topics ranging over climate analysis, improving forecasts, and storm and precipitation processes. A focus of the talk will be the important role of TRMM data in multi-satellite precipitation analyses at fine time scales and in improving our understanding of the validity of climate-scale variations through comparison with, and eventual improvement of, the GEWEX Global Precipitation Climatology Project (GPCP) 25-year data set.
Author
Climatology; TRMM Satellite; Precipitation (Meteorology); Variability

48
OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20050092381 NASA Marshall Space Flight Center, Huntsville, AL, USA
Morphological Evolution of Directional Solidification Interfaces in Microgravity: An Analysis of Model Experiments Performed on the International Space Station
Strutzenberg, Louise L.; Grugel, R. N.; Trivedi, R. K.; [2005]; 1 pp.; In English; American Institute of Aeronautics and Astronautics Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Copyright; Avail: Other Sources; Abstract Only

A series of experiments performed using the Pore Formation and Mobility Investigation (PFMI) apparatus within the glovebox facility (GBX) on board the International Space Station (ISS) has provided video images of the morphological evolution of a three-dimensional interface in a diffusion controlled regime. The experimental samples were prepared on ground by filling glass tubes, 1 cm ID and approximately 30 cm in length, with 'alloys' of succinonitrile (SCN) and water in an atmosphere of nitrogen at 450 millibar pressure. The compositions of the samples processed and analyzed are 0.25,0.5 and 1.0 wt% water. Experimental processing parameters of temperature gradient and translation speed, as well as camera settings, were remotely monitored and manipulated from the ground Telescience Center (TSC) at the Marshall !3pace Flight Center. During the experiments, the sample was first subjected to a unidirectional melt back, generally at 10 microns per second, with a constant temperature gradient ahead of the melting interface. Following the melt back, the interface was allowed to stabilize before translation is initiated. The temperatures in the sample were monitored by six in situ thermocouples and the position is monitored by an optical linear encoder. For the experiments performed and analyzed, the gradients ranged from 2.5 - 3.3 K/mm and the initial pulling velocities ranged from 0.7 micron per second to 1 micron per second with subsequent transition velocities of up to 100 microns per second. The data provided by the PFMI for analysis includes near-real-time (NRT) video captured on the ground during the experiment runs, ISS Video Tape Recorder (VTR) data dumped from the VTR at the end of the experiment run and recorded on the ground, telemetry data including temperature and position measurements, and limited flight HI-8 tapes in 2 camera views of experiment runs for which tapes have been returned to the investigators from ISS. Because of limited down mass from the ISS, the majority of the initial analysis has been performed using the NRT and VTR video data but will be supplemented with the HI-8 video as it becomes available. hardware and procedures required to prepare samples for correlation to flight samples is described. Using this ground-based system, a series of experiments have been performed for direct comparison with the flight data. The results of these comparisons as well as implications to future

microgravity experiments are presented and discussed. A ground-based thin-sample directional solidification system as well as all associated
Author
Morphology; Evolution (Development); Microgravity; Directional Solidification (Crystals); Temperature Measurement

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20050110068 Surrey Univ., London, UK
Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna
Agius, A. A.; Leach, S. M.; Suvannapattana, P.; Saunders, S. R.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1114-1117; In English; See also 20050109927; Copyright; Avail: Other Sources

The emerging satellite personal communication networks (SPCN) will offer global communication coverage based on small handheld terminals. Briefly, the requirement for the antenna system is to have a radiation pattern of defined shape in the elevation direction in order to fulfill a G/T requirement of around -23dB/K in the receiving mode, circular polarisation, bandwidth of around 2% and finally size appropriate for use on a compact handheld terminal. The Quadrifilar Helix Antenna (QHA) is the most promising radiator for such an application because it offers a pattern which can be shaped in elevation as required with small structure changes, and circular polarisation due to its symmetric four-element structure and its phase quadrature feeding configuration. It is then important for the system designer to know the exact behaviour of this radiator when it is placed on different size terminals and near to the human body in order to evaluate the link performance. In previous work about the free space performance of the QHA has been analysed in detail. However, no information about the effects of nearby objects on the pattern performance of the QHA have been presented. This contribution aims to show the effects of the human head and hand on the radiation pattern of the QHA. The radiation pattern shape and polarisation performance of the antenna system (antenna structure, feeding arrangement, and mobile phone case) are examined through simulations and measurements.
Author
Antenna Radiation Patterns; Quadratures; Human Body; Communication Networks; Head (Anatomy)

20050110095 Electronic Science and Technology Univ. of China, Chengdu, China
The General NMM Solution for 2-D EMF Problems with Arbitrary Excitations under General Coordinates
Jin, Pan; Na, Zai-Ping; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1190-1193; In English; See also 20050109927; Copyright; Avail: Other Sources

Since Chew et al proposed the numerical-mode matching method (NMM) in the middle of 1980's, the method has get a rapid development in simulating 2-D inhomogeneous structures, as well as in the application of well logs. By using the algorithm 2-D and 2.5-D problems can be solved with only one-dimensional numerical simulation, which saves the computational time many powers than the conventional numerical method such as the 2-D FD method. Besides this another merit of NMM is that it can give obvious formulas with analytic.numerical forms to directly compute the unknown fields of complex boundary problems. The prominent advantages of NMM have made it be one of the most efficient means to solve the EMF problems in 2-D inhomogeneous media. But as far as the present applications, the theory and the algorithm have been limited to certain problems only in Cartesian and cylindrical coordinates. Much more extensive and thorough understanding about the method still stays to be revealed and studied. For example, such questions need to be answered like how about the NMM in other coordinates, and how about the general expressions for fields with arbitrary excitations no matter how the problem is about the electromagnetic wave or about the static-steady potential. This paper is written out to answer these questions.
Author
Numerical Analysis; Two Dimensional Models; Simulation; Boundary Value Problems

20050110329 General Hospital Corp., Boston, MA USA
Center for Innovative Minimally Invasive Therapy (CIMIT)
Parrish, John A.; Oct. 2004; 133 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-2-0006
Report No.(s): AD-A429800; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Center for Integration of Medicine and Innovative Technology (CIMIT), is a consortium of nonprofit Massachusetts-based institutions led by Massachusetts General Hospital and includes Brigham and Women's Hospital, Massachusetts Institute of Technology and Draper Laboratory. CIMIT develops technologies to advance the diagnosis and treatment of patients using minimally invasive and less costly approaches. CIMIT coordinates and implements research programs in cardiovascular disease, cancer, trauma, and critical care, supported by basic science and engineering development in biomaterials, endoscopic tools, energy delivery, medical imaging, and other novel technologies. This unique military/civilian partnership allows DoD the transfer to the military of successful minimally invasive approaches developed at CIMIT. The overall goal of CIMIT is to create a national program that combines clinical and technological excellence and educational components to generate, develop, and reduce-to-practice innovative and high-impact concepts in minimally invasive therapy.
DTIC
Cardiovascular System; Endoscopes; Heart Diseases; Medical Services; Therapy

20050110330 Medical Coll. of Wisconsin, Milwaukee, WI USA
Use of a Transgenic Mouse Model With a Regulatable Estrogen Receptor Alpha (ER) to Study the Role of ER in Mammary Gland Development and Cancer
Sugg, Sonia L.; Sep. 2004; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0199
Report No.(s): AD-A429801; No Copyright; Avail: Defense Technical Information Center (DTIC)

Estrogen (E2) is required for the development of breast cancer, but there are few animal models to study its mechanism of action in vivo. We hypothesize that the timing of estrogen receptor alpha (ERalpha) action is crucial in normal mammary gland development and tumorigenesis. Therefore, a transgenic mouse model with a regulatable ERalpha is being generated. In vitro, a mutant ERalpha (525L) has a severely attenuated response to endogenous estradiol (E2) but a wild-type (WT) response to diethylstibestrol (DES). Gene targeting was used to insert 525L into the WT ER gene. Positive clones were injected into mouse blastocysts and chimeras were generated. There has been no germline transmission so far. Additional injections and further breeding continues. The resultant transgenic mouse will enable us to study how the timing of ER activation modulates normal mammary maturation and the development of mammary cancers.
DTIC
Breast; Cancer; Estrogens; Mammary Glands; Mice

20050110332 Johns Hopkins Univ., Baltimore, MD USA
Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models
Sukumar, Saraswati; Jun. 2004; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0285
Report No.(s): AD-A429807; No Copyright; Avail: Defense Technical Information Center (DTIC)

Breast cancer is the second leading cause of cancer death in women and incidence rates continue to rise. While survival rates of women diagnosed with early stages of breast cancer have significantly improved, the survival rates of women with more advanced disease remain quite poor. Thus, novel diagnostic, prognostic, and therapeutic modalities are needed. Metastasis is the primary cause of fatality in breast cancer patients and is believed to begin with the loss of cell adhesion in neoplastic epithelium. Although tight junctions (TJs) have clearly been shown to play a role in cell adhesion, their potential role in cancer progression has been scarcely studied. In 1998, a new family of TJ proteins named Claudins (CLDNs) was discovered (1, 2), which are now known to be the main sealing proteins of the TJ. Although changes in tight junction permeability have been observed in several types of cancer, little is known about the role of CLDNs in cancer. Despite the high degree of sequence similarity among the 20 CLDN family members there is evidence suggesting that each CLDN may have a unique biological function. For example, CLDN 1-deficient mice have been shown to die within 1 day of birth despite the presence of CLDN 4, while CLDN 3 and 4 alone serve as receptors for Clostridium perfringens enterotoxin (CPE). This proposal arose out of observations that several members of the claudin gene family were differentially expressed in invasive ductal carcinomas of the breast (3). Compared to normal breast, Claudin-7 expression was lost in 50% of breast carcinomas, while Claudin 3 and 4 were generally overexpressed in breast carcinomas (3).
DTIC
Bacteria; Breast; Cancer; Cardiovascular System; Diseases; Imaging Techniques; Mammary Glands; Metabolism; Proteins

20050110334 Alabama Univ., Birmingham, AL USA

The Influence of Stromal Transforming Growth Factor-Beta Receptor Signaling on Mouse Mammary Neoplasia

Crowley, Michael R.; Aug. 2004; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0201

Report No.(s): AD-A429809; No Copyright; Avail: Defense Technical Information Center (DTIC)

The purpose of this proposal was to determine if loss of TGF-beta signaling in the stroma affects tumor development and to identify TGF-beta regulated genes via custom gene chip microarrays. Our laboratory had developed mice transgenic for a dominant-negative TGF-beta type II receptor driven by the metallothionine promoter whose expression was restricted to the mammary stroma. Transgenic and wild type mice were given pituitary isografts, zinc water and either left untreated or treated with 7,12-dimethylbenz-(a)-anthracene (DMBA). Mice treated with carcinogen did not differ in latency, tumors per mouse, growth rate, or tumor free survival. They did differ with respect to histology, however. Mice not treated with carcinogen had a significantly shorter tumor free survival in addition to differences in tumor type. Mammary gland specific custom gene chip microarrays were produced and screened for genes regulated by TGF-beta. Several genes were identified following microarray analysis yet only approximately 15% were verified to be regulated by TGF-beta. One gene, the platelet derived growth factor receptor alpha (PDGFRalpha), was analyzed in detail. The PDGFRalpha was up-regulated in the mammary glands while down-regulated in the mammary fibroblasts treated with TGF-beta. PDGFRalpha did not regulate branching morphogenesis as PDGF pellets implanted into the mammary gland had no effect.

DTIC

Breast; Cancer; Mammary Glands; Mice

20050110341 Department of the Navy, Washington, DC USA

Discourse Analysis of Navy Leaders' Attitudes About Mental Health Problems

Westphal, Richard J.; Aug. 2004; 44 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429820; No Copyright; Avail: Defense Technical Information Center (DTIC)

Mental disorders are a significant source of medical and occupational morbidity for sailors. The literature suggests that stigma, fear of negative career impact, and subordinates' concern about leaders' attitudes are significant barriers to the use of mental health services. Semi-structured interviews and military policies were used as data sources to analyze the language, knowledge, and attitudes of Navy surface fleet leaders about mental illness and mental health treatment using Foucault's concept of discourse analysis. A discourse is a system of knowledge that influences language, perceptions, values, and social practices. The data shows that concerns about sailors' mental combat readiness, not mental illness stigma, were the dominant discourse of leaders' attitudes about mental illness and subordinates' mental health services use. In particular, organizational differences between the surface warfare and the mental health communities may influence leaders' attitudes more than stigma. This study provides an elaborated view of mental health knowledge and power within a Navy community. That view can be used to identify practical concrete implications for further research on stigma in the military and for improvements to fleet mental health services.

DTIC

Mental Health; Military Personnel; Navy

20050110349 Johns Hopkins Univ., Baltimore, MD USA

Development of Artificial Antigen Presenting Cells for Prostate Cancer Immunotherapy

Schneck, Jonathan P.; Oelke, Mathis; May 2004; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0370

Report No.(s): AD-A429835; No Copyright; Avail: CASI; A02, Hardcopy

A major goal in cancer immunotherapy is to generate an effective anti-tumor immune response. Adoptive immunotherapy involves stimulation of tumor-specific T cells, ex vivo (outside the body), followed by transfer of expanded numbers of activated T cells back into patients. While adoptive immunotherapy holds promise as a treatment for cancer, development of adoptive immunotherapy has been impeded by the lack of a reproducible and economically viable method for generating therapeutic numbers of antigen-specific CTL. The work proposed in this application will enable advances in adoptive immunotherapy. Most prostate cancers express prostate specific molecules. These molecules, including PSA and PMSA, can serve as potential targets for immune-based treatments. Studies on immune recognition of these molecules have already identified potential target regions within these proteins and are the basis of a variety of different experimental immunotherapies for treatment of prostate cancer. In this study we propose to study the ability to use HLA-Ig based aAPC as a viable method for induction, expansion and activation of prostate specific T cells for immunotherapy for prostate cancer. These studies will

serve as precursor ones for induction and expansion of prostate specific CTL from patients with disease for initiation of adoptive immunotherapy phase I clinical studies.
DTIC
Antigens; Cancer; Prostate Gland

20050110355 Trudeau Inst., Inc., Saranac Lake, NY USA
Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast
Dobrzanski, Mark J.; Sep. 2004; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0429
Report No.(s): AD-A429842; No Copyright; Avail: CASI; A03, Hardcopy

Cytolytic CD8 T cells fall into two subpopulations based on cytokine-secretion. Type 1 CD8 cells (Tc1) characteristically secrete IFN-gamma, whereas type 2 CD8 cells (Tc2) secrete ILA and IL- 5. Using a TSA mammary carcinoma cell line, expressing HA as a surrogate tumor-associated antigen, we assessed the therapeutic effects of adoptively transferred HA tumor-specific Tc1 and Tc2 effector cells in mice with established malignancy. Both Tc1 and Tc2 subpopulations effectively delayed tumor cell growth and mediated tumor regression in mice with established malignancy. Flow cytometric analysis showed that donor cells accumulated at the tumor site and antitumor effects were highly tumor specific. 'First-line' treatment with either methotrexate (MTX) or 5-Fluorouracil (5-FU) chemotherapeutic agents markedly enhanced the co-therapeutic effects of Tc2 effector cells. Whereas, MTX but not 5-FU, acted synergistically with corresponding Tc1 immunotherapy. Although effector cell therapies in combination with chemotherapy appeared markedly effective in delaying tumor growth they were non-the-less ineffective in establishing total long-term tumor eradication. These studies suggest a significant role for tumor-reactive Tc1 or Tc2 effector cell subpopulations in T cell-mediated antitumor responses and immunotherapy for the treatment of breast cancer and warrant further investigation as a potentially relevant anticancer therapy for breast cancer.
DTIC
Antigens; Breast; Cancer; Chemotherapy; Control Equipment; Drugs; Mammary Glands; Tumors

20050110356 Colorado Univ., Denver, CO USA
Protein Kinase Pathways That Regulate Neuronal Survival and Death
Heidenreich, Kim A.; Aug. 2004; 110 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429843; No Copyright; Avail: Defense Technical Information Center (DTIC)

Loss of post-mitotic neurons from the adult brain underlies the pathology of neurodegenerative diseases and neurotoxin exposure. Neuronal cell death occurs by two mechanisms: necrosis and apoptosis. Apoptosis is a process whereby developmental cues and environmental stimuli activate a genetic program to implement a series of steps that culminate in cell death. An important aspect of apoptosis is that it can be halted and such interventions may rescue dying neurons. The overall goal of this project is to identify key protein kinases involved in regulating neuronal survival and apoptosis. The progress made in these areas has resulted in 4 published manuscripts (plus 2 submitted articles) and 9 abstracts presented at national and international scientific meetings in 2002.
DTIC
Apoptosis; Brain; Death; Neurology; Neurophysiology; Proteins; Survival

20050110357 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA
An Evaluation of Stereoscopic Digital Mammography for Earlier Detection of Breast Cancer and Reduced Rate of Recall
Getty, David J.; Aug. 2004; 59 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0295
Report No.(s): AD-A429845; No Copyright; Avail: Defense Technical Information Center (DTIC)

The goal of this project is to evaluate stereoscopic digital mammography, compared to standard, non-stereo digital mammography, for the earlier detection of breast cancer and reduced rate of patient recall for further workup. During the project, approximately 2000 women at elevated risk for development of breast cancer will receive both standard (non- stereo) and stereo digital mammograms at the Emory Breast Clinic. In this second year of the project, we replaced the original CRT-based stereo display workstation with a new improved stereo workstation based on a pair of high-resolution, LCD medical monitors. The change to the new workstation has required us to rewrite the software application that will be used by the participating mammographers to control various aspects of the displayed stereo mammogram as they interpret

mammographic cases. The revised software will include new capabilities that were not feasible on the original workstation. A copy of the completed stereo workstation will be shipped to Emory University in August, 2004 at which time we will begin enrolling patients into the study. The research protocol was changed slightly during the year. The Research Protocol and Subject Consent documents were modified accordingly and approved by both the Emory and Army IRB's.
DTIC
Breast; Cancer; Computer Programs; Digital Systems; Display Devices; Mammary Glands

20050110359 John Wayne Inst. for Cancer Treatment and Research, Santa Monica, CA USA
Gangliosides During Tumor Progression in Patients With Prostate Cancer
Ravindranath, Mepur H.; Jul. 2004; 78 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0062
Report No.(s): AD-A429848; No Copyright; Avail: Defense Technical Information Center (DTIC)

The objective is to identify gangliosides associated with prostate cancer (Cap) and their ability to induce immune responses. Resorcinol-HCl and specific monoclonal antibodies were used on 2D-chromatograms, and to visualize on the cell surface with confocal-fluorescence microscopy. IgM against eight gangliosides from sera of patients with BPH, organ-confined and unconfined Cap, and age-matched healthy men were. analyzed by ELISA double-blinded and compared using ANOVA and Fisher's least significant difference methods. Endogenous IgM to gangliosides were measured in patients with confined CaP. CaP cells expressed GM1b, GM2, GD2, GD1a, and GM3. GM1a, GD1b and GT1b were undetectable. GM1b and GD1a were more prominent in AR-negative than in AR-positive cells. CaP patients differed from healthy and BPH patients in increased anti-GD2 and antiGD1a IgM and decreased anti-GD3. Other anti-ganglioside IgMs showed no difference among groups. The augmentation of anti-GD1a IgM in patients with organ-confined CaP but not in patients with uncoffined CaP or BPH or in healthy controls is striking (p \h 0.025). The unique ganglioside profiles identify HH870 cell line a potential component of a polyvalent-vaccine for immunotherapy of CaP. Augmentation of anti-GD1a IgM in confined CaP may signify an earliest. immune response to eliminate GD1a from tumor microenvironment and circulation.
DTIC
Cancer; Ganglia; Patients; Prostate Gland; Tumors

20050110399 Army Research Inst. of Environmental Medicine, Natick, MA USA
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m)
Cymerman, Allen; Friedlander, Anne L.; Muza, Stephen R.; Hagobian, Todd A.; Subudhi, Andrew W.; Jan. 2005; 26 pp.; In English
Report No.(s): AD-A429911; T05-04; No Copyright; Avail: Defense Technical Information Center (DTIC)

To identify soldiers with a possible health risk when deployed rapidly to moderate altitude, oculometrics were investigated as an objective index of the hypoxic effect on the CNS. The authors previously described the effects of a 4-hour exposure to real and simulated 4,300 m altitude on the pupillary light reflex as measured by the initial pupil diameter (PD), constriction amplitude (CA), and constriction latency (CL). Saccadic Velocity (SV) was measured as an index of extraocular motor function. Within 1 hour of exposure PD was reduced 5% and CL 2%. After 24 hours the reductions progressed to 12% and 5%, respectively. These effects were due to hypoxia per se, readily reversible, not gender related, and independent of eye dominance. SV was not acutely affected. To determine whether oculomotor reflexes could serve as an acclimatization variable and an index of AMS severity, data were collected during the long-term phase of the field study conducted at Pikes Peak, CO (4,300 m). After sea-level, baseline (SLB) measurements were taken, 18 men 19-to-33 years old were transported to Pikes Peak, where they remained for 14 days. The same oculometric variables were measured on days 1-4, 6, 7, 9, 10, and 12 in addition to several classical measures of altitude acclimatization: environmental symptoms questionnaire (ESQ) , heart rate (HR), pulse oximetry (SpO2), end-tidal PO2 and PCO2, and 24-hour urinary epinephrine and norepinephrine concentrations. PD and CL decreased from SLB for days 1-4 and returned toward SLB, paralleling changes in ventilatory and circulatory variables. CA decreased on days 1-2 and remained decreased for 12 days. SV increased over the first 6 days and then returned toward SLB with continued exposure, similar to changes in urinary catecholamines. With acclimatization, CL correlated with HR and SpO2; SV correlated with PCO2, HR, and SpO2. AMS severity peaked during days 2-4, returned toward SLB over the next 10 days, and correlated only with CL (p=0.047
DTIC
Altitude Acclimatization; Altitude Sickness; Eye (Anatomy); Hypoxia; Physiological Effects; Reflexes

20050110408 Health Research, Inc., Buffalo, NY USA
Functional Interactions of the TACC2 Breast Tumor Suppressor Gene and Its Relevance to Breast Tumor Progression
Still, Ivan; Dec. 2004; 25 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0208
Report No.(s): AD-A429928; No Copyright; Avail: CASI; A03, Hardcopy

Previous analyses suggested that loss of the transforming acidic coiled coil gene 2 (TACC2) occurs during breast tumorigenesis. TACC2 induced inhibition of the tumorigenic phenotype of certain breast cancer cells is mediated via the conserved TACC domain. This region binds to the histone acetyltransferases (HATs), hGCN5, and pCAF. We have now shown that hGCN5 is also downregulated in breast cancer, and that introduction of hGCN5 into cell lines can inhibit cellular division. Significantly, TACC2 can negate the in vitro suppression of DNA-dependent protein kinase (DNA-PK) mediated pCAF activity. This suggests that defects in TACC2 may impact chromatin structure, DNA repair and gene transcription Thus, we have begun to address the potential interface between TACC2 and BRCA1 mediated regulation of the p21 gene. Our initial data suggests that basal levels of p2l and STAT1 are decreased in TACC2 transfected cell lines, resulting in defective p2l induction by interferon gamma. TACC2 does not directly bind BRCA1, but may compete with BRCA1 in a ternary complex with FHL2, a promoter specific coregulator. Combined, the data generated in this proposal indicates an intimate role of TACC2 at multiple levels in cell signaling pathways regulating mammary gland development and tumorigenesis.
DTIC
Acidity; Breast; Cancer; Genes; Mammary Glands; Tumor Suppressor Genes; Tumors

20050110409 California Univ., San Francisco, CA USA
Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women
Tice, Jeffrey A.; Oct. 2004; 5 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0193
Report No.(s): AD-A429929; No Copyright; Avail: CASI; A01, Hardcopy

The current study is testing the feasibility and preliminary efficacy of soy supplementation to decrease risk of breast cancer by reducing breast density in individuals with \g 50% breast density on mammography and who are at elevated risk for breast cancer. One hundred women will be randomized to either 25 g/day of soy protein or placebo (milk protein). The randomized placebo controlled design will allow for comparative toxicity and efficacy determinations using patient symptom scores and validated quality of life tools. Biological endpoints, including mammographic breast density, breast cytology, urinary estrogen metabolites, and blood serum biomarkers (IGF-1/IGF-BP 3), will be evaluated. Feasibility will be assessed by measuring the rate of recruitment, the percentage of women consuming at least 80% of the expected number of protein packets, and the dropout rate. Presently, 25 women have completed the study protocol and 24 women are on study treatment with the last women being scheduled to complete the study in January of 2005.
DTIC
Blood; Breast; Cancer; Females; Health; Mammary Glands; Prevention; Proteins; Risk; Serums

20050110410 Brigham and Women's Hospital, Boston, MA USA
Severe Caloric Restriction in Adolescence and Incidence of Breast Cancer
Michels, Karin B.; Ekbom, Anders; Aug. 2004; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0162
Report No.(s): AD-A429931; No Copyright; Avail: CASI; A03, Hardcopy

Context Restricting caloric intake is one of the most effective ways to reduce spontaneous tumors in experimental animals. Yet whether similar associations hold in the human has not been appropriately studied. Objective To determine whether caloric restriction in early life reduces the risk of breast cancer Design Retrospective cohort study Setting Sweden; use of the Swedish Inpatient Registry and the Swedish Cancer Registry Subjects 7303 women who were treated for anorexia nervosa requiring hospitalization between 1965 and 1998 Main Outcome Measure Invasive breast cancer. Results Women who suffered from anorexia nervosa prior to age 40 had a 53% (95% confidence interval CI 3-81%) lower incidence of breast cancer than the Swedish general population. Women with anorexia nervosa who were parous had a 76% (95% CI 13-97%) reduced incidence of breast cancer. Conclusions We conclude that severe caloric restriction may confer protection from breast cancer among humans. Low caloric intake prior to first birth followed by a subsequent pregnancy appears to be associated with an even more pronounced reduction in the risk of breast cancer.
DTIC
Breast; Cancer; Diseases; Heat Measurement; Human Beings; Mammary Glands

20050110411 California Univ., Irvine, CA USA

Anti-Angiogenesis Therapeutic Indicators in Breast Cancer

Su, Min-Ying L.; Aug. 2004; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0178

Report No.(s): AD-A429932; No Copyright; Avail: Defense Technical Information Center (DTIC)

This project was proposed to study therapeutic indicators for anti-angiogenic therapy. Two different animal tumor models were studied, R323O AC adenocarcinoma and carcinogen ENU induced tumors. Longitudinal MRI studies were performed before and during therapy to monitor the changes occurring over the entire treatment period. Immunohistochemical analysis was performed to measure 4 molecular markers p53, TSP-l, VEGF and factor VIII microvessel density in pre-treatment and post-treatment specimens. ENU induced tumors came with different types, thus could simulate the wide variation of human breast cancer. However, the tumor also showed a very complicated response pattern. All MRI markers and IHC markers were correlated with final treatment outcome. Unlike in humans, the early volumetric changes did not predict outcome. The contrast enhancement kinetics measured using the blood pool agent Gadomer-l7 may provide an indication for therapy response. The vascular volume measured by Gadomer-l7 decreased in responder, and increased in non-responders. Also the baseline vascularity measured by Gadomer-l7 was associated with future response, possibly due to a higher blood supply thus more delivery of therapeutic agents. The developed methodology is currently applied in human studies, and that is expected to yield more interesting results in understanding chemotherapy induced changes.

DTIC

Animals; Breast; Cancer; Mammary Glands; Neoplasms; Therapy

20050110412 Tufts Univ., Boston, MA USA

Promotion of Epithelial to Mesenchymal Transformation by Hyaluronan

Krause, Silva; Zoltan-Jones, Alexandra; Jul. 2004; 17 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0467

Report No.(s): AD-A429933; No Copyright; Avail: CASI; A03, Hardcopy

During carcinoma progression, tumor cells often undergo changes similar but not identical to epithelial-mesenchymal transitions in embryonic development. In this study I have demonstrated that experimental stimulation of hyaluronan synthesis in normal epithelial cells is sufficient to induce mesenchymal and transformed characteristics. Using recombinant adenoviral expression of hyaluronan synthase 2, 1 showed that increased hyaluronan production promotes anchorage- independent growth and invasiveness, induces gelatinase production, and stimulates phosphoinositide-3-kinase/Akt pathway activity in phenotypically normal MDCK canine kidney and MCF-lOA human mammary epithelial cells. Cells infected with hyaluronan synthase 2 adenovirus also acquire mesenchymal characteristics, including up-regulation of vimentin', dispersion of cytokeratin, and loss of organized adhesion proteins at intercellular boundaries. Furthermore, I showed that transforming effects of two well-described agents, hepatocyte growth factor and P-catenin, are dependent on byaluronan-cell interactions. Thus increased expression of hyaluronan is sufficient to induce epithelial to mesenchymal transition and acquisition of transformed properties in phenotypically normal epithelial cells. In addition I have shown that the extracellular matrix metalloproteinase inducer emmprin, promotes anchorage-independent growth and stimulates ErbB2, phosphoinositide 3-kinase /Akt, MAP kinase and focal adhesion kinase cell survival signaling pathways in a hyaluronan-dependent manner.

DTIC

Breast; Cancer; Mammary Glands

20050110413 Pittsburgh Univ., Pittsburgh, PA USA

Center for Behavioral Research: Individual Interventions for Breast Cancer Patients

Baum, Andrew; Sep. 2004; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0373

Report No.(s): AD-A429935; No Copyright; Avail: CASI; A02, Hardcopy

This is an annual report for the Center for Biobehavioral Research in Breast Cancer, a center of excellence that was initially funded in September, 2001. The Center was designed to support, stimulate, conduct, and disseminate research and research reports on the biological and behavioral interactions characterizing the development and progression of breast cancer as well as treatment and survivor effects. Behavioral variables, particularly those directly related to activity in biological regulatory systems and defense systems, appear to be key determinants of participation in early detection and prevention programs, effective use of chemoprevention agents, and in patient adjustment, caregiving, and quality of life. This multidisciplinary Center is devoted to the investigation of biobehavioral pathways underlying breast cancer prevention and control, including development of research and training, involving participation by behavioral scientists, oncologists, nurses,

social workers, psychiatrists, immunologists and molecular biologists. These activities are directed towards organization, stimulation, and facilitation of integrated biobehavioral research aimed at prevention and control of breast cancer. The Center has assembled an interacting group of behavioral, biological, and medical scientists to foster new collaborations and extend existing ones in the context of training and education about breast cancer. These training opportunities, free exchange of ideas, and regular interaction will supplement and connect research activity on proposed projects as well as research cores that support this research. Integration of theory, cross-cutting research themes, and multidisciplinary training has begun to produce novel ways of thinking about breast cancer research and innovative, patient-focused research activity.
DTIC
Breast; Cancer; Health; Mammary Glands; Medical Science; Patients

20050110414 Virginia Commonwealth Univ., Richmond, VA USA
Role of Brca1 in Nonhomologous DNA End Joining
Povirk, Lawrence F.; Sep. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0620
Report No.(s): AD-A429936; No Copyright; Avail: CASI; A03, Hardcopy

To examine the possible role of the breast cancer susceptibility factor BRCA1 in the nonhomologous end joining pathway of DNA double-strand break repair, an assay to detect both accurate and inaccurate end joining events in intact cells was devised. A fusion gene of green fluorescent protein (EGFP) and neomycin resistance (nec) was constructed with a linker containing cleavage sites for the enzymes BcgI and 1-Scel. EcgI induces two simultaneous breaks, excising a 34-bp segment of DNA. Accurate repair of such a break would be detected as a 34-bp deletion that would put neo back in-frame and confer G4l8 resistance. Inaccurate repair events of both BcgI- and 1-Scel-induced breaks would similarly be detected. A lentivirus vector was constructed to introduce the fusion gene into human cells, and transductants of MCF-7 breast tumor cells were isolated. Although development of the assay system is not yet complete, proof-of-principle experiments showed that deletions could indeed be generated by 1-Scel-induced cleavage and detected as reactivation of the neo gene. Intracellular DNA cleavage by BcgI, introduced into cells by electroporation was also demonstrated, although it remains to be determined whether such cleavage will be sufficient to detect repair and assess repair accuracy.
DTIC
Breast; Cancer; Deoxyribonucleic Acid; Genes; Mammary Glands

20050110416 Auburn Univ., AL USA
Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms
Petrenko, Velery A.; Dec. 2004; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0454
Report No.(s): AD-A429942; AROD-42193.3-LS; No Copyright; Avail: Defense Technical Information Center (DTIC)

The authors introduced new formats of phage display -- landscape phage and mosaic landscape phage, in which all 4,000 copies of the major coat protein in the phage bear one or two foreign peptides. Libraries of landscape and mosaic landscape phages contain billions of clones with different peptides. This work demonstrated the great potential of the landscape phage probes as elements of biosensors and threat agent detectors. The authors learned that landscape phages' affinity selected against various agents (bacteria, spores, proteins) demonstrate high specificity, selectivity, and extreme robustness that commend them well as candidate probes for separation, concentration, and continuous monitoring of biological threats. They showed that selected bacterium- and virus-binding phages may be used as probes for identification of surface components of these pathogens -- potential targets for vaccines and drug development. It is significant, too, that this work represented the first test of a phage evolution strategy that may have broad applicability in any system where directed enhancement of the probe's performance is required. In particular, it may improve the operational affectivity of already existing detection and monitoring devices. It also suggests a new strategy of genetically directed nano-manipulation, which may be beneficial in creating new materials for nano-electronics, medicine, and fundamental research. Objectives were as follows: construct of filamentous phage landscape libraries displaying randomized peptides in various formats on every copy of the major coat protein, create libraries of mosaic phage on whose surface displays a mixture of two different peptides, use various model antigens to select phage that bind antigens with high affinity, characterize the specific binding between selected phage and antigen, use test pathogens to select binding landscape phage, and identify target receptors on the bacterial and viral particles.
DTIC
Antibodies; Bacillus; Bacteriophages; Biological Weapons; Detection; Libraries; Salmonella; Terrain; Topography; Viruses

20050110422 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Appropriate Treatment of Head Injuries by Surgeons During the Civil War

White, William G.; Jun. 2004; 118 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429953; No Copyright; Avail: Defense Technical Information Center (DTIC)

Surgeons during the Civil War have been classified by soldiers from that time period as incompetent butchers. However, evidence of head injury cases from the battles of Antietam, Gettysburg, The Wilderness, and Petersburg suggests that most surgeons were competent and followed the medical standards of practice of the 1860s. The civilian method of practicing medicine was similar to that of the military, although military surgeons found that procedures such as trephining met with more fatalities than their civilian counterparts. A possible reason for a high mortality rate with military trephining may be because the field environment in which the procedures were done was often dirty and many head wounds became infected. Other contributing factors could be that surgeries were undertaken on a large number of patients using the same unclean instruments. The small sample size of severe head injuries indicates that the survival rate was approximately 35 percent of those who survived until they arrived at a major hospital. Infection appears to have been the most significant factor in determining whether the patient would live or die. Overall, the surgeons of the Civil War were not butchers and they did the best they could given the technology and medical knowledge of the time.

DTIC

Head (Anatomy); Injuries; Surgeons; Therapy; Warfare

20050110428 South Carolina Univ., Columbia, SC USA

Do the Effects of Exercise on Breast Cancer Prevention Vary With Environment

Teas, Jane; Oct. 2004; 12 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0659

Report No.(s): AD-A429963; No Copyright; Avail: CASI; A03, Hardcopy

Does walking outdoors have the same breast cancer protective effect as walking on a treadmill indoors, away from natural light, in a typical gym atmosphere? Is the ambient exposure to sunlight important in stress and breast cancer risk reduction? Our basic premise is that the breast cancer protective mechanisms of exercise depend on context of exercise, not just on the number of repetitive muscular contractions completed over a specific period of time, and that a more pleasant and peaceful environment will decrease perceived stress and enhance immunity, theoretically leading to more positive mood and more effective cancer surveillance. A more relaxed walking atmosphere may decrease physiological consequences of stress, such as decreasing salivary cortisol, alpha-amylase, and melatonin. Revisions to the original endpoints include adding 3 questionnaires to assess mood changes, and including of physiological measures of stress (alpha-amylase, melatonin, and cortisol). By focusing on the context of exercise (indoor versus outdoor), we will be able to better define the important aspects of exercise on breast cancer prevention.

DTIC

Breast; Cancer; Health; Mammary Glands; Physical Exercise; Prevention

20050110433 Pennsylvania Univ., Philadelphia, PA USA

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination

Domchek, Susan M.; Sep. 2004; 24 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0619

Report No.(s): AD-A429970; No Copyright; Avail: CASI; A03, Hardcopy

Molecular targets to facilitate early detection and preventative therapy for women at high risk for breast cancer have not been characterized. Two recently characterized intracellular enzymes human telomerase reverse transcriptase (hTERT) and the cytochrome P450 isoform 1B1 (CYP1B1), each overexpressed in \g90% of invasive breast cancers but rarely found in normal tissue -- may fill this gap. Such targets, if found at the earliest time of malignant transformation, may be ideally suited not only for early detection but also cancer prevention by vaccination. A growing clinical experience in advanced cancer patients has underscored the safety and feasibility of vaccination strategies. The universal expression of hTERT and CYP1B1 provide an opportunity for both early detection and cancer vaccination. We hypothesize that the candidate universal tumor antigens hTERT and CYP1B1 can be detected in ductal lavage specimens, specific for the presence of carcinoma. We further hypothesize that immunologic responses can be elicited in advanced breast cancer patients using vaccines incorporating hTERT, providing a safety and feasibility platform for ultimately vaccinating women at high risk for breast cancer.

DTIC

Antigens; Breast; Cancer; Clinical Medicine; Detection; Health; Mammary Glands; Targets; Therapy

20050110439 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Lessons Learned: The 'Pale Horse' Bioterrorism Response Exercise

Jarrett, David; Dec. 2003; 6 pp.; In English

Report No.(s): AD-A429977; No Copyright; Avail: Defense Technical Information Center (DTIC)

In August 2002, the city of San Antonio, Texas, and the Fort Sam Houston Army Post (located within the city) conducted Pale Horse, one of the most ambitious, city-based, large-scale, tabletop bioterrorism response exercises to date. The exercise used significant executive-level resources from the Department of Defense (DoD), city, state, and region. The purpose of the bioterrorism response exercise was to test the command infrastructure in a large tabletop exercise. The exercise included command-level players from military medical (major Army and Air Force medical facilities located in San Antonio), civilian medical, city government, boards of health, state medical, National Guard, regional Federal Emergency Management Agency (FEMA), and DoD communities. The initial goals of the exercise were to foster critical thinking, identify roles and responsibilities, and exercise and validate existing plans. The programmed corollary to the exercise was to develop solutions for the inevitable shortfalls and controversial issues that would arise during play. This article discusses the experience with attention to the shortfalls and controversial issues identified during the exercise. The primary scenario was an unannounced terrorist attack wherein aerosolized and appropriately stabilized smallpox virus was sprayed over the attendees at the Alamo Dome during a football game. No announcement or threat was relayed (covert attack), and all attendees dispersed to their normal routine. Initial victims of smallpox then began to present to medical providers with the onset of fever in congruence with the normal incubation period. The article summarizes the lessons learned from the exercise in terms of vaccination, communication, and manpower requirements; the need for additional services and planning; legal issues, such as quarantine and liability; social ramifications; and command and control challenges.

DTIC

Aerosols; Emergencies; Management Methods; Physical Exercise; Viruses

20050110451 Thomas Jefferson Univ., Philadelphia, PA USA

Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk

Surmacz, Eva; Oct. 2004; 22 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0655

Report No.(s): AD-A429997; No Copyright; Avail: CASI; A03, Hardcopy

Obesity is a risk factor for breast cancer development in postmenopausal women and correlates with shorter disease-free and overall survival in breast cancer patients, regardless of menopausal status. Adipose tissue is a major source of leptin, a pluripotent cytokine regulating energy balance and controlling different processes in peripheral tissues, including breast cancer cell growth. In this work, we asked whether leptin can stimulate breast cancer cell growth and counteract anti-tumorigenic activities of the antiestrogen ICI 182,780 (ICI). MCF-7 estrogen receptor alpha (ERalpha)-positive breast cancer cells were used as a model. MCF-7 cells were found to express the signaling form of the leptin receptor and respond to leptin with cell growth and activation the STAT3, ERK1/2, and Akt/GSK3/pRb pathways. As expected, the exposure of cells to 10 nM ICI blocked cell proliferation, induced rapid ERalpha degradation, inhibited nuclear expression of ERalpha, and reduced ERalpha-dependent transcription from estrogen response element-containing promoters. All these effects of ICI were significantly attenuated by simultaneous treatment of cells with l00 ng/ml leptin. We concluded that leptin interferes with the effects of ICI on ERalpha in breast cancer cells. Thus, high leptin levels in obese breast cancer patients might contribute to the development of antiestrogen- resistance.

DTIC

Breast; Cancer; Clinical Medicine; Crosstalk; Estrogens; Hormones; Mammary Glands; Obesity

20050110453 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

The Reliability and Validity of the Outcome Rating Scale: A Replication Study of a Brief Clinical Measure

Bringhurst, David L.; Watson, Curtis W.; Miller, Scott D.; Duncan, Barry L.; Jan. 2004; 14 pp.; In English

Report No.(s): AD-A430000; No Copyright; Avail: CASI; A03, Hardcopy

There is an industry-wide trend toward making outcome evaluation a routine part of therapeutic services, yet most measures are infeasible for everyday clinical use. Consequently, the Outcome Rating Scale (ORS) was developed and recently validated by its authors (Miller, Duncan, Brown, Sparks, & Claud, 2003) . This article reports the findings of an independent replication study evaluating the reliability and concurrent validity of the ORS as studied in a non-clinical sample. Concurrent validity was tested by comparing the ORS with the Outcome Questionnaire 45.2 (OQ) using correlation statistics. The findings

re-confirm that the ORS has high test-retest reliability, strong internal consistency, and moderate concurrent validity. Implications for clinical practice and future research are discussed.
DTIC
Clinical Medicine; Medical Services; Ratings; Reliability

20050110454 Massachusetts Univ., Amherst, MA USA
Nanoparticle-Mediated Rescue of p53 Through Targeted Degradation of MDM2
Fischer, Nicholas; Rotello, Vincent M.; Sep. 2004; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0257
Report No.(s): AD-A430001; No Copyright; Avail: CASI; A02, Hardcopy

The interaction between mdm2 and p53 is a viable therapeutic target, as overexpression of mdm2 can lead to excessive p53 degradation, suppressing a cell's ability to cope with cellular insult. The goal of this research is to use recent advances in nanotechnology to develop a specific nanoparticle antagonist to disrupt the mdm2:p53 interaction. Inhibiting the interaction between p53 and mdm2 allows wild-type p53 concentrations to rise to functional levels, effectively killing proliferating tumor cells. By incorporating traditional peptide inhibitors of mdm2 with mixed monolayer protected gold cluster nanoparticles, we hope to effect mdm2 denaturation on the nanoparticle surface, increase peptide stability, and facilitate intracellular peptide delivery. Nanoparticle characteristics, such as size, surface chemistry and biocompatibility, may be controlled and modified for these specific applications. In the first year of the research grant, nanoparticles featuring mdm2-specific peptides have been synthesized and characterized by transmission electron microscopy, gel electrophoresis, UV-Vis absorbance, and fluorescence spectrometry. The nanoparticles are water soluble, stable for months at room temperature, and successfully inhibit the binding of mdm2 top 53. Current work is focused on optimizing peptide loading on the nanoparticle, determining changes in mdm2 conformation upon nanoparticle binding, and preparing for experiments on cultured cells.
DTIC
Degradation; Nanoparticles; Nanotechnology; Peptides; Rescue Operations

20050110456 University of South Florida, Tampa, FL USA
The Role of the Prohibition Gene in Apoptosis of Breast Cancer Cells
Kinkade, Rebecca; Chellappan, Srikumar; Oct. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0215
Report No.(s): AD-A430003; No Copyright; Avail: CASI; A02, Hardcopy

Prohibitin, a potential tumor suppressor protein, was originally identified by its ability to induce G1/S arrest in human fibroblasts. Mutations in the prohibitin gene were subsequently found in sporadic breast tumors. Our experiments in B cells and breast cancer cells suggest that prohibitin protects against apoptosis induced by camptothecin, a topoisomerase 1 inhibitor. A human B cell line (Ramos) stably over-expressing prohibitin and treated with camptothecin exhibits 50% less apoptosis compared to the parental cell line. BT 549 breast cancer cells, which express high levels of endogenous prohibitin, exhibit 20% less death from camptothecin than ZR 751 cells, which have low levels. E2F transcriptional activity increases in response to camptothecin, but this increase is attenuated in cells overexpressing prohibitin. Moreover, we find that prohibitin and p53 associate in vitro and co-localize in the breast cancer cell lines MCF7 and T47D. Functionally, prohibitin may activate p53 mediated transcription and augment p53 binding to a target promoter. Further, prohibitin was specifically exported from the nucleus of breast cancer cells, but not normal cells.. The role of this in cellular apoptosis is being evaluated. Our studies are elucidating the mechanisms whereby prohibitin affects the chemotherapeutic response and may help in directing therapeutic strategies for breast cancer treatment.
DTIC
Apoptosis; Breast; Cancer; Mammary Glands; Neoplasms; Suppressors

20050110457 Duke Univ., Durham, NC USA
Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection
Tornai, Martin P.; Brzymialkiewicz, Caryl N.; Aug. 2004; 44 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0558
Report No.(s): AD-A430004; No Copyright; Avail: CASI; A03, Hardcopy

Nuclear medicine based molecular imaging techniques can be used as an adjunct tool in the diagnosis of breast cancer, particularly for women with dense breast tissue. The dedicated emission mammotomograph is now fully functional; the

tomographic gantry was enhanced by including an automated radius-of-rotation capability, to allow for fully 3D imaging of a pendant, uncompressed breast. As a result, novel 3D acquisition orbits have been developed to contour various sized breasts. Initial phantom measurements with a l6x20 sq cm field-of-view cadmium zinc telluride detector show the capability of the system to acquire data about concentric hemispheres of the breast, minimizing distance-dependent spatial resolution effects, maximizing the viewable breast volume while more-nearly- completely sampling the breast, and minimizing background contamination from the heart and liver. Results indicate 3D mamnotomography, incorporating a compact CZT detector and unique 3D camera trajectories, is a promising dedicated breast imaging technique for visualization of tumors less than 1cm in diameter. Future work includes evaluation of: patient bed shielding, sampling schemes for various shaped breasts, and axillary imaging.
DTIC
Breast; Cancer; Detection; Imaging Techniques; Mammary Glands; Nuclear Medicine; Tomography

20050110459 California Univ., San Francisco, CA USA
Identification of Functions of Neurofibromin Distinct from the RASGAP domain
McCormick, Frank; May 2004; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0170
Report No.(s): AD-A430006; No Copyright; Avail: CASI; A02, Hardcopy

We proposed to study new functions of neurofibromin in the model organism, the budding yeast, Saccharornyces cerevisiae. The design of our study is mainly to generate dominant negative mutants of neurofibromin and its yeast homologs (Iral and Ira2), induce their expression in wild type yeast and elicit an interfering phenotype. We will then screen a yeast library to identify novel interaction partners of neurofibromin. We have constructed various mutants and fragments of Iral and neurofibromin. All of them have been tested in either transient or stably integrated expression. So far we have not observed any obvious interfering phenotype in the yeast strains that we have used. We have also experienced difficulties in detecting the expression of some of the mutants. We are continuing to test more yeast strains as difference strains have variable sensitivities to these mutants. Our second methodology to search for new functions of neurofibromin is gene expression profiling. We have obtained some preliminary data comparing Iral/Ira2 deletion and Ras super-activation. We are working towards verifying these data and hopefully reaching some definitive answers in the near future.
DTIC
Mutations; Yeast

20050110462 California Univ., Los Angeles, CA USA
The Origin and Significance of Mammary Intraductal Foam Cells
Barsky, Sanford H.; Sep. 2004; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0712
Report No.(s): AD-A430010; No Copyright; Avail: CASI; A02, Hardcopy

Intraductal 'foam cells' are the most commonly encountered cells in spontaneous nipple discharge, nipple aspirate fluid and ductal lavage yet their origin and significance remain a mystery. They frequently surround DCIS and other intraductal proliferations but their presence has been regarded as a nuisance since they often hide the diagnostically more important epithelial cells. Our previous immunocytochemical studies with macrophage (CD68, lysozyme), epithelial (cytokeratin, estrogen receptor) and myoepithelial (smooth muscle actin, CALLA, maspin) markers have indicated that foam cells are of macrophage lineage and terminally differentiated (negative Ki-67 and PCNA). Their origin has been presumed to be of ductal lining epithelium. However this has not been proven. The origin and significance of mammery intraductal foam cells remain an important and unanswered question warranting study. Specifically our 'Concept' proposal tests the hypothesis that these intraductal macrophages take origin from bone marrow derived hematopoietic precursors. Bone marrow from wild type male C57 black mice and green fluorescent protein (GFP)-transgenic male C57 black mice (Jackson Laboratories) will be harvested by femoral flushing. In the former group, the bone marrow will be labelled ex vivo by retroviral transfection of GFP using the latest generation of modified retroviral vectors designed to maximize gene expression in hematopoietic stem cells. In both groups, the harvested marrow will be tail-vein injected into lethally irradiated female C57 mice. Mice exhibiting successful bone marrow engraftment of at least 50% donor marrow will be identified and made pseudopregnant with injections of progesterone and their mammary fat pads will be excised and examined. The presence of GEP intraductal macrophages will be searched for.
DTIC
Foams; Mammary Glands

20050110465 Johns Hopkins Univ., Baltimore, MD USA
HOXB7: An Oncogenic Gene in Breast Cancer Cells
Rubin, Ethel; Sukumar, Saraswati; May 2004; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0426
Report No.(s): AD-A430013; No Copyright; Avail: CASI; A03, Hardcopy

Homeobox genes control anterioposterior body axis patterning during development. Although expressed primarily in developing embryos, a growing body of evidence shows that homeobox gene re-expression in adult tissues is associated with tumorigenesis. Earlier work has shown that introduction of HOXB7, one of the members of this gene family, into non-expressing breast cancer cells induced expression of a number of pro-angiogenic factors and formed tumors upon xenograft into nude mice. Since a growing body of evidence showed that HOXR7 may be involved in ovarian, skin and breast cancer, we wanted to investigate its expression levels in breast carcinomas and evaluate its oncogenic potential in this study. To characterized the role of HOXB7 in breast cancer, a number of HOXB7-interacting proteins in breast cancer cells were identified and binding to HOXB7 was confirmed in vivo. Interestingly, all of the HOXB7-associated proteins identified have well characterized roles in the non-homologous end joining (NHEJ) pathway for DNA double strand break (DSB) repair as well as a larger role in maintenance of genomic integrity. Cell survival experiments demonstrated that breast cancer cells stably transfected with HOXB7 survive better after induction Df DNA DSB with fewer chromosomal abnormalities following exposure to gamma radiation. In addition, transduction of HOXB7 into the normal immortalized mammary epithelial cell line, MCFlOA, induced anchorage independent growth that was dependent of PARP activity. These data have led us to propose that HOXB7 may serve a role in breast cancer tumorigenesis in which PARP shares a common pathway.
DTIC
Breast; Cancer; Carcinogens; Genes; Mammary Glands; Tumors

20050110468 Duke Univ., Durham, NC USA
Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer
Jesneck, Jonathan; Lo, Joseph; May 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0373
Report No.(s): AD-A430017; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this study was four fold: 1) Identify subsets of the training data of breast cancer features using both a priori information and unsupervised learning methods. 2) Build local models for breast cancer prediction for each subset of the training data using supervised learning methods. Evaluate the performance of the local models on the training data relative to a single, global, supervised learning model and to current clinical practice. 3) Combine the local models to form a global, modular model and evaluate the performance of the modular model on the evaluation data set relative to a single, global, supervised learning model and to current clinical practice. 4) Develop an ensemble classifier combining three sources of data (image processing, radiologist extracted mammographic findings, and patient history) for the task of computer aided diagnosis of breast microcalcification clusters. We developed the world's largest database of over 4400 cases containing radiologist extracted mammographic findings, patient age, and biopsy outcome, and we used this data to develop modular, global CAD models using different machine learning algorithms applied to the entire database.
DTIC
Breast; Cancer; Clinical Medicine; Computer Techniques; Diagnosis; Machine Learning; Mammary Glands

20050110473 Melbourne Univ., Victoria, Australia
Applying Statistical Models to Mammographic Screening Data to Understand Growth and Progression of Ductal Carcinoma in Situ
Gertig, Dorota; Erbas, Bircan; Byrnes, Graham; Dowty, James; Sep. 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0687
Report No.(s): AD-A430024; No Copyright; Avail: CASI; A03, Hardcopy

Little is known about the natural history of ductal carcinoma in-situ (DCIS). Estimates from studies of recurrence following surgery suggest about 30% recur as invasive cancer. The aim of this study is to use novel applications of statistical methods to estimate the proportion of DCIS that progress to invasive cancer. We first analysed observed screening data and showed that neither time since previous negative screen or HRT use were associated with size of DCIS. Similar results were found for histological grade. We then developed a computer simulation for mammographic screening data which models progression and detection of ductal carcinoma in situ. The purpose of the simulation is to infer the distribution of DCIS sizes we would expect in mammography data finder different scenarios of tumor initiation, growth, invasion and detection. The simulation therefore provides the user with a test for these competing theories by enabling comparison with actual

mammagraphy data. Preliminary results show that low growth rates and low invasion rates provide the best fit to the data. Further work will include the addition of screening round and different mechanisms of invasion to the modeling.
DTIC
Breast; Cancer; Mammary Glands; Mathematical Models

20050110474 Rockefeller Univ., New York, NY USA
Role of E-Cadherin Homophilic Contacts in the Inhibition of Cell Growth of Primary Breast Cells
Perez-Moreno, Mirna; Fuchs, Elaine; Aug. 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0485
Report No.(s): AD-A430025; No Copyright; Avail: CASI; A02, Hardcopy

At present, it remains obscure whether E-cadherin directly transfers growth inhibitory signals to the cells, or if other types of molecular cell interactions indirectly influenced by the establishment of cadherin mediated cell contacts, are responsible for contact inhibition of growth. In this study I selectively activate the formation of E-cadherin homophilic adhesive bonds, using a specific recombinant protein to engage E-cadherin molecules at the cell surface of primary epithelial cells. My previous data demonstrated that E-cadherin is capable of transducing a growth inhibitory signal independent of other cell-cell interactions. Moreover, my previous data also shows that this event is not mediated through a Wnt/beta-catenin signaling antagonism. This has directed me to analyze the relationship between the association of p120(exp ctn) with E cadherin and the inhibition of cell growth. We have successfully generated E-cadherin Deltal2O transgenic mice, and pl2O conditional KO mice in skin and mammary epithelia to study the consequences of the loss of the interaction of p120 with E-cadherin in vivo. In addition using a yeast-two hybrid screen I have identified novel interacting partners of pl20(exp ctn) that can be potentially involved in transducing growth inhibitory signals to the cells.
DTIC
Bonded Joints; Breast; Cell Division; Epithelium

20050110475 Dana Farber Cancer Inst., Boston, MA USA
The Mechanism of Retinoblastoma Protein-Mediated Terminal Cell Cycle Arrest
Rajabi, Hasan N.; Sep. 2004; 26 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0224
Report No.(s): AD-A430026; No Copyright; Avail: CASI; A03, Hardcopy

Inactivation of retinoblastoma gene (Rb) is observed in several human cancers including those of the breast. A characteristic feature of many human cancers is the inability to maintain a terminal cell cycle arrest, whereas the Rb product (pRb) has been implicated in the maintenance of a terminal cell cycle arrest. However, in contrast to our knowledge of how pRb regulates proliferation in a cycling population, little is known how it maintains a permanent cell cycle arrest. The proposed studies are aimed at elucidating the molecular mechanism by which pRb accomplishes this task and plays the role of tumor suppressor of tumor formation. Our working hypothesis is that pRb, in cooperation with MyoD, participates in the transcriptional repression of one or more immediate early genes required for the induction of cyclin Dl. And this event ultimately prevents the re-entry into the cell cycle, thus maintaining a terminal cell cycle arrest. To test this hypothesis myogenic differentiation has been used as model, because it represents a differentiation system in which pRb has been implicated in a terminal cell cycle arrest both in vitro and in vivo. In the past year I have discovered that: (1) The induction of Fra-1 and not any other immediate early genes is blocked following restimulation of differentiated myoblasts. (2) Ectopic expression of the cell cycle inhibitory protein pl6, which bring about a cell cycle arrest distinct from a terminal cell cycle arrest, has no effect on expressions of both Fra-1 and cyclin Dl. In an effort to further study the regulation of the Fra-1 gene I have created Fra-1 promoter reporter and its deletion mutants. Also constructed a retrovirus vector for ectopic expression of Fra-1 to establish a causal relationship between Fra-1 and cyclin Dl. These results and reagents provide the basis upon which to discover the detailed mechanism by which pRb participates in a terminal cell cycle arrest.
DTIC
Cancer; Proteins; Retina; Tumors; Vaccines

20050110477 Alabama Univ., Birmingham, AL USA
An Oncotropic Adenovirus Vector System for Breast Cancer Treatment
Dmitriev, Igor P.; Sep. 2004; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0629
Report No.(s): AD-A430028; No Copyright; Avail: CASI; A03, Hardcopy

In this study, we generated the replicating Ad5-based vector encoding the Ad4l short fiber devoid of CAR and HSG binding while containing C-terminal His tag for targeting purposes. We compared our Ad5F4ls6H vector with control Ad5F4ls for the ability to induce cytopathic effect in CAR-positive 293 cells. We found that the parental 293 cells were relatively refractory to Ad5F4ls6H while it was significantly more infectious in 293AR cells, expressing the cognate artificial anti-His tag receptor, as compared to the control Ad5F4ls vector. These results suggest that generated Ad5F4ls6H indeed lacks CAR-mediated tropism while is able to utilize fiber-incorporated His tag for cell binding. In parallel, we produced bispecific 3D5-C6.5 scFv molecule with affinities for both His tag and c-erbB-2 oncoprotein. We then examined the utility of the 3D5-C6.5 adapter for Ad5F4ls6H vector targeting by assessing the improvements in oncolysis of c-erbB-2-positive cells. The presence of the c-erbB-2-targeting 3D5-C6.5 adapter in the infection medium significantly improved the oncolytic potency of the AdSF4ls6H vector in c-erbB-2-positive 435.eBl breast cancer cells. These results indicated that the 3D5-C6.5 adapter mediated specific Ad5F4ls6H binding to the cellular c-erbB-2-oncoprotein allowing efficient oncolytic infection and, thus, demonstrated the feasibility of our Ad targeting approach in vitro.
DTIC
Adenoviruses; Breast; Cancer; Mammary Glands; Therapy

20050110478 Emory Univ., Atlanta, GA USA
Harnessing Technology for Evidence-Based Education and Training in Minimally Invasive Surgery
Smith, C. D.; Oct. 2004; 39 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0765
Report No.(s): AD-A430029; No Copyright; Avail: CASI; A03, Hardcopy

Training specific surgical skills on simulators has been proven to bring a better-prepared student to a human operating room, and when the simulator-trained student performs a portion of a procedure fewer errors are made when compared to a learner who has not been trained on a simulator. This current study seeks to further this work by first developing a curriculum for training an entire procedure, laparoscopic cholecystectomy, using simulation technologies and integrating cognitive, psychomotor aspects of full procedure training, and second, to test the effectiveness of curriculum-based training through a multicenter, international research group, the MASTER group. Thus far the curriculum has been developed and validated locally (See Appendix A). Expert performance levels have been established through several large surveys of advanced laparoscopic surgeons (Appendix B & C). The methodology for executing the study at multiple sites has been developed and distributed. Local IRS approval has been acquired at the lead center and other sites are in the process of submitting their IRBs. There have been project delays due in part to research staff changes and difficulty in acquiring IRS due to confusion regarding the exempt status usually granted to educational research projects.
DTIC
Education; Surgery

20050110480 Naval Health Research Center, San Diego, CA USA
Review of Marine Corps Expeditionary Force Preventive Medicine Materiel Requirements
Edwards, Nathan; Galarneau, Michael; Konoske, Paula; Dec. 2003; 48 pp.; In English
Contract(s)/Grant(s): Proj-M0095
Report No.(s): AD-A430031; 04-07; No Copyright; Avail: Defense Technical Information Center (DTIC)

A review of the preventive medicine (PM) Authorized Medical Allowance Lists (AMALs) 637/638 was conducted by the Naval Health Research Center and held at Medical Logistics Company, Camp Pendleton, 2002. Twenty-seven subject matter experts (SMEs) from 14 Navy and Marine Corps commands were assembled and tasked with identifying the primary PM objectives required in a theater of operations. For the 10 primary PM objectives identified, task profiles detailing the step-by-step approach used to achieve the objectives were constructed. SMEs were asked to assign the supplies required to conduct the tasks, and to estimate the relative frequency of each task under the conditions of a worst-case scenario conflict. Finally, the number of times each PM task might be conducted and the type and quantity of materiel projected was then organized into deployable PM modules. This report outlines the mission and task-based approach used to ensure that AMALs 637 and 638 contain the medical equipment and supplies needed by the PM personnel (including PM officers, environmental health officers, entomologists, industrial hygiene officers, and PM technicians) to provide force health protection and occupational and environmental health surveillance in all expeditionary environments, as well as the recommended reconfigurations resulting from these analyses. The theater PM objectives were water sanitation, pest control, heat injury/cold injury prevention, disease surveillance and control, food safety, field sanitation, habitability, waste management, industrial hygiene, and training.
DTIC
Estimates; Health; Medical Equipment; Sanitation; Supplying

20050110481 Naval Health Research Center, San Diego, CA USA

Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room

Hill, Martin; Galarneau, Michael; Pang, Gerry; Konoske, Paula; Jun. 2004; 67 pp.; In English; Original contains color illustrations

Report No.(s): AD-A430032; 04-22; No Copyright; Avail: Defense Technical Information Center (DTIC)

The equipment and consumable supply blocks for the surgical company operating room (OR), officially known as Authorized Medical Allowance Lists 639 and 640, respectively, have not been updated since 1998. The success of the new Forward Resuscitative Surgery System (FRSS) in Operation Iraqi Freedom and the use of surgical company ORs as jump FRSSs to relieve the mobile surgical suites as they moved forward with the front line showed the need to standardize the supplies used in both ORs to minimize training and logistical support requirements. The primary objective of this study was to determine the supply requirements of the surgical company OR with equipment that has been upgraded and standardized to the level of the FRSS. The new supplies and equipment must uphold the Marine Corps doctrine of greater mobility and minimal logistical footprints on the battlefield. The NHRC method of modeling clinical requirements was chosen for this project due to its ability to provide an audit trail for each piece of equipment and each consumable supply item. The NHRC method utilizes the Deployable Medical Systems (DEPMEDS) 'Time, Task, Treater' files for Levels 3 and 4, but adapted to Levels 1 and 2 of field medical care. Seventy-two DEPMEDS patient conditions (PCs) were identified for the surgical company OR level of care (Level 2), including 59 PCs also seen at the FRSS and 13 that were surgical company-specific. Equipment and consumables from both ORs were compared and, where appropriate, upgraded equipment and supplies from the FRSS were substituted for older equipment in the surgical company OR. Task profiles were then created using the DEPMEDS treatment profiles and the revised surgical company OR supplies. A patient stream was created using NHRC's Estimating Supplies Program and ReSupply Validation Program and run through the revised surgical company OR model, producing a supply list that linked each item to its PC and task.

DTIC

Estimates; Medical Equipment; Rooms; Standardization; Supplying; Surgery

20050110485 Case Western Reserve Univ., Cleveland, OH USA

The Role of Calgranulin Overexpression in Breast Cancer Progression

Pink, John J.; Sep. 2004; 11 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0675

Report No.(s): AD-A430038; No Copyright; Avail: CASI; A03, Hardcopy

The mechanism responsible for the progression of breast cancer to estrogen independence is currently unknown. We have demonstrated a strong correlation between elevated expression of Calgranulin A and Calgranulin B and the loss of estrogen dependence. Experiments using estrogens and antiestrogens have demonstrated that this is not the result of direct interference with estrogen receptor signaling and must therefore require additional steps. Interestingly, we have also shown that expression of calgranulins in estrogen independent breast cancer cells is quite variable and may be differentially regulated during the cell cycle. We are currently in the process of determining if forced overexpression of calgranulin A and/or calgranulin B can drive cells to lose their dependence on estrogens for growth.

DTIC

Breast; Cancer; Estrogens; Mammary Glands

20050110490 Sloan-Kettering Inst. for Cancer Research, New York, NY USA

Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer

Robson, Mark E.; Jul. 2004; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0325

Report No.(s): AD-A430045; No Copyright; Avail: CASI; A02, Hardcopy

Women with breast cancer arising as a consequence of germline mutations in BRCA1 or BRCA2 are at significant risk of contralateral breast cancer (CBC). Examination of factors influencing contralateral risk will provide insight into prevention strategies for unaffected women with BRCA mutations. To evaluate CBC risk factors, the funded study was designed to assess the impact of tamoxifen and radiotherapy on CBC risk. Records from a total of 874 Ashkenazi women with breast cancer diagnosed between 1990 and 1996 were reviewed to expand the initial cohort of 305 women treated between 1980 and 1990. Changes in medical record storage and HIPAA privacy regulations prevented the gathering of required basic clinical and/or follow-up information for 75% of patients diagnosed between 1990 and 1992, and for approximately 20% of patients diagnosed between 1992 and 1996. The loss of the patients from the data set introduced a possible survival bias, and thus

alternative methods of addressing the study goals were sought. Specifically, concatenation of the original 1980-1990 data set with a similar ascertainment from another institution was performed, suggesting a 53% contralateral risk reduction with adjuvant tamoxifen, and 103 clinically ascertained patients were analyzed. The clinical ascertainment did not support a benefit from tamoxifen.
DTIC
Breast; Cancer; Estrogens; Females; Mammary Glands; Mutations; Pharmacology; Radiation Therapy; Risk

20050110491 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Ebola and Marburg Viruses Replicate in Monocyle- Derived Dendritic Cells without Inducing the Production of Cytokines and Full Maturation
Bosio, Catharine M.; Aman, M. J.; Grogan, Case; Hogan, Robert; Ruthel, Gordon; Nov. 2003; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430046; No Copyright; Avail: Defense Technical Information Center (DTIC)
Ebola virus (EBOV) and Marburg virus (MARV) cause rapidly progressive hemorrhagic fever with high mortality and may possess specialized mechanisms to evade immune destruction. We postulated that immune evasion could be due to the ability of EBOV and MARV to interfere with dendritic cells (DCs), which link innate and adaptive immune responses. We demonstrate that EBOV and MARV infected and replicated in primary human DCs without inducing cytokine secretion. Infected DC cultures supported exponential viral growth without releasing interferon (IFN)-alpha and were impaired in IFN-alpha production if treated with double-stranded RNA. Moreover, EBOV and MARV impaired the ability of DCs to support T cell proliferation, and infected, immature DCs underwent an anomalous maturation. These findings may explain the profound virulence of EBOV and MARV-DCs are disabled, and an effective early host response is delayed by the necessary reliance on less-efficient secondary mechanisms.
DTIC
Growth; Lymphocytes; Viruses

20050110493 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs
Mellquist-Riemenschneider, Jenny L.; Garrison, Aura R.; Geisbert, Joan B.; Saikh, Kamal U.; Heidebrink, Kelli D.; Jan. 2003; 9 pp.; In English
Report No.(s): AD-A430048; No Copyright; Avail: Defense Technical Information Center (DTIC)
The filoviruses Ebola virus (EBOV) and Marburg virus (MARV) cause severe hemorrhagic fever in humans for which no vaccines are available. Previously, a priming dose of a DNA vaccine expressing the glycoprotein (GP) gene of MARV followed by boosting with recombinant baculovirus-derived GP protein was found to confer protective immunity to guinea pigs (Hevey et al., 2001. Vaccine 20, 568-593). To determine whether a similar prime-boost vaccine approach would be effective for EBOV, we generated and characterized recombinant baculoviruses expressing full-length EBOV GP (GP(1,2)) or a terminally-deleted GP (GPa-) and examined their immunogenicity in guinea pigs. As expected, cells infected with the GPa- recombinant secreted more GP(1) than those infected with the GP(1,2) recombinant. In lectin binding studies, the insect cell culture-derived GPs were found to differ from mammalian cell derived virion GP, in that they had no complex/hybrid N-linked glycans or glycans containing sialic acid. Despite these differences, the baculovirus-derived GPs were able to bind monoclonal antibodies to five distinct epitopes on EBOV GP, indicating that the antigenic structures of the proteins remain intact. As a measure of the ability of the baculovirus-derived proteins to elicit cell-mediated immune responses, we evaluated the T-cell stimulatory capacity of the GPa- protein in cultured human dendritic cells. Increases in cytotoxicity as compared to controls suggest that the baculovirus proteins have the capacity to evoke cell-mediated immune responses. Guinea pigs vaccinated with the baculovirus-derived GPs alone, or in a DNA prime-baculovirus protein boost regimen developed antibody responses as measured by ELISA and plaque reduction neutralization assays; however, incomplete protection was achieved when the proteins were given alone or in combination with DNA vaccines. These data indicate that a vaccine approach that was effective for MARV is not effective for EBOV in guinea pigs.7
DTIC
Animals; Deoxyribonucleic Acid; Guinea Pigs; Proteins; Vaccines; Viruses

20050110494 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Molecular Mechanisms of Filovirus Cellular Trafficking

Aman, M. J.; Bosio, Catharine M.; Panchal, Rekha G.; Burnett, James C.; Schmaljohn, Alan; Jan. 2003; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A430049; No Copyright; Avail: Defense Technical Information Center (DTIC)

The filoviruses, Ebola and Marburg, are two of the most pathogenic viruses, causing lethal hemorrhagic fever in humans. Recent discoveries suggest that filoviruses, along with the phylogenetically or functionally related viruses, utilize a complex mechanism of replication, exploiting multiple cellular components, including lipid rafts, endocytic compartments, and vacuolar protein-sorting machinery. In this review, we summarize these recent findings and discuss the implications for vaccine and therapeutics development.

DTIC

Fever; Hemorrhages; Lethality; Microorganisms; Pathogens; Viruses

20050110495 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Vaccines and Animal Models for Arboviral Encephalitides

Nalca, Aysegul; Fellows, Patricia F.; Whitehouse, Chris A.; Jan. 2003; 24 pp.; In English

Report No.(s): AD-A430050; No Copyright; Avail: Defense Technical Information Center (DTIC)

Arthropod-borne viruses ('arboviruses') cause significant human illness ranging from mild, asymptomatic infection to fatal encephalitis or hemorrhagic fever. The most significant arboviruses causing human illness belong to genera in three viral families, Togaviridae, Flaviviridae, and Bunyaviridae. These viruses represent a significant public health threat to many parts of the world, and, as evidenced by the recent introduction of the West Nile virus (WNV) to the Western Hemisphere, they can no longer be considered specific to any one country or region of the world. Like most viral diseases, there are no specific therapies for the arboviral encephalitides; therefore, effective vaccines remain the front line of defense for these diseases. With this in mind, the development of new, more effective vaccines and the appropriate animal models in which to test them become paramount. In fact, for many important arboviruses (e.g. California serogroup and St. Louis encephalitis viruses), there are currently no approved vaccines available for human use. For others, such as the alphaviruses, human vaccines are available only as Investigational New Drugs, and thus are not in widespread use. On the other hand, safe and effective vaccines against tick-borne encephalitis virus (TBEV) and Japanese encephalitis virus (JEV) have been in use for decades. New challenges in vaccine development have been met with new technologies in vaccine research. Many of the newer vaccines are now being developed by recombinant DNA technology. For example, chimeric virus vaccines have been developed using infectious clone technology for many of the arboviruses including, WNV, JEV, and TBEV. Other successful approaches have involved the use of naked DNA encoding and subsequently expressing the desired protective epitopes. Naked DNA vaccines have been used for TBEV and JEV and are currently under development for use against WNV.

DTIC

Animals; Arthropods; Diseases; Encephalitis; Fever; Hemorrhages; Infectious Diseases; Japan; Vaccines; Viruses

20050110497 Arizant Healthcare, Inc., Eden Prairie, MN USA

Patient Warming Device for Casualty Care

Hansen, Gary; Albrecht, Mark; Barrows, Ryan; McGregor, Andrew; Sparrow, Ephraim; Jan. 2005; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-M-0273

Report No.(s): AD-A430054; No Copyright; Avail: Defense Technical Information Center (DTIC)

We have shown that convective air warming device (e.g., 'Bair Hugger') is feasible for cold weather conditions and aeromedical evacuation. The goal of the project was to develop such a device that can keep patients warm in 0 deg C conditions and can run for 2 hours using battery power. Our testing showed that with appropriate insulation and recirculation of warm air from within the device, as little as 250W was needed for adequate function. Using this information, we built prototype heating units and coverlets that made efficient use of available battery power. The warming coverlet was designed as disposable sleeping bag that fully encloses the patient but still allows easy access for medical treatment. The heating unit attaches under a standard litter and readily adapts to available power sources(110 VAC, 24 VDC, and battery). Testing with volunteers verified that the system was well able to meet requirements. Therefore it could follow a patient from forward medical facilities, through ground and helicopter transport, post-surgical waiting, and finally through evacuation on military aircraft. It is also compatible with existing Bair Hugger surgical blankets. Civilian uses for the same technology are planned, specifically medical transport and outdoor rescue.

DTIC

Air Transportation; Casualties; Evacuating (Transportation); Heating Equipment; Hypothermia; Medical Services; Patients

20050110502 California Univ., Los Angeles, CA USA

Regulation of TRAIL-Mediated Apoptosis in Prostate Cancer by Overexpression in XIAP

Bonavida, Benjamin; Jan. 2004; 43 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0023

Report No.(s): AD-A430062; No Copyright; Avail: CASI; A03, Hardcopy

The failure to eradicate advanced prostate cancer that is resistant to conventional therapies, such as chemo and hormonal therapies, has led to the exploration of novel therapeutic applications such as immunotherapy. One form of immunotherapy is to generate anti-tumor cytotoxic lymphocytes that can recognize and eradicate resistant tumor cells. Cytotoxic lymphocytes mediate their killing by various mechanisms including the perforin granzyme pathway and by members of the TNF-alpha superfamily. Among the TNF-alpha superfamily, TRAIL has been shown to be selectively cytotoxic to cancer cells and poorly cytotoxic to normal cells and is, therefore, considered as a good candidate for prostate cancer therapy. However, the development of drug/hormonal resistant prostate cancer results in the development of tumor cells resistant to immune killer cells and, indeed, prostate cancer cell lines have been shown to be relatively resistant to TRAIL-induced apoptosis. Resistance is under the regulation of apoptotic regulatory gene products in the cancer cells. We have demonstrated that prostate cancer cells resistant to TRAIL are due in large part to the overexpression of the anti-apoptotic gene product, XIAP and Bc1(sub -xL), both of which are under the regulation of constitutive NF-kB. Inhibition of NF-kB or either XIAP or Bc1(sub-xL) expression results in the reversal of resistant tumor cells and sensitivity to TRAIL-induced apoptosis. This proposal investigates the role of XIAP in resistance to TRAIL and investigates the underlying mechanisms of the regulation of XIAP expression in prostate cancer cells. We have proposed to investigate 1) The role of XIAP in protecting prostate cancer cells from TRAIL-mediated apoptosis, 2) The regulation of XIAP by NF-kB and NF-kB regulation by XIAP, and 3) The role of endogenous TNF-alpha and IL-6 in the regulation of XIAP and resistance of tumor cells to TRAIL-induced apoptosis.

DTIC

Apoptosis; Cancer; Hormones; Prostate Gland

20050110505 Boston Univ., Boston, MA USA

Metastatic Progression of Breast Cancer by Allelic Loss on Chromosome 18q21

Thiagalingam, Sam; Sep. 2004; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0160

Report No.(s): AD-A430065; No Copyright; Avail: CASI; A02, Hardcopy

The molecular basis of a pro-oncogenic role of TGFbeta in promoting advanced metastatic cancer remains unclear. The TGFbeta levels are increased locally and systemically in-advanced breast tumors particularly at the leading edges and in metastasis. Our studies provide direct evidence for the association between the inactivation of SMAD4 gene localized to chromosome 18q and upregulation of pro-angiogenic/ metastatic factors such as angiopoietin and VEGF in breast cancer. Additionally, our preliminary data also provides evidence for the synergistic activation of pro-angiogenic/ metastatic effects by TGFbeta in the presence of defective SMAD4 in breast cancer. We therefore hypothesize that normal Smad4 mediated events are required to maintain suppression of metastasis and disabling these events is a major step towards the development of metastatic malignant breast cancer. We are in the process of the identification and characterization of the mediator and effector genes that regulate metastatic progression of breast cancer upon inactivation of the Smad4 mediated events.

DTIC

Breast; Cancer; Chromosomes; Losses; Mammary Glands; Metastasis

20050110506 Hawaii Univ., Honolulu, HI USA

A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer

Shumay, Dianne M.; Maskarinec, Gertraud; Sep. 2004; 87 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0260

Report No.(s): AD-A430066; No Copyright; Avail: CASI; A05, Hardcopy

The study purpose is to examine the extent to which levels of depression and anxiety and coping at 3-5 months post-diagnosis are related to complementary and alternative medicine (CAM) use at initial assessment (T1) and follow-up at 9 (T2) and 15 (T3) months. This study will also identify the types of CAM sought after by women with higher levels of anxiety and depression. Seventy-one women completed the survey at T1 and 40 women completed the follow-up survey at T2. Data collection is continuing for T2 and T3. Cross-sectional and repeated measures analysis found no effect for anxiety or depression at T1 and T2 on CAN use at either tine point. However, when we looked at earlier CAN use as a predictor of later emotional distress, CAM use predicted anxiety and depression, with the effect varying by type of CAM used. The award has

supported a quality training experience for the trainee and has supported her to continue to make satisfactory progress on her dissertation.
DTIC
Anxiety; Breast; Cancer; Emotional Factors; Emotions; Females; Mammary Glands

20050110507 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model
Nelson, Edward L.; Prieto, Darue; Alexander, Terri G.; Pushko, Peter; Lofts, Loreen A.; Jan. 2003; 17 pp.; In English
Contract(s)/Grant(s): N01-CO-12400
Report No.(s): AD-A430067; No Copyright; Avail: Defense Technical Information Center (DTIC)

Many tumor-associated antigens (TAAs) represent self' antigens and as such, are subject to the constraints of immunologic tolerance. There are significant barriers to eliciting anti-tumor immune responses of sufficient magnitude. We have taken advantage of a Venezuelan equine encephalitis-derived alphavirus replicon vector system with documented in vivo tropism for immune system dendritic cells. We have overcome the intrinsic tolerance to the self' TAA rat neu and elicited an effective anti-tumor immune response using this alphavirus replicon vector system and a designed target antigen in a rigorous rat mammary tumor model. We have demonstrated the capacity to generate 50% protection in tumor challenge experiments (p=0.004) and we have confirmed the establishment of immunologic memory by both second tumor challenge and Winn Assay (p=0.009). Minor antibody responses were identified and supported the establishment of T helper type 1 (Th1) anti-tumor immune responses by isotype. Animals surviving in excess of 300 days with established effective anti-tumor immunity showed no signs of autoimmune phenomena. Together these experiments support the establishment of T lymphocyte dependent, Th1-biased anti-tumor immune responses to a non-mutated self' TAA in an aggressive tumor model. Importantly, this tumor model is subject to the constraints of immunologic tolerance present in animals with normal developmental, temporal, and anatomical expression of a non-mutated TAA. These data support the continued development and potential clinical application of this alphaviral replicon vector system and the use of appropriately designed target antigen sequences for anti-tumor immunotherapy.
DTIC
Antibodies; Antigens; Breast; Cancer; Encephalitis; Immunology; Mammary Glands; Rats; Tumors; Viruses

20050110508 Kentucky Univ., Lexington, KY USA
An Epidemiological Study of Leptospira-Induced Abortion in Mares in Central Kentucky (1990-2004)
Hall, David C.; Feb. 2005; 126 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430068; CI04-953; No Copyright; Avail: Defense Technical Information Center (DTIC)

Leptospirosis can cause fetal abortion in pregnant mares. The number of abortions attributed to leptospiral infection in central Kentucky can differ greatly from year to year. This study compares years having a higher than average prevalence of leptospiral abortions to years having an average or below average prevalence of such abortions in the horse population. Environmental factors, such as temperature and precipitation, as well as geographical location using geographical information system (GIS) technology were examined. Other factors that were examined include time of year, gestational age of the foal, age of the mare, parity of the mare, future reproductive success of the mare, and contact with wildlife.
DTIC
Epidemiology; Fetuses; Horses; Risk

20050110509 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques
Geisbert, Thomas W.; Hensley, Lisa E.; Larsen, Tom; Young, Howard A.; Reed, Douglas S.; Dec. 2003; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430069; No Copyright; Avail: Defense Technical Information Center (DTIC)

Ebola virus (EBOV) infection causes a severe and fatal hemorrhagic disease that in many ways appears to be similar in humans and nonhuman primates; however, little is known about the development of EBOV hemorrhagic fever. In the present study, 21 cynomolgus monkeys were experimentally infected with EBOV and examined sequentially over a 6-day period to investigate the pathological events of EBOV infection that lead to death. Importantly, dendritic cells in lymphoid tissues were identified as early and sustained targets of EBOV, implicating their important role in the immunosuppression characteristic of EBOV infections. Bystander lymphocyte apoptosis, previously described in end-stage tissues, occurred early in the

disease-course in intravascular and extravascular locations. Of note, apoptosis and loss of NK cells was a prominent finding, suggesting the importance of innate immunity in determining the fate of the host. Analysis of peripheral blood mononuclear cell gene expression showed temporal increases in tumor necrosis factor-related apoptosis-inducing ligand and Fas transcripts, revealing a possible mechanism for the observed bystander apoptosis, while up-regulation of NAIP and cIAP2 mRNA suggest that EBOV has evolved additional mechanisms to resist host defenses by inducing protective transcripts in cells that it infects. The sequence of pathogenetic events identified in this study should provide new targets for rational prophylactic and chemotherapeutic interventions.
DTIC
Fever; Hemorrhages; Infectious Diseases; Monkeys; Pathogenesis; Shock (Physiology); Viruses

20050110511 Alabama Univ., Birmingham, AL USA
Interdisciplinary Breast Cancer Training Program
Lamartiniere, Coral A.; Sep. 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0119
Report No.(s): AD-A430072; No Copyright; Avail: CASI; A03, Hardcopy

The goal of the University of Alabama at Birmingham Interdisciplinary Breast Cancer Training Program (IBCTP) is to educate and train predoctoral students in a multidisciplinary environment with a focus on breast cancer research. The aims of the program are as follows: (1) recruit predoctoral trainees to the IBCTP; (2) assure that predoctoral trainees obtain a broad-based breast cancer education and carry out interdisciplinary breast cancer research; (3) administer this program with sufficient oversight to ensure high-quality education and training, efficient completion of degree requirements, and productive research careers. For academic year 2004-2005, the authors recruited 2 new students and had one previous student transfer to another program, resulting in a total of 10 students in the IBCTP (6 more than initially recommended by the study section). Two students were accepted for PhD candidacy. The IBCTP hosted 12 scientists to present seminars on cancer-related research and to talk to the predoctoral trainees. The Breast Cancer Causation and Regulation course and Breast Cancer Journal Club received 'very good' evaluations. Seven abstracts/presentations were made by 4 students at scientific meetings. One Susan Komen predoctoral grant was renewed and two new research grants were awarded to faculty, in part because of student data used in the preparation of the grant applications.
DTIC
Breast; Cancer; Education; Mammary Glands; Medical Science; Students

20050110517 Naval Health Research Center, San Diego, CA USA
Microhematuria Associated With a Special Operations Craft Mission
Hodgdon, James A.; Walsh, Brandon J.; Hackney, Anthony C.; Sep. 2004; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-WX-20415; N00014-02-WX-20417; Proj-01033
Report No.(s): AD-A430082; NAVHLTHRSCHC-04-24; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Military Personnel; Shock (Physiology); Urinalysis

20050110529 Polytechnic Univ., Brooklyn, NY USA
Fuel From Self-Degrading Bioengineering Packaging
Gross, Richard A.; Jan. 2005; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-03-1-0091
Report No.(s): AD-A430101; RGFUEL6; ARO-45474.1-CH-DRP; No Copyright; Avail: Defense Technical Information Center (DTIC)

Research focused on developing an enzyme that could be embedded within a single-use plastic and convert the plastic after use to products of value such as fuel to troops in the field. Polylactic acid (PLA) was selected for this work since it is commercially available, degradable by an enzyme (Proteinase K), and is known to have properties compatible with those required by the military for many single-use materials. Engineering of Proteinase K for PLA degradation required a low throughput assay that accurately selects variants that offer improvements in a wide range of enzyme characteristics including the structure of products formed, activity at low pH, and thermal stability. This required a new technological approach to protein engineering. Using an integrated substitution choice method and sequence-activity models we obtained dramatic improvements in enzyme performance while screening only 100 variants. The small number of variants required allowed us

to accurately assess the distribution of products formed and enzyme behavior while varying different physical parameters of importance for final process design such as temperature and pH. A new LC-MS method was developed that provided information on degradation product chain length, concentration, and stereochemical composition. Improvements in enzyme performance relative to the wild-type achieved by this new protein engineering method include identification of variants with: i) 12-fold improvement at low pH (5.5), ii) 5-fold improvement in dimer yield, and iii) 2-fold improvement in heat stability at 650C. This contrasts to other methods such as directed evolution that requires screening of thousands of variants per cycle to obtain improvement factors normally 1.5 to 2-fold.
DTIC
Bioengineering; Degradation; Energy Conversion; Enzymes; Fuels; Packaging

20050110538 Defense Science Board, Washington, DC USA
Interim Report of the Defense Science Board Task Force on SARS Quarantine
Lederberg, Joshua; Gibson, Roger L.; Dec. 2004; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430115; No Copyright; Avail: Defense Technical Information Center (DTIC)
The Task Force established by the Defense Science Board (DSB) to assess Department of Defense (DoD) quarantining guidance for dealing with a Severe Acute Respiratory Syndrome (SARS) epidemic met on three occasions during 2003-2004 to review the status of current and planned DoD policies and procedures related to SARS outbreak response. The Task Force received a number of briefings describing SARS and other disease outbreak response and quarantine operations, Centers for Disease Control and Prevention SARS guidelines, lessons learned, DoD global surveillance systems, and military/civilian public health interfaces. The Task Force's initial findings and recommendations in six areas are included. Appendix A of this report contains the Terms of Reference given to the Task Force by the Under Secretary of Defense. To integrate public health needs, on behalf of national security, the Task Force was asked to review and assess the following: (a) Existing doctrine and process by which quarantine policy is generated as applied to all personnel in OCONUS as well as CONUS theaters, (b) Required cooperation with non-DoD agencies and non-U.S. government entities including other countries; (c) Capacity of local commanders to rapidly surveil disease status and establish need, ways, and means for quarantine in relation to their assigned missions; (d) Methods, technologies, and legal doctrine to allow safe transport of personnel through quarantined areas, and restriction of movement where needed; (e) Sample scenarios; (f) Coordination and allocation of DoD and non-DoD resources to combat SARS; and (g) identification and tracing of individuals potentially exposed to SARS. Appendix B contains references to documents reviewed by the Task Force. Appendix C contains recommendations to enhance two documents: DoD Directive 'Emergency Health Powers on Military Installations,' May 12, 2003; and 'US Government Interagency SARS Concept of Operations Plan.'
DTIC
Contamination; Defense Program; Planetary Quarantine; Policies; Public Health

20050110540 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA
Uniformed Services University of the Health Sciences Journal 2003 Edition
Dix, Mary A.; Aug. 2004; 659 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430119; No Copyright; Avail: Defense Technical Information Center (DTIC)
This 2003 Edition of the USU Journal documents that the Uniformed Services University of the Health Sciences (USU) continues to meet, or exceed, its Congressionally established and Department of Defense directed mission to provide continuity and leadership and ensure medical readiness and continuing education for the Military Health System (MHS) through the provision of career-oriented, uniquely trained physicians, advanced practice nurses and scientists and specialized educational training, exercises and research to meet the combat, humanitarian, and peacetime health care requirements of the MHS.
DTIC
Health; Medical Services; Military Operations; Universities

20050110542 Pennsylvania State Univ., Hershey, PA USA
Neoplastic Consequences of a Mutator Phenotype in Human Breast Epithelial Cells: A Prospective Analysis
Eckert, Kristin A.; Aug. 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0395
Report No.(s): AD-A430121; No Copyright; Avail: Defense Technical Information Center (DTIC)
Non-tumorigenic MCF-10AT and tumorigenic MCF-10AT cells were stably transfected with pIRES-pol beta. DNA

polymerase B overexpression in both cell lines resulted in loss of proliferative potential through apoptosis. Pol beta overexpression in MCF-10AT/AT cells increased the number of apoptotic cells within the population and altered the ratios of pro- and anti-apoptotic protein levels. Pol beta overexpression in MCF-10A cells resulted in a low incidence of tumors. Pol B overexpression in MCF-10A cells resulted in a reduced incidence relative the parental cells, but an increased incidence relative to the vector control cells. The suppression of MCF-10AT cell tumorigenicity in the vector transfected controls is likely due to the observed molecular alterations in cell cycle progression proteins induced by puromycin selection. The tumors produced by pol beta-overexpressing cells displayed an altered histology, relative to the MCF-10AT parental tumors. Molecular analysis of MCF-10A or AT/poIB tumors demonstrated that exogenous poIB protein expression was diminished or lost in the tumor population. We propose that poIB overexpression induces genomic instability in MCF-10A and MCF-10AT cells, resulting primarily in cell death. In rare cells, or within the host environment of the mammary fat pad, cells are selected that have extended proliferative potential, allowing for additional genetic changes and neoplastic progression.
DTIC
Breast; Carcinogens; Diseases; Genetics; Neoplasms; Phenotype

20050110543 Yale Univ., New Haven, CT USA
Outcome Based Screening for Prognostic Phospho-RTK (Receptor Tyrosine Kinase) Antibodies Using Tissue Microarrays)
Rimm, David; Aug. 2004; 43 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0463
Report No.(s): AD-A430123; No Copyright; Avail: Defense Technical Information Center (DTIC)

Receptor Tyrosine Kinases (RTKs) have been identified as potential targets for both breast cancer prognosis and therapy. We proposed use of tissue microarrays to evaluate the prognostic value of RTKs with emphasis on the phosphorylation status of these receptors. Analysis of a series of phospho-receptor antibodies on large cohorts on tissue microarrays should reveal which RTKs are most likely to be of prognostic and therapeutic value. As of this progress report, we have completed construction of the tissue microarrays and completed collection of the clinical data. We have also completed and submitted a pilot study of RTKs using conventional analysis of this array. In the proposal we show automated analysis of the arrays has potential to reveal relationships that are undetectable by conventional methods. We have now completed our efforts in construction of the device capable of high through-put automated array analysis. We have completed studies using this technology (called AQUA, for automated quantitative analysis)on a number of RTKs. Although we were unable to successfully use phosphor-An, the quantitative assess of the RTKs themselves provided novel information with respect
DTIC
Antibodies; Breast; Cancer; Mammary Glands; Tyrosine

20050110559 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Production and Purification of Refolded Recombinant Human IL-7 From Inclusion Bodies
Ouelette, Thomas; Destrau, Sophie; Ouelette, Timothy; Zhu, Jianwei; Roach, John M.; Jan. 2003; 12 pp.; In English
Report No.(s): AD-A430155; No Copyright; Avail: Defense Technical Information Center (DTIC)

A recombinant clone of human rhIL-72 that codes for 152 amino acids was cloned into Escherichia coli HMS 174(DE3) pLys S under the control of a T7 promoter. The cloned rhIL-7 has a molecular weight of 17.4 kDa with three disulfide bonds and three sites for glycosylation. The molecule has a hydrophobic nature and heparin affinity. The isoelectric point of this recombinant protein is 9.3 by CZE and 8.45 by AAA. The insoluble inclusion bodies produced during fermentation were solubilized by homogenization with 6M guanidine HCl. The rhIL-7 inclusion bodies were enriched for monomer by size exclusion chromatography using a Superdex 200 Prep Grade solumn under denaturing conditions. The enriched, denatured rhIL-7 monomer was reduced and stratically refolded at a final protein concentration of 80 - 100 g/ml and a final guanidine HCl concentration of 0.06 M at 2-8 C for 48 - 72 hours. The refolded monmeric rhIL-7 was subsequently purified by low pressure liquid chromatography using hydrophobic interaction cation exchange and size exclusion chromatography. The purified final product was \g95% pure by Coomassie brilliant blue -stained SDS-PAGE, high pressure size exclusion chromatography and reverse phase HPLC. The endotoxin level was \h 0.05 EU/mg. The final purified product was biologically active in a validated IL-7 dependent pre-B cell bioassay. In anticipation of human clinical trials this material is currently being evaluated for safety and efficacy in non-human primate toxicology studies.
DTIC
Amino Acids; Escherichia; Purification

20050110564 Virginia Commonwealth Univ., Richmond, VA USA
MTA1-Regulated Gene Expression: New Markers of Breast Cancer Metastasis
O'Connell, Peter; Sep. 2004; 26 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0648
Report No.(s): AD-A430181; No Copyright; Avail: CASI; A03, Hardcopy

Doctors examine primary tumors and nearby lymph nodes to assess cancer spread, as node-positive breast tumors require obligatory chemotherapy. Most breast cancers are 'node-negative' (confined to the breast), but, if left untreated, one fourth of these patients die from occult systemic disease ('micrometastasis'). Women with node-negative breast tumors that overexpress metastasis-associated 1 (MTA1) protein had recurrence risks identical to women with systemic disease (RR 2.7, p = 0.0006). For the 7% (29/394) of patients with tumors expressing the highest levels of MTA1, relapse rates exceeded 60% (1). MTA1 detected recurrence risk before relapses were clinically evident, MTA1 is a prognostic marker and may herald micrometastasis. We plan to treat breast cancer cells with antisense and control oligomers with an antisense construct that specifically blocks MTA1 protein formation. Gene expression microarrays can measure levels for nearly every gene. Genes that are differentially expressed in AS-MTA1-treated versus control breast cancer cells are either directly or indirectly MTA1-regulated. Since MTA1 is known to enhance tumor metastasis (2,3) , future studies of differentially expressed (MTA1-regulated) genes will confirm their role in primary breast tumor metastasis. MTA1, gene expression arrays, and new micrometastasis markers should allow doctors and patients to objectively weigh the need, and likely clinical benefits of breast cancer chemotherapy.
DTIC
Breast; Cancer; Lymphatic System; Mammary Glands; Markers; Metastasis

20050110568 California Univ., San Francisco, CA USA
Modification of Epigenetic Changes in Cancer by the Stromal Environment
Tlsty, Thea D.; Sep. 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0663
Report No.(s): AD-A430193; No Copyright; Avail: CASI; A03, Hardcopy

The stromal environment can modulate important epigenetic changes that are seen in carcinogenesis. We hypothesize that growth of primary, normal (non-tumorigenic) epithelial cells in the presence of stromal fibroblasts that have been isolated from a mammary adenocarcinoma will change the frequency of methylation events at promoter sequences such as for l4-3-3sigma and pl6. Promoter hypermethylation of l4-3-3sigma is a frequent event in both early and later stages of breast cancer and silencing occurs in over 90% of breast tumors. We have successfully established a methylation-specific PCR assay to distinguish methylated from unmethylated alleles of the l4-3-3sigma promoter. We found that l4-3-3sigman is unmethylated in normal HMEC. We further determined that vHMEC, postulated to be a very early step in breast carcinogenesis, also lacks appreciable hypermethylation of l4-3-3sigma promoter sequences. Interestingly, 14-3-3sigma is methylated in mammary fibroblasts. To address whether mammary Stroma affects the frequency of methylation in mammary epithelial cells using our established methylation-specific PCR assay, will require partitioning techniques to separate fibroblasts (with methylated 14-3-3sigma sequences) from rare epithelial cells that may have hypermethylated the same sequences.
DTIC
Breast; Cancer; Epithelium; Mammary Glands

20050123898 NASA Glenn Research Center, Cleveland, OH, USA
Elastic Response of Crimped Collagen Fibrils
Freed, Alan D.; Doehring, Todd C.; [2005]; 14 pp.; In English; 2004 ASME International Engineering Congress, 13-19 Nov. 2004, Anaheim, CA, USA
Contract(s)/Grant(s): DAMD17-01-1-0673; SSA3-516; NIH-NHLBI-HL-72598
Report No.(s): IMECE-2004-61578; E-14639; No Copyright; Avail: CASI; A03, Hardcopy

A physiologic constitutive expression is presented in algorithmic format for the elastic response of wavy collagen fibrils found in soft connective tissues. The model is based on the observation that crimped fibrils have a three-dimensional structure at the micrometer scale that we approximate as a helical spring. The symmetry of this waveform allows the force/displacement relationship derived from Castigliano's theorem to be solved in closed form. Model predictions are in good agreement with experimental observations for mitral-valve chordae tendineae
Author
Collagens; Elastic Properties; Connective Tissue; Fibers; Folding; Physiology

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20050092386 NASA Marshall Space Flight Center, Huntsville, AL, USA
Effects of Nuclear Interactions in Space Radiation Transport
Lin, Zi-Wei; Barghouty, A. F.; [2005]; 1 pp.; In English; 1st Space Exploration Conference, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

Space radiation transport codes have been developed to calculate radiation effects behind materials in human mission to the Moon, Mars or beyond. We study how nuclear fragmentation processes affect predictions from such radiation transport codes. In particular, we investigate the effects of fragmentation cross sections at different energies on fluxes, dose and dose-equivalent from galactic cosmic rays behind typical shielding materials.
Author
Nuclear Interactions; Dosage; Radiation Effects; Radiation Transport

20050110364 Naval Postgraduate School, Monterey, CA USA
Circadian Rhythms, Fatigue, and Manpower Scheduling
Pearson, Kristen A.; Dec. 2004; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429857; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Benefield Anechoic Facility (BAF), Edwards Air Force Base, California, is the largest anechoic military test facility in the world for testing developmental and operational electromagnetic equipment. Supervisors must often extend employees' work hours considerably in order to meet mission (i.e., test) timelines. Supervisors at the BAF currently have no accurate means of identifying when an employee's work performance is at risk of decreasing due to sleep deprivation, unbalanced circadian rhythms, and/or fatigue. Therefore, the focus of this research was to create a method for supervisors to effectively gauge the work performance levels of employees placed at risk for sleep deprivation. Thus, individual sleep data were collected for one week on eight volunteers at the BAF using assigned sleep monitoring devices known as Actigraphs. Extensive questionnaires were developed to determine volunteers' sleep pattern, demographics, and sleep history. For analysis Sleep, Activity, Fatigue, and Task Effectivenesspurposes, the Fast Avoidance Scheduling Tool (FAST), based on the Sleep, Activity, Fatigue, and Task Effectiveness (SAFTE) model was used to determine how the performance level of each volunteer differed based on the amount of sleep acquired. The results demonstrated that as the week progressed and the volunteers' sleep decreased, the effectiveness of their work performance correspondingly decreased to a level where the safety of the test and the volunteers were both at risk.
DTIC
Circadian Rhythms; Manpower; Scheduling; Sleep Deprivation

20050110489 Baylor Coll. of Medicine, Houston, TX USA
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome
Dalton, Pamela; Sep. 2004; 30 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0782
Report No.(s): AD-A430044; No Copyright; Avail: CASI; A03, Hardcopy

Troops deployed in the Persian Gulf War were exposed to an unusually diverse mix of odorous chemicals at the same time that they were exposed to physiological and psychological stressors, a scenario that research in animal models suggests will lead to the development of specific conditioned responses. The goal of this research is to investigate the extent to which people can acquire stress reactions as conditioned responses to odors and exhibit health symptoms as a result of such conditioning episodes. Thus, the paradigm investigated in this project can serve as a model system for examining and understanding the persistent symptom constellations found in Gulf War Syndrome (GWS) and other stress-mediated syndromes. Results from the first three studies strongly suggest that odor-stress conditioning can mediate elevations in hormonal status (salivary cortisol), self-reported stress, health symptoms, and judged cognitive effort on memory tests, and that cognitive information about the nature of the chemical odor may enhance the stress and health symptom reports over that which is due to conditioning alone. Current studies are continuing to explore additional parameters of the odor-stress conditioning paradigm.
DTIC
Conditioning (Learning); Deployment; Gulfs; Odors; Physiological Effects; Signs and Symptoms; Warfare

20050123671 Cornell Univ., Ithaca, NY, USA

Do Integrins Mediate the Skeletal Response to Altered Loading?

vanderMeulen, Marjolein C. H.; [2004]; 3 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NCC2-1201; No Copyright; Avail: CASI; A01, Hardcopy

In vivo experiments were performed to examine the role of B1 integrin in skeletal adaptation to reduced and increased loading. Transgenic mice were generated with a dominant negative form of the B1 integrin cytoplasmic domain with expression driven by the osteocalcin promoter (pOCb1DN). This fragment consists of the transmembrane and intracellular domains and interferes with endogenous integrin signalling in vitro. This promoter targets expression of the transgene to mature bone cells. Expression of the transgene was confirmed by immunoprecipitation and western blotting. Reduced loading was generated by hindlimb suspension and increased loading the resumption of normal loading following hindlimb suspension. Two groups of female 35-day old mice were examined: poCb1DN transgenic mice (TG) and wild-type littermate controls (WT). Animals were hindlimb suspended for 1 week (HU, n = l0/gp) or 4 weeks (HU, n = 4 - 7/gp) or suspended for 4 weeks followed by reloading by normal ambulation for 4 weeks (RL, n = l0/gp). Age-matched controls (CT) were pairfed based on the HU food intake. The protocols were approved by the NASA Ames Research Center IACUC. Upon completion of the experimental protocol, body mass was recorded and tissues of interest removed and analyzed following standard procedures. Femoral whole bone structural behavior was measured in torsion to failure to obtain whole bone strength (failure torque) and torsional rigidity. Ash content (ash) and fraction (% ash) were determined for the tibia. Total ash is indicative of bone size whereas %ash is a material property. Tibial curvature was measured from microradiographs. For each experiment, the effects of genotype (TG, WT) and treatment (CT, HU/RL) were assessed by two-factor ANOVA followed by the Tukey-Kramer posthoc to identify significant differences at an alpha level of 0.05. Our goal was to understand differences resulting from altered integrin function in the adaptation to altered loading.

Author

Bone Mineral Content; Musculoskeletal System; Osteocalcin

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20050092399 NASA Marshall Space Flight Center, Huntsville, AL, USA

ISS ECLSS Technology Evolution for Exploration

Carrasquillo, Robyn; [2005]; 8 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The baseline environmental control and life support systems (ECLSS) currently deployed on the International Space Station (ISS) and the regenerative oxygen generation and water early 1990's. While they are generally meeting, or exceeding requirements for supporting the ISS crew, lessons learned from hardware development and on orbit experience, together with advances in technology state of the art, and th&e unique requirements for future manned exploration missions prompt consideration of the next steps to be taken to evolve these technologies to improve robustness and reliability, enhance performance, and reduce resource requirements such as power and logistics upmass This paper discusses the current state of ISS ECLSS technology and identifies possible areas for evolutionary enhancement or improvement.

Author

Life Support Systems; International Space Station; Deployment; Environmental Control; Oxygen Production

20050109772 Membrane Technology and Research, Inc., Menlo Park, CA, USA

Protective Clothing Based on Permselective Membrane and Carbon Adsorption

2004; In English

Report No.(s): DE2004-826316; No Copyright; Avail: National Technical Information Service (NTIS)

The goal of this project was to develop chemical protective clothing for use by DOE decontamination and decommissioning workers that is sufficiently water vapor permeable to keep the workers cool, thereby enhancing their productivity. This report describes the results of Phase II of a two-phase project to complete development of the novel permselective material and to test protective clothing made from the fabric. In Phase I a novel material incorporating a nonporous hydrophilic polyvinylacohol (PVA) layer, which is water vapor permeable but relatively impermeable to organic vapors, was developed. The results of the Phase I tests showed that the chemical resistance of the MTR material is comparable

to that of Saranex/Tyvek materials, and that the comfort properties are closer to those of Tyvek (as measured in terms of CLO and permeability). Chemical resistance was measured using permeation tests against liquid dichloromethane. Comfort properties were ascertained by measuring the water vapor transmission of the material and by sweating manikin tests on whole protective suits.
NTIS
Adsorption; Carbon; Protective Clothing

20050109830 Federal Aviation Administration, Cambridge, MA, USA
Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs)
Chandra, D. C.; Yeh, M.; Riley, V.; Sep. 2004; 162 pp.; In English
Report No.(s): PB2005-103170; No Copyright; Avail: CASI; A08, Hardcopy

The Federal Aviation Administration (FAA), system designers, and customers all recognize that Electronic Flight Bags (EFBs) are sophisticated devices whose use could affect pilot performance. As a result, human factors issues have received considerable attention from the EFB community. In addition, the FAA's Advisory Circular (AC) on EFBs (AC 120- 76A) identifies a need for evaluating EFBs from a human factors perspective, and contains a list of human factors considerations for review. However, the AC does not specify how to perform EFB human factors evaluations. This research was directed at developing a tool that could be used by FAA Aircraft Certification Service specialists in the field to conduct structured and comprehensive, yet practical, EFB usability evaluations. Two tools were developed for initial tests, with the expectation that a single tool would eventually emerge. The tools were refined over the course of several tests with prototype commercial EFB systems. In the end, we found that both tools are valuable, but in different ways. In this report, we describe both tools, our procedures for testing the tools, and our methods of processing the resulting data into feedback for the manufacturer.
NTIS
Human Factors Engineering; Pilot Performance; Prototypes; Refining; Air Bag Restraint Devices

20050110551 Air Force Research Lab., Wright-Patterson AFB, OH USA
Helmet-Mounted Display Targeting Symbology Color Coding: An Air-to-Air Scenario Evaluation
Geiselman, Eric E.; Post, David L.; Jan. 1999; 12 pp.; In English
Report No.(s): AD-A430137; No Copyright; Avail: Defense Technical Information Center (DTIC)

Laboratory and flight test evaluations have consistently demonstrated the potential for helmet-mounted display (HMD) presented information to enhance air combat performance. The Air Force Research Laboratory's (AFRL's) Helmet-Mounted Sight Plus (HMS+) program seeks to provide further enhancement by enabling the presentation of multi-color symbology and sensor imagery. To take proper advantage of color-capable HMDs, systematic evaluations must be conducted to identify the best color-coding techniques. The experiment described here is the second we have conducted to address this need. The first experiment identified the better of two competing color coding strategies for air-to-air weapons symbology and indicated that pilots preferred the color codes over an otherwise equivalent monochrome baseline. The present experiment compared the 'winning' color code to the monochrome baseline during trials of a complex multi-player air-to-air weapon delivery scenario. Twelve fighter pilots representing three different countries (U.S., U.K., and Sweden) flew simulator trials that included target identification, intercept, attack, missile launch, and defensive maneuvering tasks. Participants subjective feedback and performance data indicated a preference for color coded symbology.
DTIC
Coding; Color; Helmet Mounted Displays

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20050092428 Los Alamos National Lab., NM, New Mexico Inst. of Mining and Technology, Socorro, NM, USA
Practical Gamma Spectroscopy Assay Techniques for Large Volume Low-Level Waste Boxes
Myers, S. C.; Gruetzmacher, K.; Sheffing, C. C.; Gallegos, L.; Bustos, R.; Feb. 2002; 12 pp.; In English
Report No.(s): DE2004-829678; No Copyright; Avail: Department of Energy Information Bridge

A study was conducted at the Los Alamos National Laboratory (LANL) to evaluate the performance of the SNAP (Spectral Nondestructive Assay Platform) analytical software for measurements of known standards in large metal waste boxes

(2.5 m3 volume). The trials were designed to test the accuracy and variance of the analytical results for low-density combustible matrices and higher-density metal matrices at two discrete gamma-ray energies: 121.78 keV and 411.12 keV. For both matrix types the measurement method that produced the most accurate results with the lowest associated standard deviation involved combining four individual measurements taken at the geometric center of each of the box's four vertical sides. With this method the overall bias and the standard deviation amongst 24 individual results for the 121.78 keV and 411.12 keV gamma rays were as follows: 3.38% (+ or = 20.19%) and 3. 68% (+ or = 15.47%) for the combustible matrix and 37. 88% (+ or = 67.64%) and 9.38% (+ or = 33.15%) for the metal matrix. The persistent positive bias from measurements of the metal box is believed to be a result of a nonhomogenously distributed matrix.
NTIS
Gamma Rays; Spectroscopy; Metal Matrix Composites

20050092441 Newcastle-upon-Tyne Univ., Newcastle, Cambridge Univ., Cambridge
Monitoring of Contractual Service Level Agreement
Molina-Jimenez, C.; Shrivastava, S.; Crowcrost, J.; Gevros, P.; 2004; 12 pp.; In English
Report No.(s): PB2005-103563; CS-TR-722; Copyright; Avail: National Technical Information Service (NTIS)

The goal of monitoring contractual Service Level Agreements (SLAs) is to measure the performance of a service, to evaluate whether its provider complies with the level of Quality of the Service (QoS) that the consumer expects. The aim of this paper is to bring to the system designer's attention the fundamental issues that monitoring of contractual SLAs involves: SLA specification, separation of the computation and communication infrastructure of the provider, service points of presence, metric collection approaches, measurement service and evaluation and violation detection service. The paper develops an architecture and give reasons why currently it is practicable to offer guaranteed QoS only to consumers sharing Internet Service Providers (ISPs) directly with the service provider.
NTIS
Internets; Systems Engineering

20050109789 Carnegie-Mellon Univ., Pittsburgh, PA, USA
Insider Threat Study: Illicit Cyber Activity in the Banking and Finance Sector
Randazzo, M. R.; Keeney, M.; Kowalski, E.; Cappelli, D.; Moore, A.; Aug. 2004; 30 pp.; In English
Report No.(s): PB2005-102962; No Copyright; Avail: CASI; A03, Hardcopy

The goal of the overall ITS is to develop information to help private industry, government, and law enforcement better understand, detect, and ultimately prevent harmful insider activity. The study consists of several components: an aggregated case-study analysis that provides an in-depth look at insider incidents that have occurred in critical infrastructure sectors between 1996 and 2002 (this report presents the first findings from this analysis); a review of the prevalence of insider activity across critical infrastructure sectors over a 10-year time frame and a survey of recent insider activity experienced by a sample of public- and private-sector organizations. This first report - from the aggregated case study analysis - examines insider incidents within the banking and finance sector. Subsequent reports from the aggregated case study analysis will examine insider activity within the information and telecommunications sector and government sector, as well as incidents across critical infrastructure sectors.
NTIS
Organizations; Law (Jurisprudence); Finance

20050109829 General Accounting Office, Washington, DC
Telemarketing: Implementation of the National Do-Not-Call Registry
Jan. 2005; 44 pp.; In English
Report No.(s): PB2005-103150; GAO-05-113; No Copyright; Avail: CASI; A03, Hardcopy

In response to consumer frustration and dissatisfaction with unwanted telemarketing calls, Congress has passed several statutes directing the Federal Trade Commission (FTC) and Federal Communications Commission (FCC) to regulate intrusive and deceptive telemarketing practices, authorizing both agencies to establish the National Do-Not-Call Registry (the national registry), and authorizing FTC to collect fees to fund this national registry. The objective of the national registry is to limit the numbers of unwanted telemarketing calls that registered consumers receive. The Conference Report for the Consolidated Appropriations Act, 2004, mandated that GAO evaluate the implementation of the national registry. Specifically, this report addresses (1) how FTC and FCC have implemented and operated the national registry, (2) fees collected to cover costs to

operate the national registry, and (3) how FTC has measured the success of the national registry.
NTIS
Appropriations; Consumers; Deception; Procedures; Telecommunication

20050109940 Grintek Avitronics, Centurion, South Africa
Aperture Theory And The Equivalence Theorem
Booysen, Adriaan J.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1258-1261; In English; See also 20050109927; Copyright; Avail: Other Sources

The equivalence theorem provides an elegant method for analyzing electromagnetic radiation and scattering from structures. A specific class of problems is where a source is enclosed within a st:ucture which forms a cavity with an aperture, as shown. From a radiation point of view, the fields within the cavity are not of any real interest, only the external fields radiated from the aperture. If the field distribution in the aperture is known (even if only approximately), this a priori knowledge can be exploited to limit calculations to the 'external' part of the problem. This technique is commonly referred to as 'aperture theory' and is discussed in many antenna textbooks.paper deals with the methods in which the equivalent aperture current densities are incorporated into the surface equivalence theorem. It will be shown that the application of image theory to problems involving radiation from apertures in half-space is incorrect and that conventional formulation of aperture theory violates a basic condition of the equivalence principle. A new aperture theory formulation is presented. The method is very simple to implement and will be shown to be exact in as far as the exact aperture fields are known.
Derived from text
Apertures; Electromagnetic Radiation; Electromagnetic Scattering; Equivalence

20050109975 Bilkent Univ., Ankara, Turkey
Fast Computation of Scattering from (Near-)Resonant Structures
Gurel, Levent; Yilmaz, Ali E.; Chew, Weng Cho; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1174-1177; In English; See also 20050109927; Copyright; Avail: Other Sources

A family of of fast direct (noniterative) solvers, which could be classified as: 1) recursive solver for the scattered field (RSSF); 2) recursive solver to invert the (impedance) matrix (RSIM), and recursive solver for the unknown (coefficient) vector (RSUV), were outlined. These solvers are related to the recursive aggregate interaction matrix algorithm (RAIMA), which is based on the recursive interaction matrix algorithm (RIMA) and the recursive aggregate T-matrix algorithm (RATMA). The noniterative nature of the solvers used in this paper is emphasized due to the inability of iterative solvers to handle problems that involve resonant or near resonant structures. Even the immensely successful fast iterative solvers that have been developed in recent years share this drawback. One example of (near-)resonant structures is a stack of closely spaced conducting patches, is shown.
Derived from text
Algorithms; Iteration; Scattering; Matrices (Mathematics); Computation

20050110025 Miller (Edmund K.), Santa Fe, NM, USA
A Comparison of Solution Accuracy Resulting from Factoring and Inverting Ill-conditioned Matrices
Miller, Edmund K.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 866-869; In English; See also 20050109927; Copyright; Avail: Other Sources

To return to the original problem that motivated this discussion, it's not clear why there is such a difference between the different residuals shown. My particular reason for examining these results is the implication they may have when using residuals in determining the convergence of an iterative solution. It seems reasonable, if the residual error is smaller than the actual error in an iterated sequence of solution estimates, to conclude that relying on the residuals as an indicator of solution accuracy could be misleading. Of coarse, it must be noted that the difference between the two error measures appears to be dependent on the CN of the matrix being solved. This could be one more reason why, as problems are being modeled using more and more unknowns, the potential related increase in CN needs to be considered in developing solution strategies. Also, possibly a different measure of residual error would circumvent or reduce the effect discussed here.
Derived from text
Iterative Solution; Accuracy; Matrices (Mathematics); Mathematical Models

20050110094 Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel
Error Control in the Reduced Expansion and Field Testing (REFT) Method for MoM Matrix Thinning
Gershon, E.; Kastner, R.; Steinberg, B. Z.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1186-1189; In English; See also 20050109927; Copyright; Avail: Other Sources

It is now widely recognized that MoM matrices may contain redundant information, resulting from the dense sampling rates of fields. Therefore, one would like to reduce the amount of data contained in the matrices by effectively slowing down the sampling rates to the level compatible with the physics of the problem, such that sparse rather than dense matrices are produced. When coupled with the obvious compactness and inherent economy of the integral equation formulation, the advantage of sparse matrices provide a newly found strength to the classical integral equations / MoM approach. The REFT method is a spatial domain method which facilitates a slow down the sampling rate for for the generation of a sparse matrix. In a sense, it is the spatial domain alternative to the spectral domain FMM. It generates a single sparse matrix, which is invertible either by direct or iterative solvers, as opposed to the FMM which requires iterative solvers. Direct solvers do not share the convergence drawbacks of iterations. A straightforward direct solver, for the case of an N x N sparse matrix, can be realized with much lower operation count than the O(N(sup 3)) associated with a straightforward Gaussian elimination. The method incorporates transformation of arbitrary basis and testing functions into a new basis, whereby the active number of both testing and basis functions is reduced to a minimum, thereby the elimination of all elements except for about 10% of the total. The initial version of the method was presented in a heuristic fasion as the RFT. The REFT facilitates straightforward operations on any MoM matrix, hence the method is applicable to 'legacy codes'. Both original and inverted matrices can be thinned. To facilitate this reduction an orthogonal transformation on the basis/testing functions is performed.
Derived from text
Error Analysis; Method of Moments; Matrices (Mathematics); Errors; Iteration

20050111485 Newcastle-upon-Tyne Univ., Newcastle
Extending the Horizons of DSE (GC6)
Hoare, T.; Jones, C.; Randell, B.; Jul. 2004; 10 pp.; In English
Report No.(s): PB2005-103585; CS-TR-853; Copyright; Avail: National Technical Information Service (NTIS)
The research, and the tool-building, to be undertaken in DSE should, in addition to concentrating on the problems of producing verifiably fault-free individual programs, include significant effort aimed at employing and exploiting high-level redundancy and structuring facilities, not just in the design and verification of complex software systems, but also during their deployment, and their adaptation in response to changing requirements. This paper aims at explaining and justifying this suggestion.
NTIS
Complex Systems; Program Verification (Computers)

20050111487 Newcastle-upon-Tyne Univ., Newcastle
Wrapping the Future
Anderson, T.; Randell, B.; Romanovsky, A.; Jul. 2004; 14 pp.; In English
Report No.(s): PB2005-103584; CS-TR-852; Copyright; Avail: National Technical Information Service (NTIS)
Enclosing a component within a software 'wrapper' is a well-established way of adapting components for use in new environments. This paper presents an overview of an experimental evaluation of the use of a wrapper to protect against faults arising during the (simulated) operation of a practical and critical system; the specific context is a protective wrapper for an off-the-shelf software component at the heart of the control system of a steam raising boiler. Encouraged by the positive outcomes of this experimentation we seek to position protective wrappers as a basis for structuring the provision of fault tolerance in component-based open systems and networks. The paper addresses some key issues and developments relating wrappers to the provision of dependability in future computing systems.
NTIS
Computer Programs; Fault Tolerance

20050111488 Newcastle-upon-Tyne Univ., Newcastle
Assessing the Risk and Valie of Adopting Emerging and Unstable Web Services Specifications
Parastatidis, S.; Webber, J.; Jul. 2004; 14 pp.; In English
Report No.(s): PB2005-103583; CS-TR-851; Copyright; Avail: National Technical Information Service (NTIS)
With the proliferation of Web Services specifications, the question of which of the multiplicity of technologies to adopt arises. While sometimes the decision can be based purely on matching requirements to protocol capabilities, a harder consideration is whether the chosen specifications will enable wide interoperability with other systems, or lead to an

architectural dead-end. This paper presents a risk assessment of several contemporary WS-* protocols, enabling architects and developers to make sane choices for service interoperability.
NTIS
Interoperability; Protocol (Computers); World Wide Web; Specifications

20050111490 Newcastle-upon-Tyne Univ., Newcastle
Using Web Services to Build Grid Applications-The No Risk WSGAF Profile
Parastatidis, S.; Webber, J.; Watson, P.; Jun. 2004; 24 pp.; In English
Report No.(s): PB2005-103582; CS-TR-850; Copyright; Avail: National Technical Information Service (NTIS)
This document presents design pattern recommendations for building Grid applications based on the principles of service orientation and using existing Web Services technologies. The design pattern described in this document is a subset of the Web Services Grid Application Framework (WSGAF) approach to building Grid applications since it only focuses on the use of the Web Services Interoperability Basic Profile 1.0a and WS-Security. Issues of stateful interactions, logical resource naming, metadata, security, and lifetime management are addressed.
NTIS
Computational Grids; World Wide Web; Metadata; Interoperability

20050111495 Newcastle-upon-Tyne Univ., Newcastle
Black Tie Optional: Modeling Programming Language Concepts
Coleman, J. W.; Jefferson, N. P.; Jones, C. B.; May 2004; 24 pp.; In English
Report No.(s): PB2005-103580; CS-TR-844; Copyright; Avail: National Technical Information Service (NTIS)
This paper describes an undergraduate course taught at the University of Newcastle upon Tyne; the title of the module is Understanding Programming Languages. The main thrust of the course is to understand how to model features of language semantics. Specifically, (structural) operational semantics (SOS) is taught as a convenient and notational light way of recording and experimenting with features of procedural programming languages. We outline the content, discuss the contentious issue of tool support and relate experiences.
NTIS
Semantics; Programming Languages

20050111496 Newcastle-upon-Tyne Univ., Newcastle
Simplified Version of the Chaum Voting Scheme
Ryan, P.; Bryans, J.; May 2004; 16 pp.; In English
Report No.(s): PB2005-103579; CS-TR-843; Copyright; Avail: National Technical Information Service (NTIS)
This report presents a simplified version of Chaum's digital voting scheme. This appears to preserve the essential characteristics of the original while being significantly easier to understand and implement.
NTIS
Voting; Digital Systems

20050111498 Newcastle-upon-Tyne Univ., Newcastle
Challenges and Opportunities in Grid Performability
Thomas, N.; May 2004; 16 pp.; In English
Report No.(s): PB2005-103578; CS-TR-842; Copyright; Avail: National Technical Information Service (NTIS)
Grid computing offers many scientific and commercial benefits, but also many technical and organisational challenges. This has led to many research areas in traditional distributed systems directing their efforts on to grid systems. Amongst the challenges for grid computing is the need to provide reliable quality of service to end users. This paper seeks to identify some of the challenges and opportunities that exist in the field of grid computing relating to system performance and dependability. These challenges are extensive and vary considerably as to the amount of effort that they are currently attracting.
NTIS
Grid Computing (Computer Networks); Computation; Systems Stability

20050111499 Newcastle-upon-Tyne Univ., Newcastle

Computing Shortest Violation Traces in Model Checking Based on Petri Net Unfoldings and SAT

Khomenko, V.; Apr. 2004; 22 pp.; In English

Report No.(s): PB2005-103577; CS-TR-841; Copyright; Avail: National Technical Information Service (NTIS)

Model checking based on the causal partial order semantics of Petri nets is an approach widely applied to cope with the state space explosion problem. One of the ways to exploit such a semantics is to consider (finite prefixes of) net unfoldings - themselves a class of acyclic Petri nets - which contain enough information, albeit implicit, to reason about the reachable markings of the original Petri nets. One of the possibilities for the verification process is to build a finite and complete prefix and use it for constructing a Boolean formula such that any satisfying assignment to its variables yields a trace violating the property being checked. (And if there are no satisfying assignments then the property is not violated.) In this paper a method for computing the shortest violation traces (which can greatly facilitate debugging the system) is proposed. Experimental results demonstrate that it can achieve significant reductions in the size of the Boolean formula as well as in the time required to compute a shortest violation trace, when compared with a naive approach.

NTIS

Petri Nets; Program Verification (Computers)

20050111500 Newcastle-upon-Tyne Univ., Newcastle

Modelling Opacity using Petri Nets

Bryans, J.; Koutny, M.; Ryan, P. Y. A.; Apr. 2004; 18 pp.; In English

Report No.(s): PB2005-103576; CS-TR-840; Copyright; Avail: National Technical Information Service (NTIS)

We consider opacity as a property of the local states of the secure (or high-level) part of the system, based on the observation of the local states of a low-level part of the system as well as actions. We propose a Petri net modeling technique which allows one to specify different information flow properties, using suitably defined observations of system behaviour. We then discuss expressiveness of the resulting framework and the decidability of the associated verification problems.

NTIS

Information Flow; Opacity; Petri Nets; Flow Characteristics

20050111503 Newcastle-upon-Tyne Univ., Newcastle

Dependable Pervasive Systems

Jones, C.; Randell, B.; Apr. 2004; 26 pp.; In English

Report No.(s): PB2005-103575; CS-TR-839; Copyright; Avail: National Technical Information Service (NTIS)

The UK is becoming ever more dependent on large networked computer systems yet the dependability of such systems is by no means always satisfactory. Techniques and tools available today make it possible to produce complex computer systems that work adequately dependably. However, there is a huge 'deployment gap', with many organisations attempting to produce and use complex systems and in particular software (which is where the complexity of such systems mainly, and appropriately, resides) using technical and management methods which are far from 'best practice'. Present trends indicate that huge networked computer systems are likely to become pervasive, as information technology is embedded into virtually everything, and to be required to function essentially continuously. Even today's 'best practice' will not suffice for such systems. This document therefore concentrates on the problems of dependably producing large complex distributed systems to match their specifications within time and budget constraints, and the problems of actually achieving adequate operational dependability from such systems when they are deployed.

NTIS

Computer Programming; Computer Networks; Complex Systems

20050111504 Newcastle-upon-Tyne Univ., Newcastle

Code Review and Personality: Is Performance Linked to MBTI Type

Da Cunha, A. D.; Greathead, D.; Apr. 2004; 22 pp.; In English

Report No.(s): PB2005-103574; CS-TR-837; Copyright; Avail: National Technical Information Service (NTIS)

Dependability frequently focuses on approaches such as rigorous design and fault tolerance. A final software product is strongly influenced by the people who created it. Large variations in individual performance in software development have been observed. Some form of innate programming ability might account for some of the differences. The influence of personality on computer programming has been examined but typically treated programming as a single process. As Weinberg suggested, different aspects of software development require different abilities so there may be no one personality type which

is better overall. To examine this, a study was carried out to discover if there was a particular personality type which tended to perform better at one specific task, in this case code review. It was found that people with a specific personality type performed significantly better on the task.
NTIS
Computer Programming; Software Development Tools; Software Engineering

20050111506 Newcastle-upon-Tyne Univ., Newcastle
Applying Petri Nets to Systems Biology using XML Technologies
Shaw, O.; Koelmans, A.; Steggles, J.; Wipat, A.; Mar. 2004; 44 pp.; In English
Report No.(s): PB2005-103568; CS-TR-827; Copyright; Avail: National Technical Information Service (NTIS)

Systems Biology is a rapidly developing discipline which utilises mathematical and computer science techniques to analyse and interpret biological models. Petri nets have been proposed as an effective formalism for Systems Biology but so far only a small number of simple manual Petri net models have been constructed and investigated. In this paper we present a scheme for automatically mapping biological systems into Petri net models using XML technology. We develop a simple prototype tool which translates Systems Biology Markup Language (SBML) to the Petri Net Markup Language (PNML). As an illustrative example we consider mapping a SBML description of the Saccharomyces cerevisiae glycolysis pathway into PNML. An analysis of the resulting PNML model then demonstrates that even basic invariant analysis can produce interesting results for biologists. Finally we discuss what features may be desirable to systems biologists
NTIS
Petri Nets; Bionics; Document Markup Languages

20050111507 Newcastle-upon-Tyne Univ., Newcastle
Visual Language for Parallel, Object-Oriented Programming
Lee, P. A.; Hamilton, M. D.; Parastatidis, S.; Feb. 2004; 14 pp.; In English
Report No.(s): PB2005-103567; CS-TR-826; Copyright; Avail: National Technical Information Service (NTIS)

This paper introduces the HiPPO (High Performance Parallel Object-oriented) language. HiPPO is unique in its combination of a visual syntax with an object-oriented computation model based on the flow of object references. The paper describes some of the notations used in the language with particular emphasis on the features provided to support the exploitation of parallelism. Aspects of the runtime support for HiPPO programs will also be described.
NTIS
Object-Oriented Programming; Syntax; Parallel Programming

20050111510 Newcastle-upon-Tyne Univ., Newcastle
Dynamic Allocation of Servers in a Grid Hosting Environment
Fisher, M.; Kubicek, C.; McGee, P.; Mitrani, I.; Palmer, J.; 2004; 10 pp.; In English
Report No.(s): PB2005-103565; Copyright; Avail: National Technical Information Service (NTIS)

A grid hosting environment is described, where servers may be reconfigured dynamically from one type of work to another in response to changes in demand. The problem of carrying out these reconfigurations in the most efficient manner is addressed by means of stochastic modelling and optimization. A heuristic policy which is close to optimal over a wide range of parameters is introduced. A prototype system based on existing resource management software has been developed to demonstrate the concepts described.
NTIS
Computer Systems Programs; Stochastic Processes; Resources Management

20050111513 Geological Survey, Storrs, CT, USA
Regression Equations for Estimating Flood Flows for the 2-, 10-, 25-, 50-, 100-, and 500-Year Recurrence Intervals in Connecticut
Ahearn, E. A.; 2004; In English
Report No.(s): PB2005-103316; USGS-SIR-2004-5160; No Copyright; Avail: National Technical Information Service (NTIS)

Multiple linear-regression equations were developed to estimate the magnitudes of floods in Connecticut for recurrence intervals ranging from 2 to 500 years. The equations can be used for non-urban, unregulated stream sites in Connecticut with drainage areas ranging from about 2 to 715 square miles. Flood frequency data and hydrologic characteristics from 70 stream flow gaging stations and the upstream drainage basins were used to develop the equations. The hydrologic characteristics

-drainage area, mean basin elevation, and 24-hour rainfall -are used in the equations to estimate the magnitude of floods. Average standard errors of prediction for the equations are 31.8, 32.7, 34.4, 35.9, 37.6 and 45.0 percent for the 2-, 10-, 25-, 50-, 100-, and 500-year recurrence intervals, respectively. Simplified equations using only one hydrologic characteristic -drainage area-also were developed. The regression analysis is based on generalized least-squares regression techniques.
NTIS
Linear Equations; Regression Analysis; Data Flow Analysis; Floods

20050111519 Helsinki Univ. of Technology, Espoo, Finland
Adaptive Autonomous Navigation of Mobile Robots in Unknown Environments
Selkainaho, J.; Dec. 2002; In English
Report No.(s): PB2005-103596; Copyright; Avail: National Technical Information Service (NTIS)

Autonomous navigation of a mobile robot is a challenging task. Much work has been done in indoor navigation in the last decade. Fewer results have been obtained in outdoor robotics. Since the early 90's, the Global Positioning System (GPS) has been the main navigation system for ships and aircrafts. In open fields, satellite navigation gives absolute position accuracy. The absolute heading information is also obtained by satellite navigation when the mobile robot is in motion. However, the use of GPS satellite navigation is mainly restricted to open areas where at least three satellites can be seen. For example, mobile robots working in underground or deep open mines cannot use satellite navigation at all, and in forest or city areas, there are serious limitations to its use. Laser range finder technology has evolved remarkably over the last decade, and offers a fast and accurate method for environment modeling. Furthermore, it can be used to define robot position and heading relative to the environment. It is obvious that the use of several alternative sensors according to the environment will make the navigation system more flexible. Laser range finder technology is particularly suitable for indoors or feature rich outdoor environments. The goal of this thesis is to develop a multi sensor navigation system for unknown outdoor environments, and to verify the system with a service robot.
NTIS
Autonomous Navigation; Robots; Position Errors

20050111543 Helsinki Univ. of Technology, Espoo, Finland
Self-Organizing Maps in Sequence Processing
Varsta, M.; 2002; 104 pp.; In English
Report No.(s): PB2005-103604; REPT-B32; Copyright; Avail: National Technical Information Service (NTIS)

Models are abstractions of observed real world phenomena or processes. A good model captures the essential properties of the modeled phenomena. In the statistical learning paradigm the processes that generate observations are assumed unknown and too complex for analytical modeling, thus the models are trained from more general templates with measured observations. A substantial part of the processes we seek to model have temporal dependencies between observations thus defining templates that can account for these dependencies improves their ability to capture the properties of such processes. In this work we discuss using the self organizing map with sequentially dependent data. Self-Organizing map (SOM) is perhaps the most popular non supervised neural network model that has found varied applications in the field of data mining for example. The original SOM paradigm, however, considers independent data, where context of a sample does not influence its interpretation. However, throwing away the temporal context of an observation when we know we are dealing with sequential data seems wasteful. Consequently methods for incorporating time into the SOM paradigm have been rather extensively studied. Such models if powerful enough would be very usable when tracking dynamic processes. In this work a Self-Organizing map for temporal sequence processing dubbed Recurrent Self-Organizing Map (RSOM) was proposed and analyzed. The model has been used in time series prediction combined with local linear models. Deeper analysis provides insight into how much and what kind of contextual information the model is able to capture. The other topic covered by the publications in a sense considers an inverse problem. In this topic SOM was used to create sequential dependence and order into initially unordered data by modeling a surface and creating a path over the surface for a surface manipulating robot.
NTIS
Mathematical Models; Data Mining; Time Series Analysis

20050111547 Helsinki Univ. of Technology, Espoo, Finland
New Canonical Representative Marking Algorithms for Place/Transition-Nets
Junttila, T.; 2002; 50 pp.; In English
Report No.(s): PB2005-103598; Copyright; Avail: National Technical Information Service (NTIS)

Symmetries of a Place/Transition-net can be exploited during the reachability analysis by considering only one representative marking in each orbit induced by the symmetries. In this report, three new algorithms for transforming a marking into a symmetric canonical representative marking are described. All the algorithms depend on the precalculation of a Schreier-Sims representation for the symmetry group of the net in question. The first algorithm uses a black box graph canonizer algorithm to produce a canonical version of the characteristic graph associated with a marking and then derives the canonical representative marking from it. The second algorithm is a backtrack search in the Schreier-Sims representation, pruning the search with the marking in question and its stabilizers found during the search. The third algorithm combines the first and second one by pruning the search in the Schreier-Sims representation with an ordered partition obtained with a standard preprocessing technique applied in graph isomorphism algorithms.
NTIS
Graph Theory; Nets; Symmetry

20050111585 General Accounting Office, Washington, DC
DOD Systems Modernization: Management of Integrated Military Human Capital Program Needs Additional Improvements
Feb. 2005; 116 pp.; In English
Report No.(s): PB2005-103213; GAO-05-189; No Copyright; Avail: CASI; A06, Hardcopy

The Department of Defense (DOD) has long-standing problems with its information technology (IT) systems supporting military personnel and pay. To address these problems, DOD initiated the Defense Integrated Military Human Resources System (DIMHRS) program, which is to provide a joint, integrated, standardized military personnel and pay system across all military components. In November 2004, DOD accepted the design for the first of three phases, DIMHRS (Personnel/Pay). GAO reviewed DODs management of the requirements definition for the system as well as the programs management structure. To assist DOD and increase its chances of successfully delivering DIMHRS (Personnel/Pay), GAO is making recommendations to the Secretary of Defense to strengthen DODs requirements-management processes and adopt an integrated approach to program management. In commenting on a draft of this report, DOD agreed or partially agreed with three of GAOs recommendations and partially disagreed with the remaining three. The department added that it agreed with the general thrust of all the recommendations but believed that it was already performing some. GAO supports DODs commitment to follow the management principles that the recommendations espouse.
NTIS
Defense Program; Information Systems

20050123564 Old Dominion Univ., Norfolk, VA, USA
Parallel Domain Decomposition Formulation and Software for Large-Scale Sparse Symmetrical/Unsymmetrical Aeroacoustic Applications
Nguyen, D. T.; Watson, Willie R., Technical Monitor; [2005]; 33 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG1-01033; No Copyright; Avail: CASI; A03, Hardcopy

The overall objectives of this research work are to formulate and validate efficient parallel algorithms, and to efficiently design/implement computer software for solving large-scale acoustic problems, arised from the unified frameworks of the finite element procedures. The adopted parallel Finite Element (FE) Domain Decomposition (DD) procedures should fully take advantages of multiple processing capabilities offered by most modern high performance computing platforms for efficient parallel computation. To achieve this objective. the formulation needs to integrate efficient sparse (and dense) assembly techniques, hybrid (or mixed) direct and iterative equation solvers, proper pre-conditioned strategies, unrolling strategies, and effective processors' communicating schemes. Finally, the numerical performance of the developed parallel finite element procedures will be evaluated by solving series of structural, and acoustic (symmetrical and un-symmetrical) problems (in different computing platforms). Comparisons with existing 'commercialized' and/or 'public domain' software are also included, whenever possible.
Author
Aeroacoustics; Symmetry; Decomposition; Finite Element Method; Parallel Processing (Computers); Computer Programs

20050123796 Kyungpook National Univ., Taegu, Korea, Republic of
Revisited Generalized Wood Anomalies
Lee, Cheol; Cho, Ung Hee; Cho, Young Ki; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1754-1757; In English; See also 20050123676; Copyright; Avail: Other Sources

Since new theories of Wood's anomalies on reflection gratings of both the slow and fast wave structures were reported in 1965, the existence of the Wood's anomalies of the resonance type, which are related to the leaky waves supportable by the grating, has been well recognized. Those works contributed considerably to clarifying the physics for the anomalies of the resonance type. The conclusion of the works, however, has a limited validity for the Off-Bragg blazing phenomena, if we explain the works from the viewpoint of blazing phenomena where two propagating modes are usually assumed. In other words, the previous conclusion is not enough to describe various interesting physics for the Bragg blazing phenomena. Such a limitation is thought to be mainly due to approximate methods used in prior researches such as the PMRS (Periodically Modulated Reactance Surface) model, which is somewhat problematic from the viewpoint of practical realizability, and the approximate transverse resonance method valid only for narrow slot or stop case.
Author
Anomalies; Bragg Angle; Reactance; Approximation; Gratings

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20050109953 Clemson Univ., SC, USA
Coupling to a Probe in a Metal Can by an Electric Dipole
Ozzaim, Cengiz; Chalmers, M. Butler; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 838-841; In English; See also 20050109927; Copyright; Avail: Other Sources

We describe a method to compute the coupling of a signal, caused by an elementary dipole, to a load impedance terminating a coaxial guide whose center conductor protrudes into a conducting can, as suggested. The can is a right circular cylindrical shell with a flat bottom through which protrudes the coax center conductor. The coax axis is the same as the cylinder axis and its outer conductor terminates at, and is electrically connected to, the can bottom. The can wall and bottom are taken to be vanishingly thin and they are perfect conductors, as are the inner and outer walls of the coaxial waveguide. To perform this computation directly is very difficult so we resort to a method that allows us to realize significant computational savings with no loss in generality. In principle, the approach developed to solve this problem is exact and rigorous. Of course, approximations are made but only when the resulting error is very small.
Derived from text
Computation; Cylindrical Shells; Electric Dipoles

20050110352 Naval Postgraduate School, Monterey, CA USA
Simulation Modeling and Analysis of Device-Aware Network Architectures
Hou, Jin; Dec. 2004; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429838; No Copyright; Avail: Defense Technical Information Center (DTIC)

As the popularity of Internet soars, the content on the Internet is increasingly accessed by mobile devices that are usually small in form factor and limited in resources, in terms of processing capability, bandwidth and battery power. With the changing environment, content providers must serve a large number of access devices with different profiles, while the users have access to a large number of services with different content types. A key challenge in such an environment is how to enable the best possible fit between content and capabilities of a specific access device type. The goal of this thesis research is to explore on the concept of a device-aware network (DAN) that can provide the infrastructure support for device-content compatibility matching to avoid the unnecessary wastage of network and device resources that happens in current device-ignorant networks. A more efficient architecture is proposed which encapsulates device profile information in transmitting packets and incorporates content repurposing functionality in existing network entities, such as routers along the data path. Simulation models are developed to statistically evaluate the performance of the proposed architecture in comparison to existing content repurposing frameworks. The results demonstrated the feasibility and suitability of the architecture, with improvement in network bandwidth conservation.
DTIC
Encapsulating; Simulation

20050110566 Harvard Univ., Cambridge, MA USA

Implicit Memory, Perception and the Rapid Deployment of Visual Attention and Action

Nakayama, Ken; Jan. 2004; 6 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0194; Proj-2312/BS

Report No.(s): AD-A430188; AFRL-SR-AR-TR-05-0048; No Copyright; Avail: CASI; A02, Hardcopy

The learning of the deployment of transient attention is an entirely new yet robust phenomenon. We found that it is mediated by a unique primitive short term memory system which learns features, not objects. Yet it is object centered and not retinotopic. This learning is graded, incremental and short lived. We also investigated longer term perceptual learning: very short naps during the afternoon can enhance perceptual learning dramatically, that in some cases beneficial effects are as good as a whole nights sleep. We suggest that for a nap to be beneficial it must contain both SWS and REM. In terms of a neurophysiological substrate, the learning must be occurring in the early visual areas because the effects are restricted to the specific visual quadrants stimulated. The other main focus of the work has been the role of learning of attentional deployment on motor behavior, in particular arm movements. There seems to be a direct coupling between the deployment of focal attention and action, the speed of motor activities is determined by the deployment of focal attention. Less expected, are results indicating that the planning and execution of motor actions are not separable. Decisions are often countermanded by mid%stream changes in motor actions with little cost in speed or accuracy indicating that the combined brain and motor plant is adept at parallel processing of simultaneous motor commands.

DTIC

Computer Storage Devices; Deployment; Eye Movements; Neurophysiology; Visual Perception

20050111458 Naval Postgraduate School, Monterey, CA USA

Content Repurposing of Electrical Diagrams for Presentation in Handheld Devices

Papaliakos, Vasilios; Dec. 2004; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429869; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis proposes a design for content repurposing of electrical diagrams for presentation in small-screen wireless handheld devices. Content repurposing is the on-line adaptation of content to fit device capabilities and user's preferences. The focus of this thesis is on electrical diagrams of the schematic type used for maintenance purposes. Nevertheless, many of the proposed techniques are suitable for other technical drawings as well. A significant amount of work has been done in summarization of Web documents and in diagram recognition, but not for presentation of diagrams in handheld devices. In the design proposed here, techniques are proposed for understanding the semantics of electrical diagrams and for partitioning the drawing images in intelligent ways to formulate coherent units for presentation to the user.

DTIC

Artificial Intelligence; Circuit Diagrams

20050123693 Hong Kong Univ. of Science and Technology, Kowloon, Hong Kong

2.4GHz ISM Band Antenna for PC Cards

Ng, Anvil K. P.; Lau, Jack; Murch, Ross D.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2066-2069; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper we present preliminary investigations into the design of antennas for use in PC cards that communicate in the 2.4GHz ISM band. Design criteria which are considered desirable for these antenna include, compact size with low profile, low cost, 80MHz bandwidth with sharp cutoff, vertical null in antenna pattern, good efficiency, flexible impedance matching to CMOS LNA, circular polarization and possible differential operation. Experimental results from two antenna designs consisting of a PIFA and a dual PIFA configuration are described.

Author

Antenna Design; Personal Computers; Cards; Computer Components; Design Analysis

20050123706 Miller (Edmund K.), Santa Fe, NM, USA

Developing Adaptive Models and Estimating the Uncertainty of Presampled Spectral Data

Miller, Edmund K.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1688-1691; In English; See also 20050123676; Copyright; Avail: Other Sources

Model-based parameter estimation (MBPE) provides a means of more efficiently describing observables such as frequency, or spectral, responses that are obtained from generating models (GM) like NEC through use of reduced-order fitting models (FM), ideally derived from the problem physics. Besides decreasing the amount of data that is needed to develop a

continuous, analytical approximation of a response, these FMs can also be used to estimate the quantitative uncertainty of the GM samples themselves. These ideas, previously illustrated for adaptively sampling 'on-the-fly', i.e. Miller (1998), at the time the data samples are being computed, are extended here for application to presampled data.
Author
Adaptation; Analog Simulation; Parameter Identification

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20050109945 Moscow State Technical Univ., Moscow, Russia
Computer Aided Design of Holographic Antennas
Sazonov, Dimitry M.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 738-741; In English; See also 20050109927; Copyright; Avail: Other Sources

This paper is devoted to design of simplified through-type and reflect-type holographic antennas for individual Direct Broadcasting Satellite (DBS) reception. Created software tools enable a very fast definition the optimum configuration and dimensions of the holographic antenna zones and simultaneously allows fast finding the electrical performance of an antenna.
Author
Computer Aided Design; Performance Tests; Electrical Properties; Broadcasting

20050110092 Raytheon Systems Co., Rancho Cucamonga, CA, USA
Electromagnetic Parallel Processing Using the Personal Computers of a Local Area Network
Brown, Kenneth W.; Prata, Aluizio, Jr.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1178-1181; In English; See also 20050109927; Copyright; Avail: Other Sources

The modern business environment of a particular company may contain anywhere from one to several thousand personal computers. With the recent exponential increases in computer speed and memory capacity, as well as the decrease in computer costs, a good portion of these computers can be considered high performance. However, for the most part these computers are severely under-utilized. For example, secretaries and accountants use their computers mostly for word processing and simple mathematical computations. Also, most computers are idle at night and over the weekends, which represents over two thirds of the available computer time. This under-utilization of computer resources remains for the most part untapped. Solving electromagnetic problems is often a very process intensive form of analysis for which there can never be too much computer resources. More computer resources mean that the problem can either be solved quicker, more problems can be solved, or the problem size and/or complexity can be increased. One way for an electromagnetic engineer to increase available computer resources is to tap into the under-utilized computers in his or her business environment. A growing trend in business environments is to interconnect personal computers over a LAN (local area network). In fact, the MS-Windows 95 (or 98) operating system has built-in networking capability. For this operating system, a group of computers can be simply hard-wired together without a server, enabling a particular computer to access the hard drive(s) of any other computer(s) in the group. The LAN therefore offers a means to coordinate the activity of several computers such as in a parallel solution of an electromagnetics problem. In this work, the results of a parallel processed integral equation solution algorithm, implemented on 10 personal computers connected over a MS-Windows 95 LAN, is presented. This algorithm is subsequently used to rigorously analyze a 5 in diameter offset reflector antenna containing approximately 100,000 current density unknowns.
Derived from text
Electromagnetism; Local Area Networks; Parallel Processing (Computers); Personal Computers; Algorithms

20050110325 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Geographically Locating an Internet Node Using Network Latency Measurement
Turnbaugh, Eugene D.; Mar. 2004; 110 pp.; In English; Original contains color illustrations
Report No.(s): AD-A424136; AFIT/GCS/ENG/04-21; No Copyright; Avail: CASI; A06, Hardcopy

Discovering the geographic location of a node using only its Internet Protocol (IP) address and latency measurements is a big challenge. The difficulties include accurate latency measure, network address translation (NAT) masking, service blocking, disparate physical configuration, dissimilar network hardware, and inaccurate and limited measuring tools. Using only latency measurements from the Internet, this research successfully geolocated the nearest city to a destination node 100

percent of the time to 5 of 6 destinations regardless of the time of day the measurements were taken. Additionally, there was 67 percent success in identifying the two closest geographical cities to each of the six destinations. These results were accomplished using publicly available high-speed servers that gathered latency data from six geographically dispersed destinations connected to the Internet at markedly different speeds, to include a dial-up client, three cable modem users, a digital subscriber link (DSL) user, and a high-speed Internet router. This study builds upon existing research in this area and develops a heuristic, called the Time-to-Location Heuristic (TTLH). TTLH uses well-connected Internet routers, called polling stations, to collect baseline latencies to known locations, called endpoints. Using the Euclidean distance algorithm, the latencies from a destination node (at an unknown location) are compared to the baseline latencies. The lowest Euclidean distances help determine the closest endpoint cities to a destination node.
DTIC
Computer Networks; Internets; Modems; Position (Location)

20050110346 Naval Postgraduate School, Monterey, CA USA
Utilizing IXP1200 Hardware and Software for Packet Filtering
Lindholm, Jeffery L.; Dec. 2004; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429830; No Copyright; Avail: Defense Technical Information Center (DTIC)

As network processors have advanced in speed and efficiency they have become more and more complex in both hardware and software configurations. Intel's IXP1200 is one of these new network processors that has been given to different universities worldwide to conduct research on. The goal of this thesis is to take the first step in starting that research by providing a stable system that can provide a reliable platform for further research. This thesis introduces the fundamental hardware of Intel's IXP1200 and what it takes to install both hardware and software using both Windows 2000 and Linux 7.2 as the operating system in support for the IXP1200. This thesis will provide information on the installation of hardware and software configuration for the IXP1200 including Intel's Software Development Kit (SDK). Upon completion this platform can then be used to conduct further research in the development of the IXP1200 network processor. It provides a hardware and software installation checklist and documentations of problems encountered and recommendations for their resolution. Along with providing an example of using preexisting code that has been modified to filter packets of TCP or UDP to different ports.
DTIC
Computer Programs; Computers; Filtration

20050110368 Naval Postgraduate School, Monterey, CA USA
Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology
Norbraten, Terry D.; Dec. 2004; 191 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429866; No Copyright; Avail: Defense Technical Information Center (DTIC)

In order to plug-in current open sourced, open standard Java programming technology into the building blocks of the US Navy's ForceNet, first, stove-piped systems need to be made extensible to other pertinent applications and then a new paradigm of adopting extensible and cross-platform open technologies will begin to bridge gaps with old and new weapons systems. The battle-space picture in real time and with as much detail, or as little detail needed is now a current vital requirement. Access to this information via wireless laptop technology is here now. Transmission of data to increase the resolution of that battle-space snapshot will invariably be through noisy links. Noisy links such as found in the shallow water littoral regions of interest will be where Autonomous Underwater and Unmanned Underwater Vehicles (AUVs/UUVs) are gathering intelligence for the sea warrior in need of that intelligence. The battle-space picture built from data transmitted within these noisy and unpredictable acoustic regions demands efficiency and reliability features abstract to the user. To realize this efficiency Extensible Markup Language (XML) Schema-based Binary Compression (XSBC), in combination with Vandermode-based Forward Error Correction (FEC) erasure codes, offer the qualities of efficient streaming of plain text XML documents in a highly compressed form, and a data self-healing capability should there be loss of data during transmission in unpredictable transmission mediums. Both the XSBC and FEC libraries detailed in this thesis are open sourced Java Application Program Interfaces (APIs) that can be readily adapted for extensible, cross-platform applications that will be enhanced by these desired features to add functional capability to ForceNet for the sea warrior to access on demand, at sea and in real-time.
DTIC
Computer Programming; Computer Techniques; Correction; Document Markup Languages; Error Analysis; Java (Programming Language); Programming Languages; Warfare

20050110374 Naval Postgraduate School, Monterey, CA USA

Using Agent-Based Modeling to Assess the Impact of Martial Law on a Representative Iraqi Town

Tan, Peng S.; Dec. 2004; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429876; No Copyright; Avail: Defense Technical Information Center (DTIC)

One of the main challenges in the modeling and simulation community today is the study of human behavioral aspects, which are often not key considerations in traditional combat-oriented attrition-based models. In a martial law scenario, military or peacekeeping forces may be put in place to restore law and order and conduct a wide range of operations, such as setting up road blocks, imposing curfew, distributing food and manning checkpoints. This thesis focuses on the checkpoint operation and uses the agent-based modeling software PAX to assess the impacts of such a scenario on the population. Results indicate that civilians' level of anger and fear, needs and soldiers' rules of engagement play important roles in determining the success of peace support operations.

DTIC

Iraq; Simulation

20050110379 Minnesota Univ., Minneapolis, MN USA

APTU Nozzle Code Manual, Version 3.0

Candler, Graham V.; Jan. 2005; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-9829

Report No.(s): AD-A429887; AEDC-TR-05-2; No Copyright; Avail: Defense Technical Information Center (DTIC)

A nozzle simulation code developed for AEDC is designed for the analysis of hypersonic converging-diverging nozzles including the effects of high pressure, finite-rate chemical reactions and vibrational relaxation, and turbulent wall boundary layers. In addition, a module has been written to predict the onset of water vapor condensation for hydrocarbon combustion product test gases. The flow solver is based on the data-parallel line relaxation (DPLR) numerical technique. The software package includes chemical species set-up codes, a batch grid generator, the flow solver, and a post processor. Gas models include air, nitrogen, and the products of combustion of isobutene with air and make-up oxygen. Software access is limited to qualified users.

DTIC

Coding; Computer Programs; Convergent-Divergent Nozzles; Manuals

20050110382 Naval Postgraduate School, Monterey, CA USA

Principal Components Based Techniques for Hyperspectral Image Data

Fountanas, Leonidas; Dec. 2004; 103 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429890; No Copyright; Avail: Defense Technical Information Center (DTIC)

PC and MNF transforms are two widely used methods that are utilized for various applications such as dimensionality reduction, data compression and noise reduction. In this thesis, an in-depth study of these two methods is conducted in order to estimate their performance in hyperspectral imagery. First the PCA and MNF methods are examined for their effectiveness in image enhancement. Also, the various methods are studied to evaluate their ability to determine the intrinsic dimension of the data. Results indicate that, in most cases, the scree test gives the best measure of the number of retained components, as compared to the cumulative variance, the Kaiser, and the CSD methods. Then, the applicability of PCA and MNF for image restoration are considered using two types of noise, Gaussian and periodic. Hyperspectral images are corrupted by noise using a combination of ENVI and MATLAB software, while the performance metrics used for evaluation of the retrieval algorithms are visual interpretation, rms correlation coefficient spectral comparison, and classification. In Gaussian noise, the retrieved images using inverse transforms indicate that the basic PC and MNF transform perform comparably. In periodic noise, the MNF transform shows less sensitivity to variations in the number of lines and the gain factor.

DTIC

Image Processing; Imagery

20050110389 Naval Postgraduate School, Monterey, CA USA

Use of OpenSSH Support for Remote Login to a Multilevel Secure System

Herbig, Christopher F.; Dec. 2004; 225 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429900; No Copyright; Avail: Defense Technical Information Center (DTIC)

Complex multilevel secure (MLS) architectures are emerging that require user identification and authentication services not only from multilevel connections, but from pre-existing single level networks. The XTS-400 can be used as a server in

such environments. Trusted devices are required for user login via multilevel connections; however, single level remote login facilities do not require such client-side devices. Instead, a more lightweight mechanism is possible. Remote login capabilities do not exist on the XTS-400 for use over the single level networks and this capability is a desired feature for use in complex multilevel architectures. OpenSSH is an application, developed for OpenBSD, that uses the SSH protocol to provide secure remote logins and an interactive command interface. A secure remote login application, OpenSSH, was ported to the XTS-400 in order to provide remote login capabilities. The porting process identified differences between the original development platform for OpenSSH and the XTS- 400. Solutions, in the form of source code modifications, were made to overcome problems resulting from the compatibility differences encountered during the port. Testing was conducted to ensure that the port was successful and did not violate any security policies enforced by the XTS-400.
DTIC
Computer Programming; Local Area Networks; Security; Software Engineering

20050110400 Naval Health Research Center, San Diego, CA USA
Estimating Supplies Program: Evaluation Report
Tropeano, Anne; Konoske, Paula; Galarneau, Michael; Daly, Timothy; Pang, Gerald; Dec. 2002; 57 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-M0095
Report No.(s): AD-A429914; NHRC-TR-02-6F; No Copyright; Avail: Defense Technical Information Center (DTIC)

Naval Health Research Center developed the Estimating Supplies Program (ESP) as a decision tool for medical planners, providers, logisticians, and trainers that calculates the amount of supplies required to treat a specific patient stream and assesses inventory readiness. The purpose of this document is to explain the program methodology, algorithms, and calculations that ESP uses to estimate medical supplies and evaluate inventory readiness. Sample reports for both the estimating supplies and the inventory readiness capabilities are included to provide a concrete demonstration of ESP capabilities. To demonstrate the estimating supplies capability, two different patient streams were run through the same functional area. A comparison of the supply differences was then drawn out to show an explicit connection to the difference in the patient streams. To demonstrate the inventory readiness assessment capability, an inventory was built. Certain supply item quantities were changed and a comparison was made between the S ratings, a measure calculated to indicate the percentage of supplies on hand.
DTIC
Computer Programs; Estimates; Estimating; Inventories; Supplying

20050110435 Massachusetts Inst. of Tech., Cambridge, MA USA
Component Composition for Embedded Systems Using Semantic Aspect-Oriented Programming
Rinard, Martin; Oct. 2004; 266 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-00-C-1692; Proj-ARPI
Report No.(s): AD-A429973; AFRL-IF-WP-TR-2004-1568; No Copyright; Avail: Defense Technical Information Center (DTIC)

The goal of our research was to develop technologies and techniques in support of real-time systems for the defense community. Our research focused on Real-Time Java implementation and analysis techniques. Real-Time Java is important for the defense community because it holds out the promise of enabling developers to apply COTS Java technology to specialized military embedded systems. It also promises to allow the defense community to utilize a large Java-literate workforce for building defense systems. Our research has delivered several techniques that may make Real-Time Java a better platform for developing embedded systems. These techniques include ways to implement scoped memories (a key Real-Time Java construct) without the possibility of introducing unexpected and potentially catastrophic delays in the execution of real-time threads, analyses that ensure the correct use of Real-Time Java scoped memories, analyses that compute how much memory is required to execute a given Real-Time Java program (potentially helping developers calculate how much memory must be including in a given system to ensure that the system will execute without running out of memory), and optimizations that reduce the amount of memory required to execute a Real-Time Java program.
DTIC
Computer Programming; Java (Programming Language); Programming Languages

20050110436 Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France
Development of the CRIPTE Code for Electromagnetic Coupling
Parmantier, Jean-Philippe; Jan. 2005; 51 pp.; In English
Contract(s)/Grant(s): F61775-01-C0002
Report No.(s): AD-A429974; EOARD-SPC-01-4034; No Copyright; Avail: CASI; A04, Hardcopy

This report results from a contract tasking Office National d'Etudes et de Recherches Arospatiales (ONERA) as follows: The contractor will investigate methods of updating computer modeling code developed by French researchers. This code was originally developed as part of an experiment performed under the joint US-France international data exchange program on the atmospheric electricity/ aircraft interactions, DEA-AF-79-7336 (started 1979 and updated Mar 1997). ONERA will apply the CRIPTE code on the EM interaction on a full scale Mirage III aircraft wing to validate the code.
DTIC
Coding; Computer Programs; Electromagnetic Coupling

20050110443 Naval Postgraduate School, Monterey, CA USA
Analyzing and Sharing Data for Surface Combat Weapons Systems
Wilhelm, Gary L.; Dec. 2004; 93 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429986; No Copyright; Avail: Defense Technical Information Center (DTIC)

Test and evaluation of system performance has been a critical part of the acceptance of combat weapon systems for the Department of Defense. As combat weapon systems have become more complex evaluation of system performance has relied more heavily on recorded test data. As part of the on-going transformation of the Defense department Commercial-Off-The-Shelf (COTS) technology is being integrated into the acquisition of combat weapon systems. An Analysis Control Board (ACB) was created in response to these factors to support the AEGIS Weapon System Program Office. The focus of this ACB was to investigate and provide potential solutions to Data Dictionary Data Recording and Data Reduction (R2D2) issues to the AEGIS Program Manager. This thesis discusses the history of the R2D2 ACB and its past present and future directions. Additionally this thesis examines how the R2D2 ACB concept could be applied to the DD(X) Next Generation Destroyer program.
DTIC
Armed Forces (United States); Combat; Commercial Off-the-Shelf Products; Data Management; Data Reduction; Data Systems; Weapon Systems

20050110464 Metacomp Technologies, Inc., Agoura, CA USA
Introduction to CFD++, its Transient and Moving Body Capabilities
Chakravarthy, Sukumar; Jul. 2004; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-BMSB
Report No.(s): AD-A430012; No Copyright; Avail: Defense Technical Information Center (DTIC)

CFD++ is a Computational Fluid Dynamics software suite built to tackle engineering and scientific applications in aerospace, automotive, marine, biomedical, manufacturing, electronics, chemical, power, construction, cooling systems, and household products. Some of the features of CFD++ are unified physics, unified grid and unified computing; Reynolds-averaged Navier-Stokes (RANS) with state-of-the-art, realizable turbulence closures; large eddy simulation (LES) and hybrid RANS/LES; advanced wall-function treatments; coarse-grid turbulent flow-field prediction capability; compressible fluid flows with high- and low-speed specializations; incompressible flows; single and multi-species reacting flows; integrated unified-grid treatment for all grid and cell topologies, including patched non-aligned and overset grids; advanced discretization and solution methodology; fast, efficient solver; versatile boundary conditions; user-friendly Graphical User Interface and a rich collection of pre- and post-processing tools; and transparent implementation across a wide range of single- and multi-CPU computer platforms and networks. CFD++ is a superset of the various CFD methodologies available and provides accuracy, robustness, and ease of use over all flow regimes, including both unsteady and steady, inviscid, laminar, and turbulent flows. This presentation discusses CFD++ in relation to missile staging, missile staging early transients, and 3-dimensional paddle/plume interaction,
DTIC
Computational Fluid Dynamics; Computer Programs; Flow Distribution; Missiles

20050110510 Minnesota Univ., Minneapolis, MN USA
The Impact of Computer Decision Support on Military Decision Making
Larson, Adam D.; Dec. 2004; 100 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430070; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis work analyzed military personnel decision making and attitudes towards automation using a component of a decision support systems tool called Weasel. The primary goal of this study is to determine how Weasel impacts user performance and behavior. The decisions people make in military situations plays a vital role in determining the success or failure of operations. Previous work has been conducted in transportation domains such as aviation and driving. However, little, it any, research has been conducted in a military domain. This study analyzes behavior and performance in a military context with military personnel solving three strategic problems. Specific challenges addressed by this work are Weasel's overall impact on user performance, Weasel's effect on expert and novice users; user performance when Weasel exhibits questionable behavior, and the effect order of information presentation has on behavior and performance. The results of this experiment will help researchers and military personnel interested in decision making and decision support systems to better understand and the decision people make when using computer support. Additionally, information may be gained regarding situations where computer support and automation use may degrade performance. Military strategists such as commanding officers, Air Force air battle managers, and Army plans officers may benefit from this work.
DTIC
Decision Making; Decision Support Systems

20050111432 Naval Health Research Center, San Diego, CA USA
The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement
Nix, Ralph E.; Onofrio, Kathleen; Konoske, Paula J.; Galarneau, Mike R.; Hill, Martin; Dec. 2004; 53 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429957; NHRC-04-34; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Air Force Medical Support Agency, Surgeon General Support Logistics Office, requested the Naval Health Research Center (NHRC) to conduct a proof-of-concept study to assess the validity and feasibility of using a medical modeling tool developed by NHRC's Medical Modeling and Simulation laboratory in U.S. Air Force Allowance Standard (AS) development and management. The Mobile Forward Surgical Team (MFST) Unit Type Code AS was selected for this study with the goal of developing an inventory validation process using databases in NHRC's Medical Modeling and Simulation Laboratory. The primary objective of the study was to provide the Air Force with the ability to validate clinical requirements of the MFST assemblage, with the goal of using NHRC's Estimating Supplies Program (ESP) to establish a viable audit trail linking clinical requirements with supply items. The approach was to use the reliable system NHRC has in place, utilizing ESP to create patient streams, then allowing its underlying relational database structure to attach task profiles and supplies to the patient conditions (PCs) in the stream. The MFST supply and equipment inventory was mapped to clinical tasks and PCs in ESP using the Forward Resuscitative Surgical System (FRSS) model as a template. The matches from the FRSS model were identified in the MFST inventory, providing a pathway to align clinical tasks and PCs required to develop the MFST ESP model. To ensure that the MFST patient stream to be entered into ESP represented an accurate picture of what might potentially occur, a panel of subject matter experts (SMEs) was assembled to offer experience and guidance concerning likely PCs the MFST would treat. Using a patient stream that reflected the MFST mission, its concept of employment and likely PCs treated there ESP generated an appropriate supply list. The units of measure, units of issue, weight, cost, and cube data were then compared with those in the current MFST AS inventory.
DTIC
Estimates; Estimating; Inventories; Inventory Controls; Supplying; Surgery

20050111456 Texas Univ., Houston, TX USA
A General Purpose Analysis System Based on a Programmable Fluid Processor
Gascoyne, Peter R.; Sep. 2004; 104 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0515
Report No.(s): AD-A429806; ARO-41401.1-LS; No Copyright; Avail: Defense Technical Information Center (DTIC)

The goal of this project was to develop a complete system for droplet chemistry and biowarfare detection applications based on a programmable dielectrophoretic array concept. In this final reporting period design and testing of the 4th and 5th generation SOI chip was completed. A silicon and glass solid-state microfluidics system was designed at M. D. Anderson and successfully fabricated and integrated with the SOI chip at Applied MEMS. Simultaneously, cost savings in foundry work permitted an additional iteration in the final design of the integrated electrode array. Identifying and implementing the new microfluidics technology and developing the technique to bond it to the revised SOI chip imposed a delay of some 11 months on the project completion which will was used to integrate the new microfluidics with the revised chip. With the accomplishment of these steps, all of the major aims of the project have been successfully completed. Thus, a programmable

fluidic processor platform capable of on-the-fly adaptation to multiple testing challenges and based on dielectrophoretic manipulation of microdroplets has been successfully developed and demonstrated. A complete software solution for programming the system has also been provided. Finally, this new technology has been licensed for commercial development.
DTIC
Computer Programs; Computer Programming; Microelectromechanical Systems

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20050109842 NASA Marshall Space Flight Center, Huntsville, AL, USA
Engineering Lessons Learned and Systems Engineering Applications
Gill, Paul S.; Garcia, Danny; Vaughan, William W.; [2005]; 1 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; Copyright; Avail: Other Sources; Abstract Only

Systems Engineering is fundamental to good engineering, which in turn depends on the integration and application of engineering lessons learned. Thus, good Systems Engineering also depends on systems engineering lessons learned from within the aerospace industry being documented and applied. About ten percent of the engineering lessons learned documented in the NASA Lessons Learned Information System are directly related to Systems Engineering. A key issue associated with lessons learned datasets is the communication and incorporation of this information into engineering processes. As part of the NASA Technical Standards Program activities, engineering lessons learned datasets have been identified from a number of sources. These are being searched and screened for those having a relation to Technical Standards. This paper will address some of these Systems Engineering Lessons Learned and how they are being related to Technical Standards within the NASA Technical Standards Program, including linking to the Agency's Interactive Engineering Discipline Training Courses and the life cycle for a flight vehicle development program.
Author
Systems Engineering; NASA Programs; Information Systems

20050110335 University of Southern California, Marina del Rey, CA USA
Integrity Through Mediated Interfaces
Balzer, Robert; Dec. 2004; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-1-0542; DARPA ORDER-H546; Proj-H546
Report No.(s): AD-A429810; AFRL-IF-RS-TR-2004-351; No Copyright; Avail: Defense Technical Information Center (DTIC)

We created an Integrity Manager that monitors and records the tools (i.e. programs), and operations within those tools, being applied to integrity-marked data sets to provide an end-to-end audit record of all the transformations performed on the data set. This operation level audit record can be used off-line for attribution (who made a specific change and when did it occur) and on-line for authorization (who and/or which tools are allowed to make particular types of changes to an integrity-marked data set). We also use this transaction history to recreate corrupted data sets by replaying the recorded sequence of data set modifications. We also developed a wrapper that monitors the run-time behavior of opened email attachments to ensure that these processes don't do anything harmful. It does so by detecting violations of process-specific rules establishing the acceptable (and safe) behavior of these processes relative to four resources: the file system, the system registry, inter- host communication, and process spawning. When attempted violations are detected, the user is notified, informed of the severity of the violation, and determines whether to allow or prohibit the offending operation. The violation, the user's response, and the initiating email and attachment, obtained from the email client, are logged.
DTIC
Data Bases; Records Management

20050110343 Naval Postgraduate School, Monterey, CA USA
Designing a Forcenet Information Topology
Krajacich, Christopher A.; Dec. 2004; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429822; No Copyright; Avail: Defense Technical Information Center (DTIC)

Network Centric Warfare (NCW) is a theory of war that attempts to maximize the benefit of linking together, or

networking, operating forces. The Navy and Marine Corps have decided to attempt to instantiate this warfighting concept through FORCEnet. The FORCEnet concept is ambitious, but most current efforts have looked to ensure the ability to connect and share data without addressing the larger picture of how to move information within a netted force in order to maximize the benefit of information sharing. This thesis presents an information topology developed to effectively share information across a variety of force compositions. In order to fully attain the benefits of a networked force, a complementary command and control system must also be designed. This thesis also outlines a command and control system that can be employed in a network-centric force.
DTIC
Electronic Warfare; Topology

20050110367 Naval Postgraduate School, Monterey, CA USA
Integrated Network Application Management (INAM)
Nelson, Mark D.; Dec. 2004; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429865; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis attempts to create a desire for change in DoD's current approach to Network Application Management (NAM). The evolution of NAM into Integrated Network Application Management (INAM) is a crucial component of Network Centric Warfare and achieving Information Superiority and Interoperability. INAM is outlined as three functional requirements, which are Network Awareness, Mission Prioritization linkage to Network Resources, and the Balancing of Service Management. Scenarios play a key role in illustrating the new threats that DoD faces today. These scenarios also identify limitations and challenges to NAM as it exists today. These challenges require significant improvements in flexibility and responsiveness, while providing for wide integration. Trends supporting change are identified in this thesis. Two of the more important trends are the rise of Architectural and Object Oriented Development. Examples such as Training and Testing Enabled Architecture (TENA), Surveillance and Target Acquisition Network (STAN), and Virtual Proving Ground (VPG) are clear examples of these trends. The merging of the Computer Industry's efforts to expand the reach of Operating Systems with the traditional efforts from Network Management is also a trend that is examined. Organizations like Distributed Management Task Force (DMTF) are important to such examinations. Successful change can not be achieved without planning for the transition. This thesis also presents some active transition efforts addressing Network Centric Warfare. TENA, VPG and Naval Postgraduate School's Information Technology Management Master's Program provide three examples of addressing transition in DoD.
DTIC
Computer Networks; Systems Integration

20050110386 Northrop Grumman Information Technology, Inc., McLean, VA USA
Defense Information Warfare Technology Applications (DIWTA) Automated Intrusion Detection Environment (AIDE) Advanced Concept Technology Demonstration (ACTD)
Denno, Patricia; Nov. 2004; 63 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-D-0001-0001; F30602-99-D-0001-0008; Proj-AIDE; Proj-AIDE
Report No.(s): AD-A429896; AFRL-IF-RS-TR-2004-278; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report represents work done in Task 0001 and Task 0008. This paper is organized into the three years represented. Introductory material provides an overview. Subsequent sections for each year begin by describing the development process which was based on incorporating the lessons learned from the previous year, the goals for the year, and including innovations from AFRL. The paper then describes for each year the deployment and demonstration planning processes. Demonstration performance is described and summary data from each year's demonstration follows. Finally user feedback and hot wash conclusions are then presented by year, leading to a discussion of suggested improvements for Year Three development. A final conclusions section completes the document.
DTIC
Detection; Early Warning Systems; Information Systems; Technology Utilization; Warfare; Warning Systems

20050110394 Naval Postgraduate School, Monterey, CA USA
Device Profiling Analysis in Device-Aware Network
Tsai, Shang-Yuan; Dec. 2004; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429906; No Copyright; Avail: Defense Technical Information Center (DTIC)

A key challenge to communications on the network-centric battlefield is that the end-devices must utilize limited

resources to support the mission operations. This requires the devices to conserve resources by avoiding the reception, transmission, and processing of unusable information, a capability not currently available. Today's networks are completely unaware of the capability of their end-points. Being dumb pipes, they cannot optimize traffic to match the capabilities and requirements of their end devices. With such a problem present, the World Wide Web Consortium (W3C) introduced the concept of device independence. The idea is to let the client send the request with information associated with the end device. The purpose of this information is to provide information that may be needed to allow the final response to be repurposed to the capabilities of the client. The request and the delivery context flow from the client, through any intermediaries to the server. The server can use the appropriate repositories of content in constructing the response to the request. The goal of a Device-Aware Network (DAN) is to match the information delivered to the capability of the end device, thereby optimizing the network resource usage. To efficiently transmit information on a DAN, the capabilities and conditions of an end-device must be defined in advance to adapt the data format: a device profile. This thesis discusses the current standards for device profiling and gives a comparison of these standards. It then identifies a suitable standard that can serve as the starting point for creating a device profile request scenario for a DAN. Currently, the available standards for device profiling are: Composite Capabilities/Preference Profile (CC/PP) developed by the W3C, User Agent Profile (UAProf) developed by the WAP forum, SyncML developed by the mobile technology industry, and Universal Plug and Play (UPnP) developed by Microsoft.
DTIC
Data Transmission; Display Devices; Protocol (Computers)

20050110449 Pennsylvania State Univ., University Park, PA USA
Mobile Ubiquitous Security Environment (MUSE)
Phoha, Shashi; Dec. 2004; 87 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0859
Report No.(s): AD-A429994; No Copyright; Avail: Defense Technical Information Center (DTIC)

This is the final report of the Mobile Ubiquitous Security Environment (MUSE) Critical Infrastructure Protection University Research Initiative (CIP/ URI) project. MUSE was proposed to research 'understanding mobile code' in the context of Critical Infrastructure Protection (CIP). It made significant advances in this area. Mobile code differs from other software systems in that it uses networks to autonomously move code from one host to another. Many common CIP threats, such as Trojan horses and viruses, pre-date widespread use of the Internet and are not specific to mobile code. Issues such as insuring program correctness, enforcing security policies, avoiding buffer overflows, and detecting malicious code also exist for non-networked software. Our emphasis is on researching how code migration affects infrastructure protection. Viruses, worms, and Denial of Service (DoS) attacks are difficult to counteract in large part because they are highly distributed. Fortifying the defenses of individual processors, or even sub-nets, cannot sufficiently neutralize these threats. Our game theory analysis of DoS attacks contains examples of the limitations of firewalls for protecting distributed systems. Fortifying individual processors is in some ways similar to building a stronger Maginot line after World War II. MUSE studied both the threat posed by malicious mobile code, and the promise of mobile code to adapt when attacked and neutralize threats. Distributed adaptation can put attacked systems on an equal footing with their attackers. The project Statement of Work (SoW) consisted of four tasks: * Develop a theoretical model * Study the interface between mobile code and the host computer. * Study system adaptation * Create an adaptive network infrastructure.
DTIC
Computer Information Security; Computer Viruses; Distributed Processing; Security

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20050092389 NASA Marshall Space Flight Center, Huntsville, AL, USA
IVHM Framework for Intelligent Integration for Vehicle Health Management
Paris, Deidre; Trevino, Luis C.; Watson, Michael D.; [2005]; 17 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Integrated Vehicle Health Management (IVHM) systems for aerospace vehicles, is the process of assessing, preserving, and restoring system functionality across flight and techniques with sensor and communication technologies for spacecraft that can generate responses through detection, diagnosis, reasoning, and adapt to system faults in support of Integrated Intelligent Vehicle Management (IIVM). These real-time responses allow the IIVM to modify the affected vehicle subsystem(s) prior to

a catastrophic event. Furthermore, this framework integrates technologies which can provide a continuous, intelligent, and adaptive health state of a vehicle and use this information to improve safety and reduce costs of operations. Recent investments in avionics, health management, and controls have been directed towards IIVM. As this concept has matured, it has become clear that IIVM requires the same sensors and processing capabilities as the real-time avionics functions to support diagnosis of subsystem problems. New sensors have been proposed, in addition to augment the avionics sensors to support better system monitoring and diagnostics. As the designs have been considered, a synergy has been realized where the real-time avionics can utilize sensors proposed for diagnostics and prognostics to make better real-time decisions in response to detected failures. IIVM provides for a single system allowing modularity of functions and hardware across the vehicle. The framework that supports IIVM consists of 11 major on-board functions necessary to fully manage a space vehicle maintaining crew safety and mission objectives. These systems include the following: Guidance and Navigation; Communications and Tracking; Vehicle Monitoring; Information Transport and Integration; Vehicle Diagnostics; Vehicle Prognostics; Vehicle Mission Planning, Automated Repair and Replacement; Vehicle Control; Human Computer Interface; and Onboard Verification and Validation. Furthermore, the presented framework provides complete vehicle management which not only allows for increased crew safety and mission success through new intelligence capabilities, but also yields a mechanism for more efficient vehicle operations.
Author
Avionics; Systems Integration; Artificial Intelligence; Aerospace Engineering; Systems Health Monitoring

20050092398 NASA Marshall Space Flight Center, Huntsville, AL, USA
Autonomous Assembly of Modular Structures in Space and on Extraterrestrial Locations
Alhorn, Dean C.; [2005]; 1 pp.; In English; Space Technology and Applications Internationsl Forum, 13-17 Feb. 2005, Albuquerque, NM, USA; No Copyright; Avail: Other Sources; Abstract Only

The fulfillment of the new US. National Vision for Space Exploration requires many new enabling technologies to accomplish the goal of utilizing space for commercial activities and for returning humans to the moon and extraterrestrial environments. Traditionally, flight structures are manufactured as complete systems and require humans to complete the integration and assembly in orbit. These structures are bulky and require the use of heavy launch vehicles to send the units to the desired location, e.g. International Space Station (ISS). This method requires a high degree of safety, numerous space walks and significant cost for the humans to perform the assembly in orbit. For example, for assembly and maintenance of the ISS, 52 Extravehicular Activities (EVA's) have been performed so far with a total EVA time of approximately 322 hours. Sixteen (16) shuttle flights haw been to the ISS to perform these activities with an approximate cost of $450M per mission. For future space missions, costs have to be reduced to reasonably achieve the exploration goals. One concept that has been proposed is the autonomous assembly of space structures. This concept is an affordable, reliable solution to in-space and extraterrestrial assembly operations. Assembly is autonomously performed when two components containing onboard electronics join after recognizing that the joint is appropriate and in the precise position and orientation required for assembly. The mechanism only activates when the specifications are correct and m a nominal range. After assembly, local sensors and electronics monitor the integrity of the joint for feedback to a master controller. To achieve this concept will require a shift in the methods for designing space structures. In addition, innovative techniques will be required to perform the assembly autonomously. Monitoring of the assembled joint will be necessary for safety and structural integrity. If a very large structure is to be assembled in orbit, then the number of integrity sensors will be significant. Thus simple, low cost sensors are integral to the success of this concept. This paper will address these issues and will propose a novel concept for assembling space structures autonomously. The paper will present Several autonomous assembly methods. Core technologies required to achieve in space assembly will be discussed and novel techniques for communicating, sensing, docking and assembly will be detailed. These core technologies are critical to the goal of utilizing space in a cost efficient and safe manner. Finally, these technologies can also be applied to other systems both on earth and extraterrestrial environments.
Author
Spacecraft Structures; Autonomy; Large Space Structures; Extravehicular Activity; Orbital Assembly; Space Erectable Structures; Controllers

20050110387 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA
Extracting Dynamic Evidence Networks
Weischedel, Ralph; Dec. 2004; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-C-0204; Proj-EELD
Report No.(s): AD-A429898; AFRL-IF-RS-TR-2004-346; No Copyright; Avail: Defense Technical Information Center (DTIC)

BBN's primary goal was to dramatically increase the accuracy of evidence extraction. Using a hybrid of statistical learning algorithms and handcrafted patterns, SERIF achieved 93% of human performance in extracting entities, events, and relations, and 96% of human performance in extracting relations given entities and events. A second performance objective was to be able to extract entities that have names at 80% of human performance. This performance was then further improved in the relation extraction work done in 2004. An additional objective was to have a prototype robust enough that it could extract evidence continually (24x7) from a daily English news feed. All objectives were achieved. BBN's SERIF system also represents a significant advance for extraction systems in architecture and implementation. The combination of general linguistic models trained on preexisting corpora with domain specific components trained for the particular task allows powerful linguistic analysis tools to be brought to bear on extracting the relations and events of a new domain. The use of propositions as an intermediate step was an important part of this strategy, encapsulating the literal meaning of the text from which the target relations could then be derived.
DTIC
Algorithms; Information Retrieval

20050110438 Naval Postgraduate School, Monterey, CA USA
Characterization of 3 to 5 Micron Thermal Imagers and Analysis of Narrow Band Images
Quek, Yew S.; Dec. 2004; 109 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429976; No Copyright; Avail: Defense Technical Information Center (DTIC)
In this study, the use of multi narrow-band filters was explored to correlate or fuse information to improve detection and recognition for specific targets of interest. To fully understand the viability and limitations of narrow band filters in thermal imaging, laboratory test procedures were first designed to characterize thermal images using common performance parameters, particularly the Noise Equivalent Temperature Difference (NETD), the Modulation Transfer Function (MTF) and the Minimum Resolvable Temperature (MRT). An available thermal imager, the Cincinnati Electronics IRRIS-256LN, and a newly purchased thermal imager, the Indigo Systems Merlin InSb Laboratory Camera, were investigated and compared. The MRT measurement showed a superior cut-off spatial frequency of 1.33 cycle/mrad for the Merlin camera, compared with 1.18 cycle/ mrad for the Cincinnati, with similar sensitivity of about 0.1 C for both cameras. Below cut-off the Modulation Transfer for the Merlin was approximately twice that of the Cincinnati. NETD measurements for both systems were inhibited by excess noise in the measurement system. The Merlin camera was consequently employed for further research on narrow band images. Three commercially available narrow band filters, 4110/4720 nm, 4540/4720 nm and 3750/4020 nm, were selected to isolate the 'red' and 'blue' spike signatures of plume emission and aerodynamic heating found in the signature of fast moving air targets. Similar sensor characterization was carried out with these filters, however, quantitative performance parameter measurements were hindered by excessive measurement system noise. As a preliminary study in multi-spectral image analysis, spectral features of hydrocarbon combustion were extracted from correlated narrow-band images of a laboratory propane flame.
DTIC
Image Processing; Narrowband; Thermal Analysis

20050110458 Defence Science and Technology Organisation, Salisbury, Australia
Modelling Intention Recognition for Intelligent Agent Systems
Heinze, Clint; Nov. 2004; 240 pp.; In English
Report No.(s): AD-A430005; DSTO-RR-0286; DODA-AR-013-251; No Copyright; Avail: CASI; A11, Hardcopy
Mainstream visual psychology presents a sense then infer' account of vision that is analogous to the sense then infer' processing that characterises the agent intention recognition literature. From ecological psychology comes Gibson's theory of visual perception that highlights the importance of the environment in explaining the nature of vision and recognition and claims that higher order structures are directly accessible. This theory can be used as the stepping-off point for an account of intention recognition and the means by which it might be modelled. Furthermore, the capacity for virtual environments to be designed agent friendly' provides yet another dimension of design freedom. When accompanied by an explicit model of perception the intention recognition problem can be cast as a software design problem. The resulting design patterns provide useful options for modeling intention recognition in intelligent agent systems.
DTIC
Artificial Intelligence; Psychology; Systems Engineering

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20050109867 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
Regional Deformation Studies with GRACE and GPS
Davis, J. L.; Elosequi, P.; Tamisiea, M.; Mitrovica, J. X.; March 2005; 17 pp.; In English
Contract(s)/Grant(s): NNG04GF09G; NNG04GL69G; NAG5-13748; No Copyright; Avail: CASI; A03, Hardcopy

GRACE data indicate large seasonal variations in gravity that have been shown to be to be related to climate-driven fluxes of surface water. Seasonal redistribution of surface mass deforms the Earth, and our previous study using GRACE data demonstrate that annual radial deformations of +/-13 mm in the region of Amazon River Basin were observed by both GRACE and ten GPS sites in the region. For the GRACE determinations, we estimate in a least-squares solution for each Stokes coefficient parameters that represent the amplitudes of the annual variation. We then filter these parameters based on a statistical test that uses the scatter of the postfit residuals. We demonstrate by comparison to the GPS amplitudes that this method is more accurate, for this region, than Gaussian smoothing. Our model for the temporal behavior of the gravity coefficients includes a rate term, and although the time series are noisy, the glacial isostatic adjustment signal over Hudson s Bay can be observed. .
Author
Annual Variations; Global Positioning System; Surface Water; Time Series Analysis; Gravitation; Climate

20050109937 University of South Florida, Tampa, FL, USA
FDTD Modeling of Ceramic Multi-layer Capacitors Using Lumped Equivalent Models
Weller, T.; Dib, Nihad; Lakshminarayanan, B.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1086-1089; In English; See also 20050109927; Copyright; Avail: Other Sources

ABSTRACT - This paper presents results on numerical simulation of ceramic, multilayer capacitors (CMC) using the Finite Difference Time Domain (FDTD) technique. An efficient approach is demonstrated in which the CMC is represented within the FDTD grid by a combination of transmission lines and lumped elements. Two methods of compensating for the induced numerical parasitics are shown.
Author
Ceramic Matrix Composites; Finite Difference Theory; Transmission Lines; Finite Difference Time Domain Method; Time Domain Analysis

20050109943 Universidad de Vigo, Vigo, Spain
The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces
Pino, M. R.; Landesa, L.; Rodriquez, J. L.; Obelleiro, F.; Burkholder, R. J.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1406-1409; In English; See also 20050109927
Contract(s)/Grant(s): N00014-98-1-0243; Copyright; Avail: Other Sources

In a recent work, the iterative Forward Backward (FB) method has been proposed to solve the magnetic field integral equation for smooth one-dimensional rough surfaces. This method has proved to be very efficient, converging in a very small number of iterations. Nevertheless, this solution becomes unstable when some obstacle, like a ship or a large breaking wave, is included in the original problem. In this paper we propose a new extension of the FB method: the Generalized Forward Backward (GFB) method, to solve such kinds of composite problems.
Author
Radar Scattering; Surface Roughness Effects; Radar Detection; Signal Processing

20050109969 Ghent Univ., Belgium
Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques
Rogier, Hendrik; DeZutter, Daniel; Olyslager, Frank; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1062-1065; In English; See also 20050109927; Copyright; Avail: Other Sources

The finite element method, the finite-difference time-domain algorithm and the boundary integral equation technique are combined into one hybrid approach to model complex three-dimensional structures. After decomposition of the simulation geometry, the 3D boundary integral technique is used for homogeneous bounded and unbounded regions. Each inhomogeneous subregion is either described at one frequency by a finite element method, or an interaction matrix is

calculated at multiple frequencies using FDTD. By expressing continuity of the tangential fields at all the interfaces between the subregions, the interaction matrices and the excitations vectors resulting from the three different techniques are assembled into one global matrix equation.
Author
Finite Element Method; Finite Difference Time Domain Method; Integral Equations; Boundary Integral Method; Algorithms; Excitation

20050109977 New Mexico State Univ., Las Cruces, NM, USA
3-D Numerical Mode-Matching (NMM) Method for Inhomogeneous Media
Blanchard, Sean P.; Fan, Guo-Xin; Liu, Qing-Huo; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1194-1197; In English; See also 20050109927
Contract(s)/Grant(s): EPA-CR-825-225-010; NSF ECS-97-02195; Copyright; Avail: Other Sources

The numerical mode-matching (NMM) method as an efficient algorithm has been used to model various multiregion vertically and cylindrically stratified inhomogeneous media [1-6]. It has been shown that the NMM method is more efficient than a direct use of the finite element method (FEM) to solve these problems. However, the applications of the NMM method have been limited to two-dimensional (2-D) and two-and-a-half-dimensional (2.5-D) problems. In this work, we extend the NMM method to three-dimensional (3-D) inhomogeneous media, and apply the method to model electric impedance problems using the electrostatic approximation [6]. Although this work models the electric potential distribution, the solution procedure presented here can be directly applied to wave problems.
Author
Three Dimensional Models; Numerical Analysis; Electric Potential

20050109984 Illinois Univ., Urbana, IL, USA
A New FDTD Formulation with Reduced Dispersion for the Simulation of Wave Propagation Through Inhomogeneous Media
Forgy, E. A.; Chew, W. C.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1316-1319; In English; See also 20050109927; Copyright; Avail: Other Sources

The combined algorithm consists of a superposition of a collocated grid and a noncollocated grid. The update expressions for the field components of the collocated DST nodes and the noncollocated Yee nodes are derived from Faraday's law. The result is a robust, highly accurate, and efficient algorithm that inherently satisfies boundary conditions on dielectric interfaces.
Derived from text
Finite Difference Time Domain Method; Wave Propagation; Dielectrics

20050109985 Dalhousie Univ., Halifax, Nova Scotia, Canada
FDTD Modeling of Magnetized Ferrites Using Z Transforms
Hruskovec, Tomislav; Chen, Zhizhang; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1324-1327; In English; See also 20050109927; Copyright; Avail: Other Sources

Ferrite materials have numerous applications in microwave systems, especially in the implementation of non-reciprocal devices like isolators, circulators and phase shifters. The anisotropic and dispersive nature of ferrites makes very difficult to obtain exact analytical solutions to electromagnetic problems where ferrite is present. The Finite-Difference Time-Domain (FDTD) method is one of several numerical methods that has been developed to treat complex electromagnetic problems. The method was originally developed to solve scattering problems in free space, it was later extended to electric materials with frequency-dependent and nonlinear permittivity, and also to anisotropic materials. Recently, the method was extended to treat ferrites using different models for the material.
Author
Finite Difference Time Domain Method; Ferrites; Magnetic Fields

20050109987 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
The Multilevel Plane Wave Time Domain Algorithm for the Fast Analysis of Transient Scattering Phenomena
Ergin, A. Arif; Michielssen, Eric; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1342-1345; In English; See also 20050109927
Contract(s)/Grant(s): F49620-96-1-0025; NSF ECS-95-02138; Copyright; Avail: Other Sources

Analysis of transient scattering phenomena using classical time domain integral equation techniques, such as the

Marching-On-in-Time (MOT) method, places a severe burden on computational resources both in terms of the memory and CPU time required. To combat this drawback, we recently introduced a novel acceleration scheme, termed the plane wave time domain algorithm (PWTD) that reduces the computational complexity of transient analysis. This article outlines the steps involved in implementing a multilevel PWTD (MLPWTD) algorithm that complements the classical MOT scheme for analyzing transient scattering from electrically large surface scatterers residing in free-space. The MOT solver for the combined field integral equation (CFIE) is used to illustrate the specifics of the implementation. Numerical results illustrating the usefulness of this algorithm in analyzing large scale scattering phenomena are presented.
Author (revised)
Plane Waves; Time Domain Analysis; Wave Scattering

20050109989 Valladolid Univ., Spain
Inhomogeneous Cylindrical Waves: An Approach to Complex Beams
Gonzalex, M. J.; Gago-Ribas, E.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1396-1399; In English; See also 20050109927
Contract(s)/Grant(s): PB97-0487; Copyright; Avail: Other Sources

The asymptotic theory for inhomogeneous waves is based on the first order Luneberg-Kline expansion of the electromagnetic fields, which is also valid when the phase function is complex. This paper summarizes the propagation and transport energy trajectories for inhomogeneous cylindrical waves, which follows from the complex beam approximation under complex radiation condition, and behave as inhomogeneous local plane waves. They are a particular case of inhomogeneous waves characterized by a pseudo-gaussian profile in the transverse beam axis direction. In high-frequency regime, a new approximation of this kind of solutions is made and simpler expressions are found together with its validity range.
Author
Cylindrical Waves; Wave Propagation; Inhomogeneity; Beams (Radiation)

20050109990 Universidad de Vigo, Vigo, Spain
Fast Generalized Forward-backward Method by Using a Spectral Acceleration
Pino, M. R.; Burkholder, R. J.; Obelleiro, F.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1410-1413; In English; See also 20050109927
Contract(s)/Grant(s): N00014-98-1-0243; Copyright; Avail: Other Sources

The Generalized Forward-Backward (GFB) method is a generalization of the previous Forward-Backward (FB) method to to compute the electromagnetic scattering from targets on ocean-like rough surfaces. In this paper, the spectral acceleration algorithm introduced by Chou and Johnson for the FB method is adapted to the GFB. This reduces the computational cost of the GFB from O(N(exp 2)) to O(N) per iteration.
Author
Electromagnetic Scattering; Ocean Surface; Surface Roughness; Algorithms

20050109995 Tsinghua Univ., Bejing, China
Application of Conjugate Gradient Algorithm to Adaptive Beamforming
Jun, Tang; Yingning, Peng; Xiqin, Wang; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1460-1463; In English; See also 20050109927; Copyright; Avail: Other Sources

Conjugate gradient method (CGM) offers a good compromise between convergence speed and computational complexity. The basic idea of CGM is to solve a matrix equation AW=Y. Where A is a N x N matrix while W and Y are N x 1 vectors. Therefore a matrix equation must be constructed for applying CGM. The equation is constructed directly using snapshots ha adaptive beamforming. The method can be applied with small number of snapshots and it does not require spatial smoothing to decorrelate the arrivals. But the main weakness is that the model reduces the system's effective degrees of freedom by half. One other problem is that the performance of algorithm will degrade as system's noise increases. Here the matrix equation is RW=Y. Where R is the covariance matrix of input data vectors while W is the weight vector, Y is the crosscorrelation vector between input data vectors and desired signal. Applying CGM for an optimization problem is more attractive due to its environment insensitive property. Here computing gradients is a key problem. In this paper, the relationship of subarray size, snapshot number and interference number is studied for different gradient computing methods. New forward and backward CGM (FBCGM) and multilayer FBCGM(MFBCGM) methods are proposed. Their advantages can be summarized as follows: (1) They can be applied with small number of snapshots; (2) They can be applied with weaker constraint for the number of

the array elements; (3) They perform well in coherent receiving environment; (4) They have less computational load compared to SMI and subspace projection method.
Author (revised)
Beamforming; Conjugate Gradient Method; Signal Processing

20050110028 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China
Improved Wavelet-Based Beamformers with Dynamic Subband Selection
Wang, Yung-Yi; Fang, Wen-Hsien; Chen, Jiunn-Tsair; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1464-1467; In English; See also 20050109927
Contract(s)/Grant(s): NSC-88-2218-E011-007; Copyright; Avail: Other Sources

Adaptive beamformers, which can automatically adjust the weights to form prescribed spatial selectivity, have found applications in various facets of signal processing applications ranging from radar and sonar to wireless communications. To facilitate real-time implementations, it is of importance to mitigate the computational load in the weight adaptive process, especially for arrays which consist of lots of sensors in order to achieve better interference rejection and resolution. For this purpose, various attempts have been made for the design of partially adaptive beamformers, which only employ a subset of weights in the adaptive process. Despite their effectiveness, these approaches often call for computationally intensive eigendecomposition or nonlinear optimization. In this summary, we address a simple, yet effective partially adaptive beamformer with the generalized sidelobe canceler (GSC) as the underlying structure. The new beamformer employs a set of P-regular, M-band wavelet filters in the design of the blocking matrix involved. It can be shown that this new blocking matrix is orthogonal to the constraint matrix, provided the widely used pattern derivative constraints are used. The beamformer is applicable to the broadband scenario. Furthermore, a new subband selection scheme is addressed, which only retains the principal subband components in the adaptive process. Since the scheme is embedded in the blocking matrix due to the characteristics of the wavelet filters, the computational complexity can thus be further reduced with only negligible computational overhead. The furnished simulations show that the new structure can achieve roughly the same performance as compared to previous works, but with reduced computations.
Author
Wavelet Analysis; Beamforming; Adaptive Control; Signal Processing

20050110030 Victoria Univ., British Columbia, Canada
A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers
Bornemann, Jens; Amari, Smain; Vahldieck, Rudiger; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 950-953; In English; See also 20050109927; Copyright; Avail: Other Sources

H-plane waveguide diplexer and multiplexer configurations are well-known components in satellite and earth-to-earth communication systems. They combine the advantages of ease of fabrication and simplicity in numerical analysis. Commonly, TE(sub m0)-mode-based mode-matching procedures are used for the computer-aided design. While the channel filters are presynthesized for the individual Tx and Rx specifications, the entire component must be optimized in order to achieve a satisfactory input return loss. This is a fairly straightforward and well-known procedure and has been successfully applied to many individual designs with several percent of channel bandwidths. In narrow-band systems, however, the number of required modes for a reliable analysis increases dramatically. Especially for bandwidths below one percent, up to 50 odd modes might be necessary as has recently been demonstrated for individual H-plane filter components. Since field symmetries cannot be utilized in a diplexer arrangement of filters, the entire component must then be analyzed and optimized with close to 100 modes. It has turned out that under such circumstances, the diplexer design can no longer be accomplished within typical industry-driven design cycles. Therefore, this paper focuses on a new concept in diplexer design, namely a combination of the standard mode-matching technique (MMT) with the coupled-integral-equations technique (CIET), the latter being used only for the synthesis and analysis of the individual channel filters. Several major advantages are associated with this approach: First, for a full-cycle analysis of a diplexer configuration, the combined method reduces the CPU time significantly compared to ordinary MMT. Secondly, the numbers of basis functions in the CIET can be reduced during optimization without a shift in frequency as matrix sizes do not depend on the number of modes. In standard MMT algorithms, a reduced number of modes is usually associated with a (sometimes remarkable) shift towards lower frequencies. Thirdly, the CIET - at almost no additional computational cost - allows the extraction of the generalized scattering matrix so that the results are easily interfaced with mode-matching calculations of other components.
Derived from text
Diplexers; Waveguides; Computer Aided Design; Integral Equations; Narrowband; Algorithms; Bandwidth

20050110031 Universidad Politecnica de Valencia, Valencia, Spain

A New Hybrid Mode-matching Method for the Analysis of Inductive Obstacles and Discontinuities

Esteban, H.; Cogollos, S.; Vidal, A.; Boria, V. E.; Ferrando, M.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 966-969; In English; See also 20050109927; Copyright; Avail: Other Sources

A new and efficient hybrid mode-matching method for the analysis of arbitrarily shaped inductive obstacles and discontinuities is presented. An open-space spectral method is used to model the electrical behavior of the inductive problem, and the mode-matching technique is then employed for obtaining a multimode scattering matrix representation. This new method is revealed very useful for the accurate and efficient analysis of inductive problems including very arbitrary geometries. Results for some classical inductive problems covered in the literature are shown, thus confirming the accuracy of the results provided.

Author

Discontinuity; Matrices (Mathematics); S Matrix Theory

20050110032 Kiel Univ., Germany

Spherical-multipole Analysis of the Field within a Canonical GTEM-cell

Hannemann, Jens; Klinkenbusch, Ludger; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 970-973; In English; See also 20050109927; Copyright; Avail: Other Sources

The GTEM-Cell has been a subject of extensive research. However, due to its relatively large dimensions and to the sharp edges of the septum, numerical treatment of the cell's field may become very difficult. Furthermore, numerical simulation to determine the distortion of the empty cell's field by a device under test becomes even more complex. This paper introduces a mostly analytical model for the GTEM-Cell that is obtained by changing the geometry of the cross section from rectangular to elliptical. This allows an exact solution for the empty cell's field by means of a problem-adapted dyadic Green's function in sphero-conal coordinates. The solution may be combined with other numerical methods to obtain a more realistic modelling of the coupling phenomena. First numerical results are also shown.

Derived from text

Multipoles; Mathematical Models; Septum; Coordinates; Numerical Analysis

20050110055 New Mexico State Univ., Las Cruces, NM, USA

PML-FDTD Method for Elastic Waves in Cylindrical and Spherical Coordinates

Liu, Qing Huo; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1392-1395; In English; See also 20050109927

Contract(s)/Grant(s): EPA-825-225-01-; NSF ECS-97-02195; Copyright; Avail: Other Sources

For many applications, elastic waves in inhomogeneous media with cylindrical and spherical structures are of great interest. However, as demonstrated for electromagnetic waves, the original Berenger's PML (perfectly matched layer) scheme does not apply to cylindrical and spherical coordinates as it does not lead to a reflection-free boundary. The idea of complex coordinates provides a convenient way to formulate the PML for cylindrical and spherical coordinates which gives a reflection-free absorbing boundary condition. Unfortunately, if applied to cylindrical and spherical coordinates in its original form, this scheme requires some extra unknowns from its counterpart in Cartesian coordinates, thus calling for more computer memory and computation time. Recently, we develop a perfectly matched layer (PML) for elastic waves in three-dimensional cylindrical and spherical coordinates without increasing the number of unknowns from the Cartesian coordinates. The PML scheme is implemented in a finite-difference time-domain code for axisymmetric problems.

Author

Perfectly Matched Layers; Finite Difference Time Domain Method; Elastic Waves; Cylindrical Coordinates; Spherical Coordinates

20050110056 Michigan Univ., Ann Arbor, MI, USA

Propagation of Electromagnetic Waves Near the Surface of a Half-space Dielectric with Rough Interface

Chiu, Tsenchieh; Sarabandi, Kamal; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1402-1405; In English; See also 20050109927; Copyright; Avail: Other Sources

Determination of field of a small dipole over a half-space dielectric is a classical problem with a well-known solution. It is shown that when both the transmitter and receiver are near the surface, the contribution from surface waves is dominant. In practice, the transmit and receive antennas of mobile units are usually very close (relative to wavelength) to the ground. Existence of surface roughness may alter the contribution of surface waves drastically, in this case the azimuthal symmetry

of the problem may no longer be exploited, and the Sommerfeld solution must be modified significantly. The surface roughness generates incoherent scattered field which is the source of depolarization. In this paper, the effect of slightly rough surfaces on the radiation of a short dipole is studied. In what follows first, a solution for the scattered field (including the near field) from a slightly rough surface illuminated by p waves is formulated. To investigate the effect of small-scale surface roughness on surface waves, ground reflectivity and the significance of the incoherent scatter fields, an analytical solution based on a perturbation theory is proposed. In this formulation the perturbation theory is applied to a volumetric integral equation for the induced polarization current in the top rough layer of the dielectric interface. The perturbation parameter is the normalized rms height the rough surface and an iterative solution starting from the unperturbed problem (dielectric half-space with sm interface) is obtained. Basically, the formulation is similar to what has recently been applied to evaluate far-scattering from rough surfaces with inhomogeneous profile when illuminated by a plane wave. The solution for dielectric excitation is obtained by expanding the radiated field of the dipole in terms of a continuous spectrum of plane waves and adding the solution for each plane wave coherently. Statistical analysis is carried out analytically for characteristics of the coherent (mean) and incoherent (fluctuation) fields.
Author (revised)
Wave Propagation; Electromagnetic Radiation; Dielectrics; Surface Roughness Effects

20050110057 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Extensions of the Single-integral-equation Method
Marx, Egon; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1286-1289; In English; See also 20050109927; Copyright; Avail: Other Sources

Scattering of electromagnetic waves by homogeneous dielectric or finitely conducting bodies can be reduced to the solution of integral equations. In the simpler cases, only a single integral equation is needed, with no increase of required memory over scattering by a perfectly conducting body. In more complicated cases, this is not possible and two unknown boundary functions have to be defined on some of the interfaces. We decrease the required memory by changing the interface where two functions are used. We apply this method to strips on substrates, although more significant memory savings can be effected in three-dimensional problems. This method is extended to scattering from a strip on another strip on a substrate.
Derived from text
Electromagnetic Radiation; Integral Equations; Wave Scattering; Dielectrics

20050110059 Southeast Univ., Nanjing, China
Domain Decomposition Method: A Direct Solution of Maxwell Equations
Yin, Lei; Hong, Wei; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1290-1293; In English; See also 20050109927; Copyright; Avail: Other Sources

An efficient and rigorous algorithm, based on the Domain Decomposition Method (DDM), is presented in this paper for full-wave analysis of arbitrary three-dimensional (3-D) structures. Compared with other method, it can greatly reduce the computing complexity and the memory storage requirement. The iterative implementation of the method is discussed and the scattering parameters of a 3-D structure is analyzed as an example of its application. The numerical results agree very well with that obtained by FDFD method. With the algorithm, many fast and rigorous algorithm can be developed.
Author
Algorithms; Decomposition; Maxwell Equation; Iteration; Finite Difference Time Domain Method

20050110062 Nottingham Univ., UK
Time-Domain Modelling of Propagation in Nonlinear Dielectrics Using TLM
Paul, J.; Christopoulos, C.; Thomas, D. W. P.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1362-1365; In English; See also 20050109927; Copyright; Avail: Other Sources

This paper reports on the formulation of iteration procedures for the time-domain simulation of electromagnetic wave propagation in nonlinear dielectric media using transmission-line modelling (TLM). Results are presented for propagation in two types of nonlinear dielectrics.
Author
Electromagnetic Wave Transmission; Dielectrics; Transmission Lines; Time Domain Analysis

20050110063 Illinois Univ., Urbana-Champaign, IL, USA
A Fast Time Domain Integral Equation Technique for Analyzing EMC/EMI Problems
Aygun, K.; Shanker, B.; Ergin, A. A; Michielssen, E.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1366-1369; In English; See also 20050109927; Copyright; Avail: Other Sources

In this paper, a novel time domain integral equation based algorithm is proposed for analyzing EMC/EMI problems where the problem geometry is modeled by three-dimensional arbitrarily shaped perfect electrically conducting (PEC) surfaces and wires. For example, the proposed algorithm enables the analysis of radiation from modules on motherboards, cables, and shielding structures with and without apertures. The algorithm is constructed by augmenting a classical marching-on-in-time (MOT) scheme with the plane wave time domain (PWTD) algorithm. The PWTD algorithm enables the fast evaluation of transient fields by decomposing them into transient plane waves. The computational complexity of the resulting PWTD-MOT algorithm scales as O(N(sub T)N(sub S)(sup 1.5)log (exp 2) N(sub S)) as opposed to O(N(sub T)N((sub S)(sup 2)) for a classical MOT algorithm, where N(sub T) and N(sub S) are the number of temporal and spatial basis functions discretizing the current density on the geometry.
Author
Time Domain Analysis; Integral Equations; Electromagnetic Compatibility

20050110064 Physics and Electronics Lab. TNO, The Hague, Netherlands
A Conjugate Gradient FFT Method for Transient Scattering by Dielectric Cylinders
Bloemenkamp, Richard F.; vandenBerg, Peter M.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1374-1377; In English; See also 20050109927; Copyright; Avail: Other Sources

The marching-on-in-time solution of the time-domain integral equations for the scattering by an inhomogeneous scatterer is limited by the accumulation of discretization errors. However, we observe that the operator of the integral equation consists of a convolution in space and time. We therefore propose an iterative solution based on a conjugate gradient method by considering both the convolution in time and space as a discrete cyclic convolution. Using FFT routines such a convolution is computed very efficiently. Let the scattering object be an inhomogeneous lossless dielectric cylinder of arbitrary cross-section imbedded in a bounded domain D of free space. The incident wavefield is a transient electromagnetic wave with the electric field vector polarized along the cylinder axis (TM-polarization). We then have a 2D scalar problem where the incident electric field component is denoted as E(sup inc)(x, t) and the total electric field component by E(x,t), where x = (x(sub 1), x(sub 2)) denotes the two-dimensional position vector and t denotes the time variable.
Author
Fast Fourier Transformations; Dielectrics; Cylindrical Bodies; Conjugate Gradient Method

20050110081 Illinois Univ., Urbana-Champaign, IL, USA
A 2.5-D PSTD Algorithm in Cylindrical Coordinates
Wang, Jian-Guo; Lu, Ming-Yu; Michielssen, Eric; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1358-1361; In English; See also 20050109927
Contract(s)/Grant(s): EPA-CR-825-225-010; NSF ECS-97-02195; Copyright; Avail: Other Sources

Finite-difference time-domain (FDTD) method has been playing an important role in the simulations of transient electromagnetic wave propagation and scattering. However, when dealing with a large-scale problem the FDTD method starts to show its limitations. It requires significant computer memory because of the required high grid density (number of nodes per minimum wavelength lambda) of 10-20 even for a moderate size problem. For large-scale problems the required grid density increases, greatly limiting the size of solvable problems. The PSTD (pseudospectral time-domain) method is promising in that it requires only a grid density close to the Nyquist sampling density. Compared with the second-order accuracy of FDTD method, the PSTD method has an infinite order of accuracy. Previously, the PSTD method has been applied to Cartesian and 3-D cylindrical coordinates. In this work, a 2.5-D PSTD algorithm is developed for the medium which possesses an axial symmetry, i.e., the material properties are only functions of p and z. The azimuthal dependence of the fields is accounted for analytically through a Fourier series. The PML is used as the absorbing boundary condition to truncate the computational domain. Compared with the 3-D PSTD method it saves significant computer memory and computational time.
Author
Spectral Methods; Time Domain Analysis; Cylindrical Coordinates; Electromagnetic Wave Transmission; Electromagnetic Scattering

20050110082 New Mexico State Univ., Las Cruces, NM, USA
PML and PSTD Algorithm for Arbitrary Lossy Bianisotropic Media
Liu, Qing Huo; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1370-1373; In English; See also 20050109927
Contract(s)/Grant(s): EPA-825-25-010; NSF ECS-97-02195; Copyright; Avail: Other Sources

Recently, the perfectly matched layer has been extended to anisotropic media for time-domain and frequency domain solutions. Apparently the most straightforward formulation for the PML is the approach based on the complex coordinates. In this work, we present the PML formulation for an arbitrary lossy bianisotropic medium. The time-dependent Maxwell's equations are solved by using the pseudospectral time-domain (PSTD) method. In the conventional FDTD method for anisotropic media, it becomes necessary to interpolate field components over the Yee grid since all components are needed at any field location. This requirement is avoided in the PSTD algorithm since it uses a centered grid. 3-D numerical results for media with strong anisotropy confirm the efficiency of the PML and the PSTD algorithm.
Author
Perfectly Matched Layers; Anisotropic Media; Lossy Media; Time Domain Analysis; Spectral Methods

20050110085 Michigan Univ., Ann Arbor, MI, USA
Fast Spectral Domain Algorithm for Hybrid Finite Element/Boundary Integral Modeling of Infinite Periodic Arrays
Eibert, Thomas F.; Volakis, John L.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1206-1209; In English; See also 20050109927; Copyright; Avail: Other Sources

Hybrid Finite Element (FE)/Boundary Integral (BI) modeling of infinite periodic arrays (antennas and frequency selective surfaces (FSSs))has become very attractive in recent years. Originally, the fully three-dimensional (3D) modeling flexibility of the approach was obtained for the cost of high central processing unit (CPU) time requirements of the BI termination. However, this issue has been relieved by the utilization of fast integral equation methods (FIEMs) such as the Adaptive Integral Method (AIM). A basic principle of AIM and other FIEMs is that the speed-up is obtained by fast evaluation of the far interactions within the BI whereas the near interactions are still calculated in a conventional manner. Based on this strategy, considerable speed-ups can only by achieved for relatively large numbers of BI unknowns. This problem can be overcome by the Fast Spectral Domain Algorithm (FSDA) which is based on the well-known spectral domain formulation of convolution type integral equations. FSDA avoids explicit generation of any BI matrix elements. Instead, at each iteration of the employed iterative equation solver the actual current distribution is summed up in the spectral domain and the spectral Floquet mode series for evaluation of the BI is carried out only once per testing function. Thus, given a fixed set of Floquet modes, FSDA leads to a CPU time complexity of O(N) (N: number of BI unknowns) for the evaluation of the matrix-vector products in the iterative solver. In this case, the memory requirement is also of O(N) since only the precomputed values of the spectral Floquet mode series for each basis function are stored. Moreover, even for relatively small numbers of BI unknowns, FSDA results in considerable speed-ups of about two orders of magnitude. For this paper, we present the formulation of FSDA within the framework of a hybrid FE/BI approach for infinite periodic structures. Validation, convergence and timing data are given.
Author
Algorithms; Spectra; Domains; Finite Element Method; Boundaries; Integral Equations

20050110089 Office National d'Etudes et de Recherches Aerospatiales, Meudon, France
An Efficient High-frequency Boundary Integral Equation
Levadoux, David; Michielsen, Bas; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1170-1173; In English; See also 20050109927; Copyright; Avail: Other Sources

A crucial problem with the numerical computation of harmonic wave motion is that the number of degrees of freedom increases rapidly with the frequency. Although integral equation methods, where only a 'current' on the scatterer's boundary has to be constructed, reduce the dimension of the problem by one, the resulting stiffness matrices are generally full and can be relatively badly conditioned. To overcome these problems, much research is being done on the choice of efficient basis functions allowing for discretisation in smaller approximation spaces. Such optimized approximations are generally derived from knowledge of the asymptotic behaviour of solutions. Despite the reduced size of the resulting linear systems, they continue to be hard to solve, always being full, ill-conditioned or both. Another strategy is to search for methods, where matrix-vector products can be rapidly evaluated in iterative methods. In this realm, the so-called fast multipole techniques contribute some very convincing solutions. On the other hand, and this is the approach we propose here, one can also start with the construction of new 'dedicated' equation before studying different discretization method.
Derived from text
High Frequencies; Boundary Value Problems; Integral Equations; Numerical Analysis; Harmonic Motion; Waves

20050110100 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
A Diagonal Translation Operator for the Fast Evaluation of Two-dimensional Transient Wave Fields
Lu, M.; Wang, J.; Ergin, A. A.; Michielssen, E.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1338-1341; In English; See also 20050109927; Copyright; Avail: Other Sources

Accurate and efficient techniques for analyzing linear transient wave phenomena are of significant interest to many disciplines ranging from acoustics to electromagnetics to geophysics. Although integral equation based methods for analyzing two-dimensional (2D) transient phenomena have been studied extensively in the past, they all suffer from a high computational complexity, which limits their application to practical problems. To accelerate the integral equation based analysis of three-dimensional transient scattering phenomena, our group recently developed the three-dimensional plane wave time domain (PWTD) algorithm. In this paper, we extend our previous work from three to two dimensions and propose a novel 2D PWTD algorithm that relies on a diagonal translation operator for the efficient evaluation of 2D wave fields. When used in conjunction with a marching-on-in-time (MOT) scheme, this algorithm drastically accelerates the integral equation based analysis of 2D transient scattering phenomena.
Author
Wave Equations; Two Dimensional Models; Wave Scattering

20050110101 Siena Univ., Italy
Time Domain Green's Function for a Phased Semi-infinite Periodic Line Array of Dipoles
Capolino, Filippo; Felsen, Leopold B.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1350-1353; In English; See also 20050109927; Copyright; Avail: Other Sources

We have begun a systematic investigation of the time domain (TD) behavior of Green's functions which are relevant for the characterization of truncated planar periodic arrays, with emphasis on the TD Floquet waves (FW) in the propagating and evanescent parameter regimes. Our principal aim is to understand the TD wave physics and phenomenologies on simple prototypes, invoking various methods that synthesize the solution from different perspectives. The first prototype, an infinite phased periodic line array of axial dipole radiators arranged along the z-axis of a cylindrical (rho, z) coordinate system has been studied, and is reviewed in Sec. III. This prototype is a basic building block for transversely truncated plane arrays formed by a finite number of infinite line sources, which has so far been studied only in the frequency domain (FD). Truncation along the axis of a phased line array of dipoles is explored in this paper for the FD and TD. This modification of the infinite line dipole array leads to a new set of FD and TD truncation phenomena.
Author
Time Domain Analysis; Green's Functions; Floquet Theorem

20050110102 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
Acceleration of Two-dimensional Time Domain Integral Equation Solvers Using a Hilbert Transform
Wang, Jiang-Guo; Lu, Ming-Yu; Michielssen, Eric; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1354-1357; In English; See also 20050109927; Copyright; Avail: Other Sources

For many years the electromagnetics community has pursued the development of stable and fast transient simulators. Transient scattering from perfect electrically conducting (PEC) objects is often analyzed using time domain integral equations that are solved using marching-on-in-time (MOT) algorithms. Scattering of TMz waves from two-dimensional (2D) PEC objects C can be analyzed using the following electric and magnetic field time domain integral equations (EFIE, MFIE). Here, J represents the unknown source distribution, and c and mu are the wave speed and permeability of the medium surrounding the scatterer, respectively. Also, R = |r - r'| denotes the distance from the source point r' to the observation point r. A suitable linear combination of equations yields the time domain combined field integral equation (CFIE). Recently, we demonstrated several algorithms that accurately solve the above time domain EFIE, MFIE, and CFIE in a stable fashion.
Author
Hilbert Transformation; Two Dimensional Models; Electromagnetic Scattering

20050110344 Naval Postgraduate School, Monterey, CA USA
Performance Analysis of Mobile Ad Hoc Networking Routing Protocols
Thong, Lee K.; Dec. 2004; 153 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429823; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis presents a simulation and performance evaluation analysis of the various routing protocols that have been proposed for the Mobile Ad Hoc Network (MANET) environment using the Network Simulator-2 (NS-2) tool. Many routing protocols have been proposed by the academic communities for possible practical implementation of a MANET in military, governmental and commercial environments. Four (4) such routing protocols were chosen for analysis and evaluation: Ad Hoc On-demand Distance Vector routing (AODV), Dynamic Source Routing (DSR), Destination-Sequenced Distance Vector routing (DSDV) and Optimized Link State Routing (OLSR). NS-2 is developed and maintained by the University of Southern

California's Information Sciences Institute (ISI). Leveraging on NS-2 s simulation capabilities, the key performance indicators of the routing protocols were analyzed such as data network throughput, routing overhead generation, data delivery delay as well as energy efficiency or optimization. The last metric is explored, especially due to its relevance to the mobile environment. Energy is a scare commodity in a mobile ad hoc environment. Any routing software that attempts to minimize energy usage will prolong the livelihood of the devices used in the battlefield. Three important mobility models are considered, namely, Random Waypoint, Manhattan Grid, and Reference Point Group Mobility. The application of these three models will enhance the realism of simulation to actual real life mobility in an urban or military setup scenario. The performance of the routing protocols in varied node density, mobility speed as well as loading conditions have been studied. The results of the simulation will provide invaluable insights to the performance of the selected routing protocols. This can serve as a deciding factor for the U.S. Department of Defense (DoD) in their selection of the most suitable routing protocols tailored to their specific needs.
DTIC
Communication Networks; Protocol (Computers); Reliability Analysis; Vector Analysis

20050110358 Naval Postgraduate School, Monterey, CA USA
Design of Two-Axis Capacitive Accelerater Using MEMS
Lee, Chun M.; Dec. 2004; 59 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429847; No Copyright; Avail: Defense Technical Information Center (DTIC)

MEMS technology is rapidly taking an important role in today's and future military systems. MEMS are able to lower the device size from millimeter to micrometer and maintain and sometimes surpass the performance of conventional devices. This thesis encompasses the knowledge acquired throughout the MEMS courses to design a two-axis capacitive accelerometer. The required acceleration and operating temperature range were 50g in each axis and -40 C to +80 C, respectively. The accelerometer was also needed to survive within a dynamic shocking environment with accelerations of up to 225g. The parameters of the accelerometer to achieve above specifications were calculated using lumped element approximation and the results were used for initial layout of it. A finite element analysis code (ANSYS) was used to perform simulations of the accelerometer under various operating conditions and to determine the optimum configuration. The simulated results were found to be within about 5% of the calculations indicating the validity of lumped element approach. The response of the designed accelerometer was 7 mV/g and with sensitivity of 1.3g at 3dB. It was also found that the accelerometer was stable in the desired range of operation including under the shock. Two axes sensing can be achieved using two identical accelerometers having their sensing axes perpendicular to each other.
DTIC
Accelerometers; Capacitance; Finite Element Method; Microelectromechanical Systems

20050110376 Raytheon Co., Tewksbury, MA USA
Composite Combat Identification (CCID) Common Reasoning Algorithm Development Program
Jan. 2005; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-04-C-0453
Report No.(s): AD-A429878; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report presents the CRA (the CCID Common Reasoning Algorithm) Evaluation activity and its findings for the ONR CRA Development program, for which Raytheon is the prime contractor and HRL is a subcontractor responsible for the evaluation task. The CRA is a new implementation of the CCID algorithm CIDER, which was developed by Raytheon/HRL under the ONR CCID Phase-I program. Like CIDER, CRA also contains an ingest module and a Dempster-Shafer (D-S) engine. Functionally, the new CRA ingest module replaces the CIDER ingest module, and the new CRA D-S engine replaces HRL's VBS Kernel D-S engine used in CCID Phase-I. The two parts of the system use the same interface protocol and are interchangeable. The goal of the evaluation task is to evaluate the performance of the new CRA (ingest module and D-S engine) to verify that the new CRA matches or out-performs CIDER. The remainder of this report is organized as follows: Summary of the Evaluation Results; Scope of the Evaluation; Overview of Evaluation Methods; CID Performance Evaluation; Run Log Comparisons; Run-Time, Memory, and Processor Usage; and Conclusion.
DTIC
Algorithms; Classifications; Combat; Computer Programs; Decision Making; Targets

20050110390 Naval Postgraduate School, Monterey, CA USA
Alternate Configurations for Blocked Impurity Band Detectors
Garcia, Jonathan C.; Dec. 2004; 63 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429901; No Copyright; Avail: Defense Technical Information Center (DTIC)

Silicon Blocked Impurity Band (BIB) detectors are highly efficient, radiation-hardened photodetectors that operate in the range of 5-40 m. To further extend BIB coverage to 40-350 m, Ge and GaAs BIB detectors are under development; however, these new detectors face fabrication issues that have delayed their introduction. This thesis will describe the use of a numerical model to examine alternate operating modes for GaAs BIB detectors in order to bypass current fabrication issues. The numerical simulations provide an understanding of the fundamental physics that governs detector transport. The proposed alternatives to standard operation are created by reversing the detector's bias and varying the blocking layer thickness. Modeling indicates that reversing the bias on these detectors provides a larger signal current than standard configurations, while preserving the principal benefits gained from a multilayered device. At the same time, the alternate bias configuration allows for the use of thicker blocking layers, while preserving overall detector responsivity and reducing shot noise. This proposed new model of operation should allow for the relaxation of fabrication constraints without sacrificing the inherent benefits associated with BIB detectors. These devices are of potential interest for missile defense and terahertz surveillance applications.
DTIC
Impurities; Photometers

20050110393 Naval Postgraduate School, Monterey, CA USA
Sequential Multiple Comparison Testing for Budget-Limited Applications
Gonen, Ofer; Dec. 2004; 73 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429905; No Copyright; Avail: Defense Technical Information Center (DTIC)

Computer simulations which forecast the performance of complicated systems are used as decision aids in many applications. For example, a ship's defensive system may use simulation to support an automated real-time response to a perceived threat, such as an incoming missile. The system uses cumulative simulation data to evaluate a set of options in order to choose the best countermeasure. Since everything happens in 'real time', the system has limited time to run the simulation. Normally, a system would run the simulation an equal number of times for each option before coming to a decision. But this may cause the system to waste time on options which can be deemed non-optimal after only a few simulation runs. This time can be better used to help adjudicate between the better options. We evaluate the performance of sequential multiple comparisons algorithms to eliminate inferior options as quickly as possible, in order to have more time to dedicate to the exploration of better options, so that better decisions may be made. These algorithms allow inferior options to be dropped quickly depending on how well separated they are from others, but the algorithms differ in how well they achieve this objective.
DTIC
Algorithms; Computerized Simulation

20050110404 Lucent Technologies, Murray Hill, NJ USA
Fundamentals of Combinatorial Optimization and Algorithms Design: December Report
Shepherd, F. B.; Feb. 2005; 6 pp.; In English
Contract(s)/Grant(s): N00014-04-M-0042
Report No.(s): AD-A429923; 123104-02; No Copyright; Avail: CASI; A02, Hardcopy

The primary activities supported by the grant during the reporting period include a new result showing the hardness of the single-source robust network design and an invitation to include this in the special issue devoted to selected papers in FOCS 2005. A summer intern was hosted, Andrew McGregor from UPenn, who worked with Shepherd on recognizing Hilbert Bases and other theoretical topics in Math Programming. A visit was also supported for Gianpaolo Oriolo (Rome), which resulted in some new joint work on robust network design. In addition, there was a week visit from Seffi Naor (Technicion). Travel supported during this period includes trips by Shepherd to UPenn to work with Sanjeev Khanna and C. Chekuri on the mutlicommodity flow problem. This work has resulted in the FOCS 2005 paper, which in addition was invited into a special issue of selected papers. Conferences attended were the 2004 APPROX/RANDOM (chekuri) and CORC 4th Optimization Day (Shepherd).
DTIC
Algorithms; Combinatorial Analysis; Mathematical Programming; Optimization

20050110427 Naval Postgraduate School, Monterey, CA USA
The Effect of the USA Naval Academy Foundation Preparatory Program on the Performance of Naval Academy Midshipmen
Drosinos, John P.; Dec. 2004; 115 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429960; No Copyright; Avail: Defense Technical Information Center (DTIC)

This study examines the relationship between participation in the USA Naval Academy Foundation Preparatory School Program on Midshipmen performance at the USA Naval Academy. A program review was conducted and several multivariate regression models were developed to analyze the affect or the performance of Academy Midshipmen.
DTIC
Mathematical Models; Multivariate Statistical Analysis; Regression Analysis; United States

20050110492 Naval Surface Warfare Center, Bethesda, MD USA
Evolving Computational Capability for Ship Hydrodynamics
Gorski, Joseph J.; Dec. 2004; 59 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430047; NSWCCD-50-TR-2004/058; No Copyright; Avail: Defense Technical Information Center (DTIC)

The ability to obtain flow field predictions of surface ships with Reynolds Averaged Navier-Stokes (RANS) codes has improved tremendously in the last few years. This has been a result of improvements in experience, RANS codes in general, and computer capacity. In particular, the move to parallel processing has been a major catalyst for the recent improvements and a threshold of the usefulness of RANS may well have been crossed. This is particularly significant at a time the U. S. Navy is attempting to move to high-speed ships and more operations in the littorals, both of which are driving ship designs well outside of the traditional experience and experimental data bases. A discussion of where RANS computations may be able to significantly influence the current design and analysis process for surface ships is discussed. Specific areas include: hull flow field and resistance, propulsor inflow, waterjet inlets, bilge keel and appendage alignment, roll motions, maneuvering forces, and scale effects. A number of examples are given for various configurations including: Athena fitted with waterjets, AWJ-21, CG-47, DDG-51, an early DD(X) concept, an aircraft carrier, and Sea Shadow.
DTIC
Computer Systems Performance; Flow Distribution; Hydrodynamics; Navier-Stokes Equation; Ocean Surface; Reynolds Number; Ships

20050110530 Mechmath, LLC, Prior Lake, MN USA
Multi-Disciplinary Computational Tools for Naval Design
Amromin, Eduard; Jan. 2005; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-04-M-0306
Report No.(s): AD-A430103; FR-N05; No Copyright; Avail: Defense Technical Information Center (DTIC)

The general aim of Naval Design (ND) is to make a ship able to perform some prescribed mission. There is a combination of restrictions related to physical interaction of the warship and sea with others that have a military background. As a result, the ND combines numerous tasks and requires tremendous computations, but optimization of computations is a challenge because ND is a multi-criterion problem. This project delivers the complete succession of mathematical fundamentals of ND. Instead of traditional design spiral, a hierarchy multi-level design system is considered. The concept of criterion coordination with Lagrange multipliers is described. The feasible design solutions are studied with the Pareto sets. Comparison of Pruning and Constructive algorithms in grid generation is given, as well as description of LP-tay sequencing in this generation. The developed approaches are illustrated by examples of multidisciplinary ND recently considered in scientific publications. Additionally, a background of multidisciplinary trimaran optimization is developed.
DTIC
Design Analysis; Dynamic Structural Analysis; Functional Analysis; Marine Technology

20050110563 Naval Research Lab., Stennis Space Center, MS USA
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM
Weidemann, A.; Arnone, R.; Parsons, R.; Gould, R.; Ladner, S.; Apr. 2004; 12 pp.; In English
Report No.(s): AD-A430177; NRL/PP/7330-04-3; No Copyright; Avail: CASI; A03, Hardcopy

As missions for Explosive Ordinance Disposal (EOD) units and Special Operations Forces (SOF) move closer into coastal and even 'riverine' areas, there is an increased requirement for information on water clarity. This water clarity is important from the standpoint of detecting mines and minelike objects (MLO) on the bottom, in the water column, or attached to the hull of a vessel. It is also important for insersion of an EOD or SOF divers into harbors and hostile areas undetected for demining operations. In addition, as missions move at a more demanding pace, environmental intelligence is critical in determining when and where operations are most likely to be successfull. Environmental information is now demanded on the

order of minutes to hours and not days to weeks. The reality of dealing with variable environmental conditions was no where more apparent than during OPERATION IRAQI FREEDOM (OIF). During OIF there were several missions that relied on the timely delivery of water clarity information. Here we present how ocean color imagery was utilized to support EOD and SOF operations during OIF and how algorithms developed within one week were used for active operations. We also show the integration of current data into the products that allowed the warfighter to evaluate several key environmental factors.
DTIC
Diving (Underwater); Image Processing; Ordnance; Visual Acuity; Water Color

20050123688 Motorola, Inc., Arlington Heights, IL, USA
FDTD Computed Numerical Diffraction Coefficients of 3-D Infinite Material Wedges
Anantha, Veeraraghavan; Taflove, Allen; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1882-1885; In English; See also 20050123676; Copyright; Avail: Other Sources

In this paper, we apply the FDTD method of [1,2] to numerically obtain the dyadic diffraction coefficients for several infinite 3-D right-angle material wedges over a range of observation angles and frequencies. This method exploits the temporal causality inherent in FDTD modeling, as discussed in [2] for the infinite perfect electrical conductor (PEC) wedge case.
Derived from text
Finite Difference Time Domain Method; Conductors; Coefficients; Diffraction

20050123695 Technische Hochschule, Stuttgart, Germany
2D-TE Inverse Medium Scattering: An Improved Variable Metric Method
Rieger, W.; Buchau, A.; Haas, M.; Huber, C.; Lehner, G.; Rucker, W. M.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2140-2143; In English; See also 20050123676; Copyright; Avail: Other Sources

The 2D inverse electromagnetic scattering problem of reconstructing the material properties of inhomogeneous lossy dielectric cylindrical objects is considered. The material properties are reconstructed using scattering data from time-harmonic electromagnetic plane waves with the electric field vector perpendicular to the cylinder axis (TE-polarization). An improved algorithm based on a variable metric method is presented to solve the inverse scattering problem. The new method ensures positive values of the reconstructed quantities. This method involves exact first-order gradients. Numerical examples illustrate the efficiency of the algorithm.
Author
Two Dimensional Models; Electromagnetic Scattering; Cylindrical Bodies; Dielectrics; Inverse Scattering

20050123708 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
Rational Krylov Reduced Order Modeling of Frequency Selective Surfaces Through the Blazing Onset Using Woodbury Singularity Extraction
Weile, D. S.; Michielssen, E.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1730-1733; In English; See also 20050123676; Copyright; Avail: Other Sources

Frequency selective surfaces (FSSs) find use across the electromagnetic spectrum as polarizers and frequency and angular filters in devices such as radomes and subreflectors. The FSSs considered here are composed of metallic elements periodically arranged on a grid with cell size DxD. The purpose of this paper, therefore, is to use rational Krylov model order reduction (RKMOR) to construct several models. All model order reduction methods (including RKMOR) require that the MoM model of the FSS (2) be linearized. The matrix A, however, can not be linearized directly in the vicinity of the onset of a blazing mode, as it has branch point singularities at those frequencies. Thus, before the matrix is linearized, these singularities are removed using the Woodbury formula.
Derived from text
Electromagnetic Spectra; Frequencies; Selective Surfaces; Polarizers; Extraction

20050123722 Royal Inst. of Tech., Stockholm, Sweden
Infinite Phased Array Analysis Using FDTD Periodic Boundary Conditions: Pulse Scanning in Oblique Directions
Holter, Henrik; Steyskal, Hans; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1870-1873; In English; See also 20050123676; Copyright; Avail: Other Sources

A novel technique to implement periodic boundary conditions for unit cell analysis of infinite phased arrays in the finite difference time domain (FDTD) is presented. It allows for pulse excitation and oblique scan directions in both the cardinal and

inter cardinal planes. Thc ordinary Yee lattice is used which makes the algorithm easy to incorporate in an already existing FDTD code
Author
Phased Arrays; Boundary Conditions; Excitation; Finite Difference Time Domain Method

20050123723 Air Force Research Lab., Wright-Patterson AFB, OH, USA
Numerical Amplification of the Excitation Source in Waveguide Structure
Liou, L. L.; Ho, L.-F.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1874-1877; In English; See also 20050123676; Copyright; Avail: Other Sources

The finite difference in time domain method was used to study the wave propagation in a microstrip line. The boundary condition implemented at the excitation source plane causes an amplification effect on the resulting field at the source plane. The amplification factor depends on the time, spatial intervals and the effective dielectric constant of the microstrip line. The numerical origin of this effect is investigated.
Author
Amplification; Finite Difference Time Domain Method; Wave Propagation; Microstrip Transmission Lines; Permittivity

20050123724 Bilkent Univ., Ankara, Turkey
Employing PML Absorbers in the Design and Simulation of Ground Penetrating Radars
Gurel, Levent; Oguz, Ugur; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1890-1893; In English; See also 20050123676; Copyright; Avail: Other Sources

The finite-difference time-domain (FDTD) [1-3] method in conjunction with the perfectly matched layers (PML) [4] absorbing boundary condition (ABC) has been a popular choice for the simulation of ground penetrating radars (GPRs) [5] due to the following reasoas: FDTD is suitable for modeling inhomogeneities. FDTD is also suitable for the computation of time-dependent radar signals. PML is a very effective ABC that renders the FDTD method quite efficient. In this paper, in addition to the conventional usage of PML to truncate the FDTD computational domain, we will report on how the PML can also be used to simulate an absorbing material inside the FDTD computational domain.
Derived from text
Perfectly Matched Layers; Finite Difference Time Domain Method; Absorbers (Materials); Boundary Conditions

20050123745 Rafael Armament Development Authority, Haifa, Israel
Parabolic Equation-Based Propagation Fields Near Surface Irregularities Including Backscatter
Marcus, Sharman W.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1470-1473; In English; See also 20050123676; Copyright; Avail: Other Sources

Parabolic equations have become popular in describing electromagnetic propagation in a horizontally varying environment. The parabolic equation is, however, only an approximation of the governing elliptic differential equation in that it ignores backscatter and assumes that the fields vary slowly with range everywhere. Nevertheless, its solutions have been observed to agree well with other solutions and with measurements in regions in which the fields vary slowly with range even when regions of rapidly varying fields axe present between the source and the observer. This is of little value, however, if it is the backscatter that is of specific interest, as is the case, for example, in radar clutter, or if it is desired to determine the solution in a region of rapid field variation such as near a terrain irregularity. In what follows, Green's theorem is used to express the solution of the full elliptic differential equation (including backscatter) as an integral over the surface fields. A scheme is introduced which assumes that the parabolic solution represents an adequate approximation of the surface fields except near the ground irregularity where they generally vary rapidly. Near this irregularity, the surface fields are found from a numerical solution of the differential equation. Application of the method to a mixed path problem shows that the 'exact' surface fields differ from the parabolic equation solution only near the ground-water interface. At finite heights, the resulting fields that include backscatter are seen to exhibit an interference pattern in the region preceding the interface. A similar but less pronounced interference pattern can be obtained by approximating the surface fields near the mixed path interface as those obtained from the parabolic solution.
Author
Parabolic Differential Equations; Backscattering; Elliptic Differential Equations

20050123758 Nanyang Technological Univ., Nanyang, Singapore
Shape Reconstruction of a Perfectly Conducting Cylinder Using Real-coded Genetic Algorithm
Qing, Anyong; Lee, Ching Kwang; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2148-2152; In English; See also 20050123676; Copyright; Avail: Other Sources

Electromagnetic inverse scattering has been studied extensively in recent years. Most of the previous inversion algorithms are gradient based. They converge rapidly but they are prone to converge to a local optimum. A good initial guess is required to obtain a convergent solution. Genetic algorithms (GAs) are a set of slowly converging probabilistic global optimization methods based on genetic recombination and evolution in nature. They are less prone to converge to a local optimum even when the initial guess is far away from the exact one. The GAs have been widely used for solving electromagnetic problems. Chiu and Liu used the simple genetic algorithm (SGA) to reconstruct the image of a perfectly conducting cylinder. However, some significant errors are found that make the reported results questionable. In addition, as far as we know, the real-coded genetic algorithm (RGA) has never been used for solving the electromagnetic inverse problem. Practical experience and theoretical defense show that RGA works better than SGA, especially for problems with real design parameters. In this paper, RGA is used to reconstruct the shape of a perfectly conducting cylinder in free space, Numerical results validate the algorithm. The advantages and disadvantages of RGA over gradient-based algorithms are discussed based on comparison with Newton-Kantorivitch method.
Author
Genetic Algorithms; Shape Optimization; Electromagnetic Scattering; Cylindrical Bodies

20050123773 Qualcomm, Inc., San Diego, CA, USA
Code-Division Multiplexing and Frequency-Division Multiplexing for Nonlinear Inverse Scattering
Chen, Fu-Chiang; Chew, Weng Cho; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2128-2131; In English; See also 20050123676; Copyright; Avail: Other Sources

Nonlinear inverse scattering algorithms are notorious for their large memory requirement and expensive CPU run time consumption. This paper presents a novel scheme employing a code-division multiplexing (CDM) or a frequency-division multiplexing (FDM) methodology to reduce the memory requirement and CPU run time for nonlinear inverse scattering in the time-domain. We successfully incorporate the CDM and FDM schemes into nonlinear inverse scattering algorithms such as distorted-Born iterative method (DBIM) and local shape function (LSF) method in the time domain. The proposed novel schemes can reduce the CPU run time and memory requirements by a factor proportional to the number of the transmitters. It allows us to use the nonlinear inverse scattering algorithms to solve large problems for practical applications. The CDM and FDM approaches for nonlinear inverse scattering algorithms are similar to the multiple access schemes, frequency division multiple access (FDMA) and code division multiple access (CDMA), in wireless communications systems. Multiple access schemes are used to allow several mobile users to share an available RF bandwidth spectrum simultaneously. Frequency division multiple access (FDMA) divides the available RF bandwidth into several subdivisions and assigns different subdivisions to different users. Each user is allocated a unique RF bandwidth and shares the same time slots. In code division multiple access (CDMA), each user is assigned a unique code to encode the transmitted signal. All the users in CDMA systems share the same frequency bandwidth and the same time slots.
Author
Code Division Multiplexing; Frequency Division Multiplexing; Nonlinearity; Inverse Scattering

20050123776 Magdeburg Univ., Magdeburg, Germany
An Improved Renormalization Technique for Profile Inversion
Akhtar, M. J.; Omar, A. S.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2136-2139; In English; See also 20050123676; Copyright; Avail: Other Sources

An accurate and efficient method for inverting the permittivity profile of a half space medium illuminated by TEM, TE or TM polarized waves is presented. It is based on an improved renormalization technique and an accurate numerical transform in conjunction with a revised version of the non-linear Riccati differential equation describing the direct problem. A known permittivity profile has been used to generate reflection coefficient data, which have then been used in conjunction with our proposed technique to reconstruct the permittivity profile. Deviation of a maximum of 2 % could be easily achieved between original and reconstructed profiles.
Author
Riccati Equation; Permittivity; Polarized Electromagnetic Radiation; Half Spaces

20050123784 Wuppertal Univ., Germany
The Hybrid(sup 2)-Method: Combination of the FE/BE Hybrid Method with the UTD
Alaydrus, M.; Hansen, V.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1704-1707; In English; See also 20050123676; Copyright; Avail: Other Sources

The advantages of the Boundary Element Method (BEM) for the analysis of scattering or radiation problems are well known. However this method is not well suited for inhomogeneous bodies. On the other band, the Finite Element Method (FEM) is very appropriate to handle problems involving objects of complex geometries and inhomogeneous/anisotropic material distributions with the drawbacks that the open boundary condition is only approximately fulfilled and that the entire solution domain must be discretized. A very efficient tool is obtained by combining the BEM and the FEM, that means by the development of a hybrid method especially if an appropriate Green's function is involved in the BEM part so that the analysis of inhomogeneous bodies not only in free space is possible. The only disadvantage of this hybrid method is the high computation time and computer memory required if electrical large structures are involved. In order to overcome this restriction we suggest to add to the BEM and the FEM an asymptotic method for the treatment of such electrical large bodies. Actually we chose the Uniform Theory of Diffraction (UTD), which is very well established for a large class of canonical scattering problems. In our paper we first present the theoretical concept of the new BEM/FEM/UTD combination called Hybrid(sup 2) Method, followed by some first applications concerning base station antennas in complex surroundings for mobile communication system.
Author
Boundary Element Method; Finite Element Method; Diffraction; Scattering; Asymptotic Methods; Boundary Conditions

20050123786 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
Higher-Order MoM Implementation to Solve Integral Equations
Donepudi, K. C.; Gang, K.; Song, J. M.; Jin, J. M.; Chew, W. C.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1716-1720; In English; See also 20050123676; Copyright; Avail: Other Sources

In recent years, higher-order basis functions [1] have received intensive attention for solving electromagnetic problems with the finite element and Galerkin's methods. The advantage of using higher-order basis functions lies in their ability to model the fields and sources, as well as geometries, more accurately than conventional low-order methods. In this paper, we investigate the convergence properties of divergence conforming interpolatory higher-order basis functions for evaluating the Galerkin's solution of integral equations. Both the electric field integral equation (EFIE) and the magnetic field integral equation (MFIE} are used to obtain the scattered field from perfectly conducting objects. Our solution is first validated by comparing the radar-cross section (RCS) with the corresponding Mie series solution for conducting spheres. Next, we calculate the error convergence of the RCS from objects such as spheres and plates for several orders. In the case of objects with no analytical solution such as plates, an over discretized solution is taken as the reference solution and the error results are then calculated.
Author
Finite Element Method; Electric Fields; Galerkin Method; Magnetic Fields; Integral Equations

20050123829 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation
Chao, Hsueh-Yung; Chew, Weng Cho; Song, Jiming; Michielssen, Eric; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1848-1851; In English; See also 20050123676
Contract(s)/Grant(s): F49620-96-1-0025; N00014-95-1-0872; NSF ECS-93-02145; Copyright; Avail: Other Sources

The multilevel fast multipole algorithm (MLFMA) has a great advantage in analyzing radiation and scattering of complex surfaces with wire attachment [1]. It has a computational complexity of O(N log N) for a matrix-vector product, which is much lower than the complexity of the traditional ful-lmatrix method in the method of moments (MOM). In order to enhance the accuracy of impedance calculation in previous work, a variational formulation [2] based on a frill source model is incorporated. Two examples are chosen to demonstrate the accuracy of the variational formulation: a monopole antenna attached to a f'mite ground plane [3] and a module-over-backplane configuration [4]. It can be shown that. the numerical simulation agrees well with the measured data after properly modeling the SMA connector m the testing structures as a lossy transmission line. Moreover, the low complexity of the MLFMA is especially favorable for fast impedance calculation over a sweep of frequencies for large complex sU'uctttres. This paper discusses the multilevel fast multiple algorithm for analyzing surface-wire interconnects. A variational formulation for calculating the input impedance is presented. Measured data and numerical simulation are used to validate the algorithm and the formulation.
Derived from text
Impedance; Algorithms; Method of Moments; Data Simulation; Multipoles; Matrices (Mathematics)

20050123844 York Univ., UK

A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves

Randhawa, B. S.; Marvin, A. C.; Papatsoris, A. D.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1866-1869; In English; See also 20050123676; Copyright; Avail: Other Sources

The problem of an electromagnetic field propagating and scattering in a small finite-difference time-domain (FDTD) mesh enveloped in a larger ray-tracing region is investigated in this paper. The FDTD method is capable of modelling large complex structures possessing small detail . However, the finer the detail, the finer the mesh cell resolution has to he in order to accurately model the fine sub-structure. This approach can result in wasted calculations over the majority of the computational domain, where such fine detail is not needed. With the introduction of the uniform theory of diffraction (UTD) method, one could model the fields using the ray based method in a region where the structure geometry is simple, and use the FDTD method to calculate the fields scattered from the structure possessing the fine detail and/or complexity. This hybridisation of the methods would reduce computer memory and fun time requirements for the same problem compared with the FDTD method alone. It would also allow larger problems to be modelled without losing accuracy. The research has successfully hybridised the UTD method with the FDTD method as shown in the test case.

Derived from text

Electromagnetic Fields; Scattering; Finite Difference Time Domain Method; Diffraction; Finite Difference Theory; Ray Tracing

20050123845 California Univ., San Diego, CA, USA

Modeling of Gaussian Beam Diffraction from a Thick Single-slit Perfectly Conducting Screen: Finite-Difference Time-Domain Method Versus Rigorous Theory

Alvarez-Cabanillas, M. A.; Tyan, Rong-Chung; Fainman, Yeshayahu; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1878-1881; In English; See also 20050123676; Copyright; Avail: Other Sources

We model the diffraction of incident beams with Gaussian and constant spatial profiles on a thick single-slit perfectly conducting screen. Slit sizes larger and smaller than the wavelength are considered. We calculate the diffraction patterns using the Finite-Difference Time-Domain method and compare the results to those obtained by Rigorous Theory. The results are in good agreement in both cases. Introduction The Finite-Difference Time-Domain (FDTD)method recently became one of the most frequently used computational techniques for electromagnetic (EM) wave propagation modeling. In the FDTD method, Maxwell_s equations are applied using the Yee algorithm where the derivatives and the integrals in the equations are approximated by finite differences and summations, respectively. The formulation of the FDTD method is relatively simple compared to other numerical methods such as the method of moments. In this manuscript, we will study the accuracy of the FDTD method in modeling Gaussian beams diffracted from a thick single-slit perfectly conducting screen. We first describe the theory of the FDTD and the formula used in our modeling. We then compare the results calculated using the FDTD method to those obtained by Rigorous Theory (RT) [2.3].Finally, we conclude with a summary and brief discussion on the advantages of using FDTD for E-M wave propagation modeling.

Author

Finite Difference Time Domain Method; Diffraction Patterns; Electromagnetic Wave Transmission; Algorithms; Wave Propagation

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20050110333 Naval Research Lab., Washington, DC USA

Stochastic Cross-Sections Based on the Small Slope Approximation: Theory

Wurmser, Daniel; Jan. 2005; 76 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429808; NRL/MR/7140--05-8816; No Copyright; Avail: Defense Technical Information Center (DTIC)

The small slope approximation is widely used to model the incoherent scattering cross-section per unit area from stochastic rough interfaces. It consists of an integral multiplied by a prefactor. The prefactor involves a closed-form algebraic expression, but evaluation of the integral is nontrivial. This paper develops tractable methods for evaluating the integral. The rough-surface scenarios considered generally assume spectra that have tails that decrease according to a single specified power law. This assumption is typically valid for the air-sea interface and ocean bottom at frequencies below 10 and 40 kHz respectively. The scenarios involve various tradeoffs, but the most significant tradeoff involves tractability vs broad

applicability. In the most tractable scenario, it is assumed that only the isotropic tail of the spectrum is relevant. Alternately, information about the spectral peak and the power-law tail can be used to generate an isotropic 'difference spectrum' formed by taking the difference between two power laws. The difference spectrum peak can be sharpened either by grafting it to a decaying exponential at low-wavenumber, or by replacing it entirely with a Pierson-Moskowitz (isotroptic) spectrum modified by substituting its exponential factor exp(-a/k^2) with exp(-a/k). The latter spectrum is tractable, and while incorporating very sharp spectral peaks, it is rather inflexible. A typical azimuthal dependence is also considered.
DTIC
Slopes; Stochastic Processes

20050110392 Naval Postgraduate School, Monterey, CA USA
A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data
Hartley, Michael A.; Dec. 2004; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429903; No Copyright; Avail: Defense Technical Information Center (DTIC)

Budget limitations have reduced the number of military components available for testing, and time constraints have reduced the amount of time available for actual testing resulting in many items still operating at the end of test cycles. These two factors produce small test populations (small sample size) with 'heavily' censored data. The assumption of normal approximation for estimates based on these small sample sizes reduces the accuracy of confidence bounds of the probability plots and the associated quantities. This creates a problem in acquisition analysis because the confidence in the probability estimates influences the number of spare parts required to support a mission or deployment or determines the length of warranty ensuring proper operation of systems. This thesis develops a method that simulates small samples with censored data and examines the error of the Fisher-Matrix (FM) and the Likelihood Ratio Bounds (LRB) confidence methods of two test populations (size 10 and 20) with three, five, seven and nine observed failures for the Weibull distribution. This thesis includes a Monte Carlo simulation code written in S-Plus that can be modified by the user to meet their particular needs for any sampling and censoring scheme. To illustrate the approach, the thesis includes a catalog of corrected confidence bounds for the Weibull distribution, which can be used by acquisition analysts to adjust their confidence bounds and obtain a more accurate representation for warranty and reliability work.
DTIC
Censored Data (Mathematics); Errors; Monte Carlo Method; Probability Theory; Reliability; Simulation; Spare Parts; Weibull Density Functions

20050110424 Army Research Inst. of Environmental Medicine, Natick, MA USA
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997
Krull, Andrea R.; Jones, Bruce H.; Dellinger, Ann M.; Yore, Michelle M.; Amoroso, Paul J.; Nov. 2004; 7 pp.; In English
Report No.(s): AD-A429955; M03-40; No Copyright; Avail: Defense Technical Information Center (DTIC)

This retrospective cohort study compared trends in motor vehicle occupant fatalities among men in the Army with men in the civilian U.S. population. Motor vehicle fatality rates from 1980 to 1997 indicated both groups showed declines in fatality rates. The overall age-adjusted motor vehicle fatality rate for 17-to 44-year-old males in the Army fell from 40.8 to 20.6 per 100,000, a 49.5% decline. In the U.S. population, the rate dropped from 38.1 to 23.3 per 100,000 for a 38.8% decline. Deaths from motor vehicle crashes fell by almost 50% in the Army during the study period, However, motor vehicle crashes still remain the leading cause of death for men in the Army. U.S. military policies and law enforcement have the potential to make even further gains in reducing motor vehicle crashes and injuries among military personnel.
DTIC
Human Beings; Males; Military Personnel; Mortality; Motor Vehicles

20050110498 Sequoia Scientific, Inc., Bellevue, WA USA
Collaborative Investigations of Shallow Water Optics Problems
Mobley, Curtis D.; Dec. 2004; 78 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-D-0161/0003
Report No.(s): AD-A430056; No Copyright; Avail: Defense Technical Information Center (DTIC)

A combination of HydroLight and Monte Carlo numerical modeling was used to quantify the effects of water column optical properties, bottom morphology, bottom material reflectances, bottom bidirectional reflectance distribution functions (BRDFs), and external environmental conditions on remote-sensing reflectances in optically shallow waters. It was found that

typical variability in these quantities generally causes no more than 10% error in the recovery of bathymetry from hyperspectral remote sensing reflectances. Other research performed under this contract included investigations of radiometer self shading, underwater visibility, analytical modeling of remote sensing reflectances in both deep and shallow Case 2 waters, semianalytical methods for inversion of the radiative transfer equation, and the use of neural networks and regression for inversion of ocean color spectra. Reprints of five publications are included in this report.
DTIC
Optical Properties; Reflectance; Shallow Water

20050111428 South Carolina Univ., Columbia, SC USA
University of South Carolina CB Support, Basic Research in Materials and Techniques for Optical Computing Standoff Sensors
Myrick, Michael L.; Oct. 2004; 82 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-00-2-6059; Proj-0600
Report No.(s): AD-A429819; AFRL-HE-WP-TR-2004-0149; No Copyright; Avail: Defense Technical Information Center (DTIC)

Research demonstrated that multivariate optical elements (MOEs) and imaging MOEs (IMOEs) could be designed, fabricated and characterized. These devices are the computing elements of multivariate optical computing. Results of the first MOE tests revealed that near-theoretical performance could be obtained in the simple situation tested. Mid-infrared, near-infrared and Raman spectra were acquired for nearly 50 organophosphorus compounds. Measurements were made on B. globigi, and comparisons to paper was made. A prototype camera system based on an IMOE was constructed and demonstrated to work in the UV-Vis region. Improved sampling methods for bacterial spores were developed. Spectroscopy of autoclaved spores and spores devoid of DPA was reported. An instrument was designed and built to measure scattering matrix elements of single particles. It is the belief of this laboratory and our AF technical representative that rugged instruments based on these concepts can be made much more inexpensively to become an important part of the chemical and biological detection and identification program of the DOD as well as homeland defense.
DTIC
Multivariate Statistical Analysis; Optical Computers; Optical Data Processing; Raman Spectra

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20050110385 Naval Postgraduate School, Monterey, CA USA
New Fictitious Play Procedure For Solving Blotto Games
Lee, Moon Gul; Dec. 2004; 53 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429895; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this thesis, a new fictitious play (FP) procedure is presented to solve two-person zero-sum (TPZS) Blotto games. The FP solution procedure solves TPZS games by assuming that the two players take turns selecting optimal responses to the opponent's strategy observed so far. It is known that FP converges to an optimal solution, and it may be the only realistic approach to solve large games. The algorithm uses dynamic programming (DP) to solve FP subproblems. Efficiency is obtained by limiting the growth of the DP state space. Blotto games are frequently used to solve simple missile defense problems. While it may be unlikely that the models presented in this paper can be used directly to solve realistic offense and defense problems, it is hoped that they will provide insight into the basic structure of optimal and near-optimal solutions to these important, large games, and provide a foundation for solution of more realistic, and more complex, problems.
DTIC
Game Theory; Games

20050110406 Military Operations Research Society, Alexandria, VA USA
MORS Workshop. Operations Analysis Support to Network Centric Operations. Held in McLean, VA on 27-29 January 2004
Ross-Witkowski, Corrina; Sep. 2004; 200 pp.; In English
Contract(s)/Grant(s): N00014-04-C-0092
Report No.(s): AD-A429925; No Copyright; Avail: CASI; A09, Hardcopy

As Network Centric Operations (NCO) are being developed, the analytic community is being called upon to support the military services with assessments of needs and capability gaps to support decisions concerning options under consideration by the USA Armed Forces and its coalition partners. Many organizations are interested and involved in employing and analyzing Network Centric Operations. With the emergence of 'Information Age' warfare, the Operations Analysis (OA) community recognizes it must play a leadership role in creating and refining needed metrics, processes, methodologies, models and simulations. The OA Community acknowledges an urgent need to share its efforts, successes and failures in developing the key capabilities required for analytically rigorous assessments of NCO. On 27-29 January 2004, MORS held a workshop on Operations Analysis Support to Network Centric Operations at the Booz Allen Hamilton Conference Center in McLean, VA. The goal of the meeting was to bring together a multi-disciplined group of analysts, operators and engineers from across service organizations to: share their work; develop a common view of the state of practice; expose members of the broader analytic community to their needs; and, identify shortfalls and recommend solutions for improving the state of practice.
DTIC
Military Operations; Network Analysis; Operations Research

20050110484 Army Construction Engineering Research Lab., Champaign, IL USA
Civil Works Operations & Maintenance Management Tools Research Program: Program Summary FY 2000 - FY 2002
McKay, David T.; Foltz, Stuart D.; Jan. 2005; 220 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430037; ERDC/CERL-TR-05-2; No Copyright; Avail: Defense Technical Information Center (DTIC)

The purpose of the Civil Works O&M Tools research and development program was to develop new decision support tools and improve old ones that could remove a degree of subjectivity from the business of developing and executing the O&M program. The products would help managers not so much by making decisions for them but by providing a structured basis of objectivity and fact as a platform to support decisions where choices are difficult to make. The products focus on infrastructure condition assessment. infrastructure functionality evaluation, analyses which would project benefits derived from O&M investments. prioritization algorithms based upon consequences and probabilities (risk) which would be used to rank proposed work packages in the O&M budget. and lastly. an inexpensive means for communication within the U.S. Army Corps of Engineers' O&M community by way of a web site that catalogs cost savings technologies. The 3-year programs scheduled findings was cut more than 50 percent during its first 2 years and received only enough funding during the final year to partially complete some efforts and summarize the achievements described in this report.
DTIC
Decision Support Systems; Maintenance; Structural Engineering

20050111433 Temasek Defense Systems Inst., Singapore
OR Modeling of a Conceptual System of Systems for Maritime Littoral Dominance in 2020
Berner, Robert A.; Gonen, Ofer; Han, Wong C.; Monfore, Kenneth; Soon, Tan P.; Sep. 2004; 114 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429959; NPS-OR-04-009; No Copyright; Avail: Defense Technical Information Center (DTIC)

This study focuses on Operations Research (OR) modeling and analysis conducted in support of a campus-wide integrated project for developing a conceptual system of systems to establish maritime dominance in the year 2020. The study features models supporting unmanned system communications, detection, and sensor fusion designs to support this mission. The paper discusses problem definition, solution methodologies-including optimization, simulation, and analytical modeling-and insights.
DTIC
Dominance; Operations Research; Regions

20050123562 Defence Science and Technology Organisation, Edinburgh, Australia
Uncertainties in the Analytic Hierarchy Process
Warren, Lewis; December 2004; 31 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): JTW-02/304
Report No.(s): DSTO-TN-0597; DODA-AR-013-275; Copyright; Avail: Other Sources

When choosing a decision analysis technique to model a particular complex decision the fundamentals of the technique chosen should be understood by the analyst, and they should be appropriate for the characteristics of the problem itself. For analysing such complex decisions the Analytic Hierarchy Process is one of the most commonly used techniques. This technical note highlights a number of theoretical issues, some well-known and others less well-known, that introduce a considerable

degree of uncertainty into the computed output priorities for the decision alternatives.
Author
Hierarchies; Uncertain Systems; Decision Theory; Decision Making; Priorities

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20050110337 Naval Research Lab., Washington, DC USA
Application of Differential Geometry to Acoustics: Development of a Generalized Paraxial Ray-Trace Procedure from Geodesic Deviation
Bergman, David R.; Jan. 2005; 66 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429812; NRL/MR/7140-05-8835; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this report, the application of abstract differential geometry acoustics is explored. The results of this application are as follows: (1) a generalized paraxial ray-trace procedure valid for acoustic propagation in a random media with subsonic flow; (2) the demonstration of a continuum of equivalent paraxial systems related by a conformal transformation; and (3) a unified approach to treating problems in acoustics, which leads to generalized versions of Snell's law, Fermat's principle, and range- and travel-time integrals for layered media. The geodesic deviation vector is used to model beam deformation and provides one with an all-purpose tool for measuring geometric transmission loss and locating caustics within a ray skeleton without repeatedly solving the ray equations. When applied to layered media, the deviation vector is solved exactly. Compared to traditional approaches, the results are equivalent. However, the difference is vast when implemented in numerical ray-trace codes. Applications are made to several depth-dependent scenarios, including piecewise-linear sound-speed and fluid-velocity profiles for which the exact caustic structures are determined.
DTIC
Acoustics; Differential Geometry; Fluid Flow; Ray Tracing; Subsonic Flow; Underwater Acoustics

20050110380 Naval Postgraduate School, Monterey, CA USA
A Comparison of Frequency Offset Estimation Methods in Orthogonal Frequency Division Multiplexing (OFDM) Systems
Karaoglu, Bulent; Dec. 2004; 65 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429888; No Copyright; Avail: Defense Technical Information Center (DTIC)

OFDM is a modulation technique that achieves high data rates, increased bandwidth efficiency and robustness in multipath environments. However, OFDM has some disadvantages, such as sensitivity to channel fading, large peak to average ratio and sensitivity to frequency offset. The latter causes intercarrier interference (ICI) and a reduction in the amplitude of the desired subcarrier which results in loss of orthogonality. In this thesis, the effects of frequency offset are studied in terms of loss of orthogonality. A number of techniques for frequency offset estimation are presented and tested in computer simulations.
DTIC
Frequencies; Frequency Division Multiplexing; Modulation; Orthogonality

20050123759 Schlumberger-Doll Research, Ridgefield, CT, USA
Linear Inverse Problems in Wave Motion: Non-self-adjoint Integral Equations of the First Kind
Habashy, T. M.; Dudley, D. G.; Wolf, E.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1626; In English; See also 20050123676; Copyright; Avail: Other Sources

In the study of linear inverse problems, integral equations of the first kind play an important role. These problems have been widely studied and reported, for example, on the pages of the journal Inverse Problems (IOP Pub. Ltd., Bristol, England, 1985-date). In many applications, the inversion of these integral equations is widely used to produce estimates of media parameters and geometries in areas as diverse as geophysical prospecting, medical imaging, and nondestructive evaluation. Our interests are in wave motion and, in particular, in applications to geophysical exploration. A Fredholm integral equation of the first kind arises, for example, in the employment of the Born approximation in geophysics. In this paper, we consider the characteristics of the first kind integral equations and their solution(s) under the assumption that the integral operator is compact, but not necessarily selfadjoint. We begin with some general results from the theory of Hilbert space. We review some

aspects of the Spectral Theorem for Compact Self-Adjoint Operators. We then relax the self-adjoint requirement through the use of the Singular-Value
Author
Linear Equations; Inversions; Integral Equations; Geophysics; Waves

20050123838 Kentucky Univ., Lexington, KY, USA
Static Permittivity of a Multiphase System of Spheres
Whites, Keith W.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1934-1937; In English; See also 20050123676
Contract(s)/Grant(s): NSF ECS-96-24486; Copyright; Avail: Other Sources

The objective of this work is the computation of the static effective permittivity for a multiphase system of spheres located in an arbitrary lattice. It is assumed for now that there is more than one type of particle (i.e., phase), but overall there is sufficient symmetry to ensure isotropy. This paper begins with the computation of the scalar potential scattered by a lattice containing an arbitrary number of spherical phases. The T-matrix method is used to compute this scattering. Next, a derivation of the effective permittivity expression is given followed by representative results from a three-phase system. The method shown in this paper is numerically 'exact' in the sense that the effective permittivity is computed using methods capable of accurately computing the potential scattering and accounts for all mutual coupling between inclusions. Rayleigh earlier computed the permittivity of a simple cubic array of conducting spheres and more recently, McPhedran and McKenzie accurately considered all three cubic lattice types. The difference here is that a multiphase system is under investigation. Additionally, the derivation of the scattering equation is new, as is the effective permittivity expression.
Author
Static Characteristics; Permittivity; Spheres; Cubic Lattices

20050123849 Aristotle Univ. of Thessaloniki, Greece
An Enhanced Higher-Order FDTD Technique for the Construction of Efficient Reflectionless PMLs in 3-D Generalized Curvilinear Coordinate Systems
Kantartzis, N. V.; Juntunen, J. S.; Tsiboukis, T. D.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1894-1897; In English; See also 20050123676; Copyright; Avail: Other Sources

A systematic implementation of reflectionless split- and unsplit-field PMLs in 3-D nonorthogonal curvilinear coordinates via a novel higher-order FDTD methodology, is presented in this paper. The technique, which introduces both conventional and nonstandard schemes, incorporates a higher-order rendition of the covariant and contravariant vector component theory. Enhanced attenuation performance and levels of accuracy are achieved by means of new conductivity profiles and efficient ABCs terminating the PML region. Moreover, a progressively expanding curvilinear discretization algorithm leads to a significant reduction of the absorbers' necessary thickness. In the temporal variable, the four stage Runge-Kutta integrator is invoked, whereas the wider spatial increments near absorbing walls are effectively limited through the use of properly modified compact operators. Numerical verification demonstrates that the proposed higher-order curvilinearly structured PMLs offer a considerable decrease in dispersion errors and can be imposed very close to the scatterer, thus attaining notable savings in computational resources.
Author
Finite Difference Time Domain Method; Perfectly Matched Layers; Spherical Coordinates

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20050092431 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
First Results from the CEBAF CLAS Spectrometer
Mecking, B. A.; Feb. 2002; 16 pp.; In English
Report No.(s): DE2004-829661; No Copyright; Avail: Department of Energy Information Bridge

The physics program and the experimental equipment of the CEBAF Large Acceptance Spectrometer, CLAS, are described. The spectrometer is located in Hall B, one of the three experimental areas at the Continuous Electron Beam

Accelerator Facility (CEBAF) operated by the Thomas Jefferson National Accelerator Facility. The CLAS subsystems, actual operating experience, and examples for the results obtained during the first eight months of physics running are discussed.
NTIS
Spectrometers; Linear Accelerators

20050092433 Istituto Nazionale di Fisica Nucleare, Frascati, Italy
Lattices. Subgroup Summary Report
Biscari, C.; Leeman, C.; Patteri, P.; Preger, M.; York, R.; Feb. 2002; 12 pp.; In English
Report No.(s): DE2004-829647; No Copyright; Avail: Department of Energy Information Bridge

Since the overall machine layout was one of the most important subjects of discussion for the Workshop, the 'Lattices' Subgroup addressed a number of selected topics (according to the list in the Charge to the Machine) from a general point of view, rather than entering into the details of a particular design. The experience of CEBAF participants was of great help in suggesting solutions for the machine layout and in discussing the intrinsic difficulties of the project. The conclusions on the main topics considered by the Subgroup are described.
NTIS
Layouts; Subgroups; Lattices (Mathematics)

20050092439 European Organization for Nuclear Research, Geneva, Switzerland
Superconducting RF Systems and Cryogenics. Subgroup Summary Report
Benvenuti, C.; Bisognano, J.; Boni, R.; Campisi, I. E.; Chiaveri, E.; Feb. 2002; 20 pp.; In English
Report No.(s): DE2004-829644; No Copyright; Avail: Department of Energy Information Bridge

The subgroup on Supercondcuting RF Systems and Cryogenics was assigned the following tasks: (1) provide acceptable design recommendations for the accelerating structures and related RF and Cryogenics systems based on the parameters established by High Energy and Nuclear Physics needs (namely a final energy of 2.5 and 8 GeV at the end of the first and second stage, respectively, and the ability of accelerating simultaneously the 200(micro)A Nuclear Physics beam and the three bunches for High Energy Physics). (2) estimate the cost of such systems based on realistic, present day technology, with some assessment of future costs as technology and cavity manufacturing processes will improve. These tasks were carried out for the case of the original design which includes two racetracks of similar structure and with different energies, as well as for the more recent design of Amaldi and Coignet which is capable of reaching a center of mass energy of 15 GeV (alternate design). Design and cost estimates were done for a few cases of possible achievable gradients.
NTIS
Radio Frequencies; Design to Cost; High Energy Interactions

20050109775 Lawrence Livermore National Lab., Livermore, CA
Report on Measurement at Ohio University to Estimate Backgrounds for Neutron Radiography in the 10-14 MeV Region
Dietrich, F. S.; Hall, J. M.; May 1997; 12 pp.; In English
Report No.(s): DE2004-16133; UCRL-JC-127520; No Copyright; Avail: Department of Energy Information Bridge

In evaluating the feasibility of neutron radiography and tomography in the 10-14 MeV region, it is important to estimate the radiation backgrounds that could potentially interfere with the measurements. In this context, backgrounds refer to all counts in the detector other than those due to neutrons transmitted through the sample without scattering. There are two principal sources of backgrounds: (1) neutrons and gammas resulting from incident neutrons interacting in the sample, and (2) events in the detector arising from neutrons scattering in the accelerator vault and collimation system, together with natural and induced activation.
NTIS
Neutron Radiography; Feasibility Analysis; Tomography

20050109785 Los Alamos National Lab., NM
Science-Based Prediction for Complex Systems
2005; In English
Report No.(s): PB2005-103299; No Copyright; Avail: National Technical Information Service (NTIS)

Table of contents: The Evolving Deterrent; Error Analysis and Simulations of Complex Phenomena; Reducing Uncertainty in Nuclear Data; The Ocean Perspective - Uncertainties in Climate Prediction; Predicting Risk in Earth Sciences

- Vulcanological Examples; Quantum Molecular Dynamics - Simulating Warm, Dense Matter; Predicting Material Strength, Damage, and Fracture - The Synergy Between Experiment and Modeling; Complex Networks - The Challenge of Interaction Topology; Models of the Retina with Application to the Design of a Visual Prosthesis; The Turbulence Problem - An Experimentalist's Perspective; Intermittancy and Anomalous Scaling in Turbulence; Direct Numerical Simulations of Turbulence - Data Generation and Statistical Analysis; The LANS-Model for Computing Turbulence Origins, Results, and Open Problems; Field Theory and Statistical Hydrodynamics. The First Analytical Predictions of Anomalous Scaling; Physically Motivated Discretization Methods - A Strategy for Increased Predictiveness.
NTIS
Complex Systems; Prediction Analysis Techniques; Statistical Analysis; Molecular Dynamics

20050109794 Fermi National Accelerator Lab., Batavia, IL, USA
Oxygen Monitoring Cells at FERMILAB
Theilacker, J. C.; Jul. 2004; 12 pp.; In English
Report No.(s): DE2004-826434; FERMILBA-CONF-03/476-AD; No Copyright; Avail: Department of Energy Information Bridge

Questions have been raised about the accuracy of oxygen monitoring for personnel safety around systems containing gases with a molecular weight less than nitrogen. A study has been performed to test the accuracy of the oxygen monitoring devices used at Fermilab. Portable and fixed oxygen monitoring equipment is used throughout Fermilab for personnel safety in defined oxygen deficiency hazard (ODH) areas. The results are presented as well as corrective measures taken to ensure accuracy and maintain the proper level of personnel safety.
NTIS
Accuracy; Oxygen

20050109805 Fermi National Accelerator Lab., Batavia, IL, USA
Lost Tribes of Charmonium
Quigg, C.; Jun. 10, 2004; In English
Report No.(s): DE2004-826273; FERMILAB-CONF-04/109-T; No Copyright; Avail: National Technical Information Service (NTIS)

To illustrate the campaign to extend our knowledge of the charmonium spectrum, the author focuses on a puzzling new state, X(3872) (yields) (pi)(sup +) (pi)(sup -) J/(psi). Studying the influence of open-charm channels on charmonium properties leads us to propose a new charmonium spectroscopy: additional discrete charmonium levels that can be discovered as narrow resonances of charmed and anticharmed mesons. The author calls attention to open issues for theory and experiment.
NTIS
Charm (Particle Physics); Mesons; Spectra

20050109815 Lawrence Livermore National Lab., Livermore, CA
Ultrashort X-Ray Pulse Science
Chin, A. H.; May 1998; 144 pp.; In English
Report No.(s): DE2004-666159; LBNL-42044; No Copyright; Avail: Department of Energy Information Bridge

A variety of phenomena involves atomic motion on the femtosecond time-scale. These phenomena have been studied using ultrashort optical pulses, which indirectly probe atomic positions through changes in optical properties. Because x-rays can more directly probe atomic positions, ultrashort x-ray pulses are better suited for the study of ultrafast structural dynamics. One approach towards generating ultrashort x-ray pulses is by 90(sup o) Thomson scattering between terawatt laser pulses and relativistic electrons. Using this technique, the author generated (approx.) 300 fs, 30 keV (0.4 (angstrom)) x-ray pulses. These x-ray pulses are absolutely synchronized with ultrashort laser pulses, allowing femtosecond optical pump/x-ray probe experiments to be performed. Using the right-angle Thomson scattering x-ray source, the author performed time-resolved x-ray diffraction studies of laser-perturbated InSb. These experiments revealed a delayed onset of lattice expansion.
NTIS
X Ray Sources; Optical Properties

20050109837 Technion - Israel Inst. of Tech., Haifa, Israel, Stanford Linear Accelerator Center, Stanford, CA, USA,

California Univ., San Diego, Santa Cruz, CA, USA, , Rehovot, Israel

New Ways to Soft Leptogenesis

Grossman, Y.; Kashti, T.; Nir, Y.; Roulet, E.; 2004; In English

Report No.(s): DE2004-827317; SLAC-PUB-10519; No Copyright; Avail: National Technical Information Service (NTIS)

Soft supersymmetry breaking terms involving heavy singlet neutrinos provide new sources of lepton number violation and of CP violation. In addition to the CP violation in mixing, investigated previously, we find that 'soft leptogenesis' can be generated by CP violation in decay and in the interference of mixing and decay. These additional ways to leptogenesis can be significant for a singlet neutrino Majorana mass that is not much larger than the supersymmetry breaking scale, M (approx) less than 10(sup 2)m(sub SUSY). In contrast to CP violation in mixing, for some of these new contributions the neutrino oscillation rate can be much faster than the decay rate, so that the bilinear scalar term need not be smaller than its natural scale. NTIS

Leptons; CP Violation

20050109843 Fermi National Accelerator Lab., Batavia, IL, USA

Siemens Programmable Variable Speed DC Drives Applied to Wet and Dry Expansion Engines

Markley, D. J.; Jul. 1997; 20 pp.; In English

Report No.(s): DE2004-16226; FERMILAB-TM-2011; No Copyright; Avail: Department of Energy Information Bridge

This document describes the technical details of the Siemens SIMOREG line of DC variable speed drives as applied to Fermilab wet and dry mechanical expander engines. The expander engines are used throughout the lab in Helium refrigerator installations. NTIS

Mechanical Drives; Direct Current

20050109852 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Jefferson Lab Phenomenology: An Overview

Melnitchouk, W.; 2003; In English

Report No.(s): DE2004-829573; No Copyright; Avail: National Technical Information Service (NTIS)

The Thomas Jefferson National Accelerator Facility (Jefferson Lab) is a 6 GeV electron accelerator located in Newport News, Virginia, USA. Since the experimental program began in 1996, Jefferson Lab has developed into the premier electron accelerator facility in the world for precision studies of the structure of the atomic nucleus at the quark level. The Continuous Electron Beam Accelerator Facility (CEBAF) uses superconducting radio-frequency technology to produce an electron beam of unprecedented high luminosity and polarization NTIS

Phenomenology; Hadrons; Linear Accelerators

20050109853 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA, Massachusetts Inst. of Tech., Cambridge, MA, USA, Massachusetts Inst. of Tech., Cambridge, MA, USA

Charged Pion Photoproduction from Hydrogen and Deuterium at Jefferson Lab

Gao, H.; Feb. 2002; 14 pp.; In English

Report No.(s): DE2004-829599; No Copyright; Avail: Department of Energy Information Bridge

The (gamma)n (yields) (pi)(sup -)p and (gamma)p (yields) (pi)(sup +)n reactions are essential probes of the transition from meson-nucleon degrees of freedom to quark-gluon degrees of freedom in exclusive processes. The cross sections of these processes are also, advantageous, for the investigation of oscillatory behavior around the quark counting prediction, since they decrease relatively slower with energy compared with other photon-induced processes. Moreover, these photoreactions in nuclei can probe the QCD nuclear filtering and color transparency effects. In this talk, I discuss the preliminary results on the (gamma)p (yields) (pi)(sup +)n and (gamma)n (yields) (pi)(sup -)p processes at a center-of-mass angle of 90(sup o) from Jefferson Lab experiment E94-104. I also discuss a new experiment in which singles (gamma)p (yields) (pi)(sup +)n measurement from hydrogen, and coincidence (gamma)n (yields) (pi)(sup -)p measurements at the quasifree kinematics from deuterium and (sup 12)C for photon energies between 2.25 GeV to 5.8 GeV in fine steps at a center-of-mass angle of 90(sup o) are planned. The proposed measurement will allow a detailed investigation of the oscillatory scaling behavior in photopion production processes and the study of the nuclear dependence of rather mysterious oscillations with energy that previous experiments have indicated. The various nuclear and perturbative QCD approaches, ranging from Glauber theory, to

quark-counting, to Sudakov-corrected independent scattering, make dramatically different predictions for the experimental outcomes.
NTIS
Photoproduction; Hydrogen; Deuterium; Pions; Quantum Chromodynamics

20050109854 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Precision Measurements of the Neutron Spin Structure at Jefferson Lab Hall A
Zheng, X.; Sep. 2004; In English
Report No.(s): DE2004-829643; No Copyright; Avail: National Technical Information Service (NTIS)

The authors present here recent progress on the experimental study of the neutron spin structure at Jefferson Lab Hall A. They focus on two precision experiments. The physics motivation and the experimental setup will be described first. Then they present results for the neutron spin asymmetry A(sub 1)(sup n) and results for spin-flavor decomposition of the nucleon spin in the valence quark region, and preliminary results for the neutron spin structure function g(sub 2)(sup n) at low Q(sup 2).
NTIS
Neutrons; Spin

20050109859 Bechtel Corp., Oak Ridge, TN, USA
Oak Ridge National Laboratory Radiation Control Program-Partners in Site Restoration
Jones, S. L.; Stafford, M. W.; Feb. 2002; 12 pp.; In English
Report No.(s): DE2004-829617; No Copyright; Avail: Department of Energy Information Bridge

In 1998, the U.S. Department of Energy (DOE) awarded the Management and Integration (M&I) contract for all five of the Oak Ridge Operations (ORO) facilities to Bechtel Jacobs Company LLC (BJC). At Oak Ridge National Laboratory (ORNL), a world renowned national laboratory and research and development facility, the BJC mission involves executing the DOE Environmental Management (EM) program. In addition to BJC's M&I contract, UT-Battelle, LLC, a not-for-profit company, is the Management and Operating (M&O) contractor for DOE on the ORNL site. As part of ORNL's EM program, legacy inactive facilities (i.e., reactors, nuclear material research facilities, burial grounds, and underground storage tanks) are transferred to BJC and are designated as remediation, decontamination and decommissioning (D&D), or long-term surveillance and maintenance (S&M) facilities. Facilities operated by both UT-Battelle and BJC are interspersed throughout the site and are usually in close proximity. Both UT-Battelle and BJC have DOE-approved Radiation Protection Programs established in accordance with 10 CFR 835. The BJC Radiological Control (RADCON) Program adapts to the M&I framework and is comprised of a combination of subcontracted program responsibilities with BJC oversight. This paper focuses on the successes and challenges of executing the BJC RADCON Program for BJC's ORNL Project through a joint M&I contractor relationship, while maintaining a positive working relationship and partnership with UT-Battelle's Radiation Protection organization.
NTIS
Radiation Protection; Nuclear Research; Radiology; Restoration; Project Management

20050109976 Illinois Univ., Urbana, IL, USA
Fast Steepest Descent Path Algorithm for Electromagnetic Scattering Problems in Layered Medium
Hu, Bin; Chew, Weng-Cho; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1182-1185; In English; See also 20050109927; Copyright; Avail: Other Sources

FASDPA is applied to speed up the analysis of layered medium problems. Compared to the previously developed approach GAMMA which combined FMM and DCI technique GAMMA the proposed new method has several advantages GAMMA such as being simpler GAMMA more efficient and more accurate. Applying FASDPA to 3D problems in layered medium is currently under investigation.
Derived from text
Algorithms; Electromagnetic Scattering; Multipoles

20050110076 Middle East Technical Univ., Ankara, Turkey
Reciprocity in Perfectly Matched Absorbers
Kuzuoglu, Mustafa; Mittra, Raj; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1262-1265; In English; See also 20050109927; Copyright; Avail: Other Sources

In the numerical solution of electromagnetic scattering and/or radiation problems by finite methods, a mesh truncation

scheme must be employed in order to obtain a bounded computational domain. The perfectly matched layer (PML) concept, which has been introduced by Berenge, is an efficient mesh truncation technique in finite difference time domain (FDTD) applications. Basically, PMLs are designed such that a plane wave with arbitrary frequency and direction of incidence is absorbed by the layer without any reflection. Although the PML concept has been originally introduced for FDT'D simulations, it has also been used in the solution of frequency domain electromagnetic boundary value problems by the finite element method (FEM). It has been demonstrated that the PMLs can be realized in the form of bianisotropic media with suitable constitutive parameters. More recently, bianisotropic PML realizations have also been reported. The starting point of the PML, obtained is the transparent absorbing boundary (TAB) approach to mesh truncation in finite methods. It has been verified that the medium associated with TAB is bianisotropic, whose constitutive parameters depend upon the decay behavior of the fields within the medium. A new bianisotropic PML, which is space-dispersive (i.e., non-local), whose decay behavior is identical to that of the anisotropic PML introduced by Sacks et al., has been realized. In this paper, we discuss the reciprocity issue in PML media. We show that the satisfaction of reciprocity depends upon the choice of the decay behavior within the medium. We also demonstrate that the non-local character of the bianisotropic PML plays an important role in determining whether or not the reciprocity-criterion is met.
Derived from text
Perfectly Matched Layers; Absorbers; Reciprocity Theorem

20050110372 Naval Postgraduate School, Monterey, CA USA
Simulation Performance of Multiple-Input Multiple-Output Systems Employing Single-Carrier Modulation and Orthogonal Frequency Division Multiplexing
Saglam, Halil D.; Dec. 2004; 93 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429873; No Copyright; Avail: Defense Technical Information Center (DTIC)

This thesis investigates the simulation performance of multiple-input multiple-output (MIMO) systems utilizing Alamouti-based space-time block coding (STBC) technique. The MIMO communication systems using STBC technique employing both single-carrier modulation and orthogonal frequency division multiplexing (OFDM) are simulated in Matlab. The physical layer part of the IEEE 802.16a standard is used in constructing the simulated OFDM schemes. Stanford University Interim (SUI) channel models are selected for the wireless channel in the simulation process. The performance results of the simulated MIMO systems are compared to those of conventional single antenna systems.
DTIC
Frequency Division Multiplexing; MIMO (Control Systems); Modulation; Reception Diversity; Simulation

20050110444 Naval Postgraduate School, Monterey, CA USA
Iraq and Failures in U.S. Compellence Policy 1990-2003
Robinson, Esther R.; Dec. 2004; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429987; No Copyright; Avail: Defense Technical Information Center (DTIC)

Image matters; it is regularly funneled through prevailing world leaders and governments using mechanisms to maintain national interest, power, and security. One such instrument is the use of coercive force or compellence. Compellence is a strategy of control designed to impose change, using limited military or non-military methods, upon an opponent. The USA implements compellence policy through a mixture of key actors who portray powerful images to the rest of the world. Its leaders reinforce these images internally (with self, local, regional, cultural ties) and externally (with othersbased, foreign perception on a larger international scope). As U.S.-led forces in Iraq affect America's image throughout the Middle East and the world, its image of Iraq remains opaque due to U.S. perception and misperception. Is compellence policy conducive to future U.S.-Iraqi relations? How effective is it? And why did U.S. compellence policy in Iraq succeed on some levels and not on others? This thesis examines the effectiveness of U.S. compellence policy as a viable method in U.S. -Iraqi relations from 1990 to 2003. Key operations and players will be evaluated and an analysis will explore political, social and economic levels of effectiveness of compellence policy in Iraq.
DTIC
Coercivity; Failure; Foreign Policy; Iraq; Military Operations; Policies; Strategy

20050110515 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates
Love, B. M.; Batra, R. C.; Jan. 2005; 111 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0657
Report No.(s): AD-A430080; ARO-42372.4-EG; No Copyright; Avail: Defense Technical Information Center (DTIC)

Plane strain transient finite thermomechanical deformations of heat-conducting particulate composites comprised of circular tungsten particulates in nickel-iron matrix are analyzed using the finite element method to delineate the initiation and propagation of brittle/ductile failures by the nodal release technique. Each constituent and composites are modeled as strain-hardening, strain-rate-hardening and thermally-softening microporous materials. Values of material parameters of composites are derived by analyzing deformations of a representative volume element whose minimum dimensions are determined through numerical experiments. These values are found to be independent of sizes and random distributions of particulates, and are close to those obtained from either the rule of mixtures or micromechanics models. Brittle and ductile failures of composites are first studied by homogenizing their material properties; subsequently their ductile failure is analyzed by considering the microstructure. It is found that the continuously varying volume fraction of tungsten particulates strongly influences when and where adiabatic shear bands (ASB) initiate and their paths. Furthermore, an ASB initiates sooner in the composite than in either one of its constituents. We have studied the initiation and propagation of a brittle crack in a precracked plate deformed in plane strain tension, and a ductile crack in an infinitely long thin plate with a rather strong defect at its center and deformed in shear. The crack may propagate from the tungsten-rich region to nickel-iron-rich region or vice-a-versa. It is found that at the nominal strain-rate of 2000/s the brittle crack speed approaches Rayleigh's wave speed in the tungsten-plate, the nickel-iron-plate shatters after a small extension of the crack, and the composite plate does not shatter.
DTIC
Composite Materials; Deformation; Finite Element Method; Heterogeneity; Position (Location); Solids; Strain Rate; Thermodynamics

20050110520 Memtronics, Plano, TX USA
Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches
Yuan, Xiaobin; Hwang, James C.; Forehand, David; Goldsmith, Charles L.; Dec. 2004; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-03-C-7003; Proj-ARPS
Report No.(s): AD-A430086; AFRL-SN-WP-TP-2004-101; No Copyright; Avail: Defense Technical Information Center (DTIC)

For the first time, charging and discharging of traps in the dielectric of state-of-the art RF MEMS capacitive switches were characterized in detail. Densities and time constants of different trap species were extracted under different control voltages. It was found that, while charging and discharging time constants are relatively independent of control voltage, steady-state charge densities increase exponentially with control voltage. A simple charge model was constructed to predict the amount of charge injected into the dielectric and the corresponding shift in actuation voltage. Good agreement was obtained between the model prediction and experimental data.
DTIC
Capacitance; Dielectric Properties; Dielectrics; Microelectromechanical Systems; Radio Frequencies; Switches

20050110526 Army Research Lab., Adelphi, MD USA
UV Baked/Cured Photoresist Used as a Sacrificial Layer in MEMS Fabrication
Takacs, Thomas P.; Pulskamp, Jeff; Polcawich, Ronald; Feb. 2005; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430096; ARL-MR-602; No Copyright; Avail: Defense Technical Information Center (DTIC)

MEMS fabrication requires the release of compliant mechanical structures. A sacrificial layer is typically used to provide as a structural layer on which device layers can be deposited and subsequently removed to leave a suspended or freestanding device. There are several sacrificial layers commonly used in MEMS fabrication such as SiOsub2 polysilicon and polyimide. We have developed a sacrificial layer technique that can be used when many other sacrificial layers cannot be used. The use of photoresist that is Ultra Violet (UV) baked/cured as a sacrificial layer can save process steps. time and money. It can also be removed without the inherent problem of residues or stiction from wet processing, material by-products or the problematic issue of determining if the film has been completely removed.
DTIC
Fabrication; Mechanical Properties; Microelectromechanical Systems; Photoresists

20050110552 Massachusetts Inst. of Tech., Cambridge, MA USA
Student Support for Quantum Computation With Superconducting Quantum Devices
Orlando, Terry P.; Jan. 2005; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0624
Report No.(s): AD-A430138; ARO-42633.2-PH-QC; No Copyright; Avail: Defense Technical Information Center (DTIC)

The research done by the graduate students on this grant focus on two topics: predominately, the focus was on the measurements of a persistent-current qubit driven by an on-chip radiation source, and secondarily on the fabrication of qubits for a fast turn around time. For the first topic the student preformed experiments of the monolithic integration of an onchip radiation source with a persistent-current (PC) qubit and dc SQUID measurement device. The devices were fabricated at MIT Lincoln Laboratory in a Nb/Al/AlOx/Nb trilayer process. The two PC qubit states were detected by measuring the switching current of an underdamped dc SQUID magnetometer inductively coupled to the qubit. The radiation source comprised an overdamped dc SQUID operating in the voltage state and inductively coupled to the qubit and measurement SQUID through a low-Q RLC filter. The oscillator was designed to have tunable amplitude and frequency to satisfy the requirements for coherent quantum manipulation of a superconducting PC qubit. Measurements were made in the millikelvin regime and the effects of the oscillator noise on the state of the qubit were obtained. For the second topic, work was done for implementing a fabrication process for superconducting qubits with a turn-around time of the order of a few weeks.
DTIC
Quantum Computation; Quantum Theory; Students; Superconducting Devices; Superconductors (Materials)

20050111461 Rensselaer Polytechnic Inst., Troy, NY USA
Computational Nanomechanics of Materials
Huang, Hanchen; Dec. 2004; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-04-1-0107
Report No.(s): AD-A430085; ARO-46405.1-EG-CF; No Copyright; Avail: Defense Technical Information Center (DTIC)

This workshop is co-sponsored by the National Science Foundation the Army Research Office the US Association for Computational Mechanics the Oak Ridge National Laboratory - Fusion Materials Program. It provides a forum to assess the status of computational nanomechanics research and education and serves to educate junior researchers (primarily junior faculty members) in this emerging field. In addition to the education provided the workshop has also resulted in several recommendations of future research directions. The recommended focuses of future research are: (1) integration of nanostructure elements and the accompanying nanomechanics; (2) the issue of multiple time scales in nanomechanics; (3) nanomechanics of the interface between soft biological systems and harder solid structures at the nanoscale and (4) cross fertilization of physics, chemistry, materials science, continuum mechanics, and computation.
DTIC
Fertilization; Nanostructure (Characteristics)

20050111482 Helsinki Univ. of Technology, Espoo, Finland
Self-Organized Criticality and Stochastic Resonance in the Human Brain
Linkenkaer-Hansen, K.; 2002; In English
Report No.(s): PB2005-103594; Copyright; Avail: National Technical Information Service (NTIS)

The human brain spontaneously generates neuronal network oscillations at around 10 and 20 Hz with a large variability in amplitude, duration, and recurrence. Despite more than 70 years of research, the complex dynamics and functional signi.cance of these oscillations have remained poorly understood. This Thesis concerns the dynamic character and functional signi.cance of noninvasively recorded 10- and 20-Hz oscillations in the human brain. The hypotheses, experimental paradigms, data analyses, and interpretations of the results are inspired by recent insights from physics-most notable the theory of self-organized criticality and the phenomenon of stochastic resonance whose applicability to large-scale neuronal networks is explained.
NTIS
Brain; Neurophysiology; Oscillations

20050111493 Princeton Univ., NJ
Experimental Evaluation of a Negative Ion Source for a Heavy Ion Fusion Negative Ion Driver
Grisham, L. R.; Hahto, S. K.; Hahto, S. T.; Kwan, J. W.; Leung, K. N.; Jun. 2004; 24 pp.; In English
Report No.(s): DE2004-828041; PPPL-3966; No Copyright; Avail: Department of Energy Information Bridge

Negative halogen ions have recently been proposed as a possible alternative to positive ions for heavy ion fusion drivers because electron accumulation would not be a problem in the accelerator, and if desired, the beams could be photo-detached to neutrals. To test the ability to make suitable quality beams, an experiment was conducted at Lawrence Berkeley National Laboratory using chlorine in an RF-driven ion source. Without introducing any cesium (which is required to enhance negative ion production in hydrogen ion sources) a negative chlorine current density of 45 mA/cm(sup 2) was obtained under the same

conditions that gave 57 45 mA/cm(sup 2) of positive chlorine, suggesting the presence of nearly as many negative ions as positive ions in the plasma near the extraction plane. The negative ion spectrum was 99.5% atomic chlorine ions, with only 0.5% molecular chlorine, and essentially no impurities. Although this experiment did not incorporate the type of electron suppression technology that i s used in negative hydrogen beam extraction, the ratio of co-extracted electrons to Cl(sup -) was as low as 7 to 1, many times lower than the ratio of their mobilities, suggesting that few electrons are present in the near-extractor plasma. This, along with the near-equivalence of the positive and negative ion currents, suggests that the plasma in this region was mostly an ion-ion plasma. The negative chlorine current density was relatively insensitive to pressure, and scaled linearly with RF power. If this linear scaling continues to hold at higher RF powers, it should permit current densities of 100 45 mA/cm(sup 2), sufficient for present heavy ion fusion injector concepts. The effective ion temperatures of the positive and negative ions appeared to be similar and relatively low for a plasma source.
NTIS
Heavy Ions; Ion Sources; Ion Beams

20050111518 Stanford Linear Accelerator Center, Stanford, CA, USA
Search for an X(3872) charged partner in the decay mode X- Yields J/psi pi- pi0 in the B meson decays B0 Yields X- K+ and B- Yields X- Ks
Aubert, B.; Jul. 2004; In English
Report No.(s): DE2004-829787; SLAC-PUB-10657; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Mesons; Particle Decay

20050111520 Stanford Linear Accelerator Center, Stanford, CA, USA
Constraints on r(sub B) and gamma in B(sup (+-)) rightarrow D(sup 0)K(sup (+-)) decays by a Dalitz analysis of D(sup 0) Greater Than K(sub S) pi(sup -) pi(sup +)
Aubert, B.; Aug. 2004; In English
Report No.(s): DE2004-829781; SLAC-PUB-10637; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Particle Decay; Mesons; CP Violation

20050111521 Stanford Linear Accelerator Center, Stanford, CA, USA
Search for the Decay B+ Yields K+ nu nubar
Aubert, B.; Jul. 2004; In English
Report No.(s): DE2004-829780; SLAC-PUB-10646; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Mesons; Particle Decay

20050111524 Stanford Linear Accelerator Center, CA, USA
Measurement of CP-violating parameters in fully reconstructed B--\gD(*)pi and B--\gDrho decays
Aubert, B.; Aug. 2004; In English
Report No.(s): DE2004-829782; SLAC-PUB-10647; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Particle Decay; CP Violation

20050111548 Stanford Linear Accelerator Center, CA, USA
Symplectic Treatment of a Finite Crossing Angle in the Beam-Beam Collision
Cai, Y.; 2004; In English
Report No.(s): DE2004-829797; SLAC-PUB-10674; No Copyright; Avail: National Technical Information Service (NTIS)
The authors introduce a symplectic method to handle a large and finite crossing angle in the beam-beam interaction. This method has been implemented in a parallel computer program to simulate three-dimensional effects in the beam-beam interaction. The simulation results are compared with the known analytical solutions, the simulations using the Lorentz boost and experimental observations.
NTIS
Computer Programs; Particle Collisions; Beam Interactions

20050111551 Stanford Linear Accelerator Center, CA, USA
Measurement of the B0--\gK0sK0sK0s Branching Fraction
Aubert, B.; Aug. 16, 2004; In English
Report No.(s): DE2004-829777; SLAC-PUB-10643; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Mesons; Neutral Particles

20050111552 Stanford Linear Accelerator Center, CA, USA
Study of (bar B)(sup 0) --\g D(*)(sup 0) (bar K)(*)(sup 0) Decays
Aubert, B.; Aug. 2004; In English
Report No.(s): DE2004-829776; SLAC-PUB-10642; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Particle Decay; Mesons; Neutral Particles

20050111554 Stanford Linear Accelerator Center, CA, USA
Measurements of Branching Fraction, Polarization, and Direct CP-Violating Asymmetry in B(sup +) --\g K*(sup 0) (rho)(sup +) Decays
Aubert, B.; Aug. 2004; In English
Report No.(s): DE2004-829775; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Asymmetry; CP Violation; Polarization; Particle Decay; Mesons

20050111555 Grenoble-1 Univ., Annecy, France, Bari Univ., Italy, Academia Sinica, Beijing, China, Bergen Univ., Norway
Study of e(sup +)e(sup -) --\g (pi)(sup +)(pi)(sup -)(pi)(sup 0) Process Using Initial State Radiation with BaBar
Aubert, B.; Barate, R.; Boutigny, D.; Palano, A.; Chen, J. C.; 2004; In English
Report No.(s): DE2004-829758; SLAC-PUB-10624; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Radial Distribution; Electron Acceleration; Electron Irradiation

20050111556 Stanford Linear Accelerator Center, CA, USA
Searches for Charmless Decays B0 --\g eta omega, B0 --\g eta K0, B+ --\g eta rho+, and B+ --\g eta' pi+
Aubert, B.; Aug. 31, 2004; In English
Report No.(s): DE2004-829779; SLAC-PUB-10645; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Mesons; Particle Decay

20050111558 Birmingham Univ., UK
Measurement of the CKM Angles (alpha) and (gamma) at the BaBar Experiment
Ford, K. E.; Jun. 2004; In English
Report No.(s): DE2004-829729; SLAC-PUB-10579; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Matrices (Mathematics); Analyzers

20050111559 California Univ., Riverside, CA, Stanford Linear Accelerator Center, CA, USA, Oregon Univ., Eugene, OR, USA, Wisconsin Univ., Madison, WI, USA
Gas System Upgrade for the BaBar IFR Detector at SLAC
Foulkes, S.; Gary, J. W.; Shen, B. C.; Wang, K.; Boyce, R.; Jul. 2004; 18 pp.; In English
Report No.(s): DE2004-829718; SLAC-PUB-10471; No Copyright; Avail: Department of Energy Information Bridge
A new gas distribution and monitoring system was installed as part of an upgrade of the forward endcap muon detection system (IFR) of the BaBar detector at SLAC. Over 300 gas circuits are controlled and monitored. The return gas flow is monitored by digital bubblers which use photo-gate electronics to count the bubbling rate. The rates are monitored in real time

and recorded in a history database allowing studies of flow rate versus chamber performance.
NTIS
Gas Flow; Gas Analysis; Real Time Operation

20050111561 Princeton Univ., NJ
Three-Dimensional Simulation of Gas Conductance Measurement Experiments on Alcator C-Mod
Stotler, D. P.; LaBombard, B.; Jun. 2004; 18 pp.; In English
Report No.(s): DE2004-828038; PPPL-3964; No Copyright; Avail: Department of Energy Information Bridge
Three-dimensional Monte Carlo neutral transport simulations of gas flow through the Alcator C-Mod subdivertor yield conductances comparable to those found in dedicated experiments. All are significantly smaller than the conductance found with the previously used axisymmetric geometry. A benchmarking exercise of the code against known conductance values for gas flow through a simple pipe provides a physical basis for interpreting the comparison of the three-dimensional and experimental C-Mod conductances.
NTIS
Three Dimensional Models; Gas Flow; Gas Analysis

20050111562 Stanford Linear Accelerator Center, CA, USA
Beam-beam Simulation Studies for PEP-II and KEKB
Tawada, M.; Cai, Y.; Ohmi, K.; Qiang, J.; 2003; In English
Report No.(s): DE2004-826637; SLAC-PUB-10301; No Copyright; Avail: National Technical Information Service (NTIS)
The study issues for this project are: (1) Comparison of 3D PIC beam-beam simulation code; (2) Comparison of 2D PIC beam-beam simulation code; (3) Comparison between 2D PIC solver and exact Gauss solution in Weak-Strong simulation; (4) Comparison between head-on collision and xangle+crab cavity by KEK code; (5) Crossing angle dependence of luminosity for PEP-II and KEKB parameter; and (6) Tune scan for PEP-II by using weak-strong code at the crossing angle of 0, 3, 5 mrad.
NTIS
Beams (Radiation); Computerized Simulation; Crossings

20050111566 Stanford Linear Accelerator Center, Stanford, CA, USA, Granada Univ., Spain
Signatures of Long-lived Gluinos in Split Supersymmetry
Hewett, J. L.; Lillie, B.; Masip, M.; Rizzo, T. G.; 2004; In English
Report No.(s): DE2004-829764; SLAC-PUB-10630; No Copyright; Avail: National Technical Information Service (NTIS)
The authors examine the experimental signatures for the production of gluinos at colliders and in cosmic rays within the split supersymmetry scenario. Unlike in the MSSM, the gluinos in this model are relatively long-lived due to the large value of the squark masses which mediate their decay. Searches at colliders are found to be sensitive to the nature of gluino fragmentation as well as the gluino-hadron interactions with nuclei and energy deposition as it traverses the detector. They find that the worst-case scenario, where a neutral gluino-hadron passes through the detector with little energy deposition, is well described by a monojet signature. In the opposite case, where a charged gluino-hadron travels through the detector, a significantly greater reach is obtained via stable charged particle search techniques. The authors also examine the production of gluino pairs in the atmosphere by cosmic rays and show they are potentially observable at IceCube; this would provide a cross-check for observations at hadron colliders.
NTIS
Standard Model (Particle Physics); Supersymmetry

20050111567 Stanford Linear Accelerator Center, Stanford, CA, USA
Low Field Accelertor Structure Couplers and Design Techniques
Nantista, C.; Tantawi, S.; Dolgashev, V.; Jul. 2004; In English
Report No.(s): DE2004-829727; SLAC-PUB-10575; No Copyright; Avail: National Technical Information Service (NTIS)
Recent experience with X-band accelerator structure development has shown the rf input coupler to be the region most prone to rf breakdown and degradation, effectively limiting the operating gradient. A major factor in this appears to be high magnetic fields at the sharp edges of the coupling irises. As a first response to this problem, couplers with rounded and thickened iris horns have been employed and successfully tested at high power. To further reduce fields for higher power flow, conceptually new coupler designs have been developed, in which power is coupled through the broadwall of the feed waveguide, rather than through terminating irises. A ‘mode launcher’ coupler, which launches the TM(sub 01) mode in circular

waveguide before coupling through a matching cell into the main structure, has been tested with great success. With peak surface fields below those in the body of the structure, this coupler represented a break-through in the NLC structure program. The design of this coupler and of variations which use beamline space more efficiently are described here. The latter include a coupler in which power passes directly through an iris in the broad wall of the rectangular waveguide into a matching cell, also successfully implemented, and a variation which makes the waveguide itself an accelerating cell. The authors also discuss in some detail a couple of techniques for matching such couplers to travelling-wave structures using a field solver. The first exploits the cell number independence of a travelling-wave match, and the second optimizes using the fields of an internally driven structure.
NTIS
Linear Accelerators; Magnetic Fields; Radio Frequencies

20050111574 Technion - Israel Inst. of Tech., Haifa, Israel, Stanford Linear Accelerator Center, Stanford, CA, USA, California Univ., Santa Cruz, CA, USA
Beyond the Standard Model with a B and K Physics
Grossman, Y.; Oct. 2003; In English
Report No.(s): DE2004-826523; SLAC-PUB-10205; No Copyright; Avail: National Technical Information Service (NTIS)
In the first part of the talk the flavor physics input to models beyond the standard model is described. One specific example of such new physics model is given: A model with bulk fermions in a non factorizable one extra dimension. In the second part of the talk we discuss several observables that are sensitive to new physics. We explain what type of new physics can produce deviations from the standard model predictions in each of these observables.
NTIS
Fermions; Mathematical Models

20050111576 Johns Hopkins Univ., Baltimore, MD, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Weizmann Inst. of Science, Rehovot, Israel
Comments on Extracting alpha from B to rho rho
Falk, A. F.; Ligeti, Z.; Nir, Y.; Quinn, H.; 2003; 16 pp.; In English
Report No.(s): DE2004-826521; SLAC-PUB-10199; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Alpha Decay; Selection Rules (Nuclear Physics)

20050111586 Stanford Linear Accelerator Center, Stanford, CA, USA
Measurement of the Branching Fractions for the Decays B(sup 0)--\gD*(sup -) p(bar p)(pi)(sup +), B(sup 0)--\gD(sup -)p(bar p)(pi)(sup +), B0--\gD*(sup 0) p(bar p) and B(sup 0)--\gD(sup 0) p(bar p)
Aug. 2004; In English
Report No.(s): DE2004-829766; SLAC-PUB-10610; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Baryons; Mesons; Particle Decay

20050111589 Stanford Linear Accelerator Center, Stanford, CA, USA
D+ --\g K-K+pi+ Meson Decays: A Search for CP Violation and a Measurement of the Branching Ratio
Yumiceva, F.; Aug. 2004; 20 pp.; In English
Report No.(s): DE2004-829798; SLAC-PUB-10675; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
CP Violation; Mesons; Particle Decay

20050111590 Stanford Linear Accelerator Center, Stanford, CA, USA
Measurement of CP Violating Asymmetries in B(sup 0) --\g f(sup 0)(980)Ks Decays
Aubert, B.; Jul. 2004; In English
Report No.(s): DE2004-829774; SLAC-PUB-10640; No Copyright; Avail: National Technical Information Service (NTIS)
The authors have presented an updated preliminary measurement of the CP-violating asymmetries in B(sup 0) --\g f(sub 0)(980)(--\g (pi)(sup +)(pi)(sup -))K(sub s)(sup 0) decays. Their results for S and C are consistent with the Standard Model.

The hypothesis of no mixing-induced CP violation is excluded at the 2. 3(sigma) level.
NTIS
Mesons; CP Violation

20050111591 Stanford Linear Accelerator Center, Stanford, CA, USA
Measurement of CP-Asymmetries for the Decays B(sup (+-)) --\g D(sub CP)(sup 0) K*(sup (+-)) with the BABAR Detector
Aubert, B.; Aug. 2004; In English
Report No.(s): DE2004-829773; SLAC-PUB-10639; No Copyright; Avail: National Technical Information Service (NTIS)
The authors present preliminary observations of the decays of charged B mesons to a K* and a D(sup 0) where the latter particle is seen in final states of even and odd CP. They express the results in terms of R(sub CP) and A(sub CP). With more statistics, these quantities will constrain (tau)(sub B), the ratio of amplitudes defined in equations provided and the angle (gamma) of the unitary triangle by application of the Gronau-London-Wyler method.
NTIS
Asymmetry; Mesons

20050123555 Stanford Linear Accelerator Center, Stanford, CA, USA
Energy Deposition Using EGS4
Sheppard, J. C.; Apr. 2002; 20 pp.; In English
Report No.(s): DE2004-826504; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Electron Beams; Beam Switching

20050123556 Stanford Linear Accelerator Center, Stanford, CA, USA
Design Studies for Flux and Polarization Measurements of Photons and Positrons for SLAC Proposal E166: An Experiment to Test Polarized Positron Production in the FFTB
Woods, M.; Batygin, Y.; Moffeit, K. C.; Sheppard, J. C.; Nov. 2002; In English
Report No.(s): DE2004-826486; LCC-0107; No Copyright; Avail: National Technical Information Service (NTIS)
We present results from design studies carried out to investigate measurements of the flux, spectrum and polarization of undulator photons for SLAC Proposal E166. A transmission Compton polarimeter is considered for measuring the photon circular polarization. We also present results for measuring the flux and spectrum of positrons produced by the undulator photons in an 0. 5X(sub 0) Titanium target. And we present some considerations for use of a transmission Compton polarimeter to measure the circular polarization of bremsstrahlung photons emitted by the polarized positrons in a thin radiator.
NTIS
Design; Photons; Polarization

20050123557 Stanford Linear Accelerator Center, Stanford, CA, USA, College of William and Mary, Williamsburg, VA, USA, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Minnesota Univ., Duluth, MN, USA
Single-Spin Polarization Effects and the Determination of Timelike Proton Form Factors
Brodsky, S. J.; Carlson, C. E.; Hillller, J. R.; Hwang, D. S.; Oct. 2003; In English
Report No.(s): DE2004-826470; SLAC-PUB-10216; No Copyright; Avail: National Technical Information Service (NTIS)
We show that measurements of the proton's polarization in e(sup +)e(sup -) (yields) p(bar p) strongly discriminate between analytic forms of models which fit the proton form factors in the spacelike region. In particular, the single-spin asymmetry normal to the scattering plane measures the relative phase difference between the timelike G(sub E) and G(sub M) form factors. The expected proton polarization in the timelike region is large, of order of several tens of percent.
NTIS
Protons; Asymmetry; Mathematical Models

20050123558 Stanford Linear Accelerator Center, Stanford, CA, USA, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel, Rutgers - The State Univ., Piscataway, NJ, USA
Hard Photodisintegration of a Proton Pair in 3He
Brodsky, S. J.; Frankfurt, L.; Gilman, R.; Hiller, J. R.; May 2003; In English
Report No.(s): DE2004-826447; SLAC-PUB-9854; No Copyright; Avail: National Technical Information Service (NTIS)

Hard photodisintegration of the deuteron has been extensively studied in order to understand the dynamics of the transition from hadronic to quark-gluon descriptions of the strong interaction. In this work, we discuss the extension of this program to hard photodisintegration of a pp pair in the (sup 3)He nucleus. Experimental confirmation of new features predicted here for the suggested reaction would advance our understanding of hard nuclear reactions. A main prediction, in contrast with low-energy observations, is that the pp breakup cross section is not much smaller than the one for pn break up.In some models, the energy-dependent oscillations observed for pp scattering are predicted to appear in the (gamma)(sup 3)He to pp + n reaction. Such an observation would open up a completely new field in studies of color coherence phenomena in hard nuclear reactions. We also demonstrate that, in addition to the energy dependence, the measurement of the light-cone momentum distribution of the recoil neutron provides an independent test of the underlying dynamics of hard disintegration. NTIS

Deuterons; Protons; Cross Sections

20050123574 Stanford Linear Accelerator Center, Stanford, CA, USA

Search for the Decay B(sup 0) Yields K*(sup +)(rho)(sup -)

Aubert, B.; Aug. 2004; 20 pp.; In English

Report No.(s): DE2004-829771; SLAC-PUB-10636; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

Decay; Annihilation Reactions

20050123577 Stanford Linear Accelerator Center, CA, USA

B0 --\g K+ pi- pi0 Dalitz Plot Analysis

Yu, Z.; Aug. 2004; In English

Report No.(s): DE2004-829770; SLAC-PUB-10634; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available

Particle Decay; Mesons

20050123583 Stanford Linear Accelerator Center, Stanford, CA, USA

Search for D(sub (sJ))(2632) at BaBar

Aug. 2004; In English

Report No.(s): DE2004-829769; SLAC-PUB-10633; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available

Charm (Particle Physics); Mesons

20050123585 Stanford Linear Accelerator Center, Stanford, CA, USA

Measurement of the Ratio of Branching Fractions of Xic0 Decays to Xi- pi+ and to Omega- K+

Aug. 2004; In English

Report No.(s): DE2004-829768; SLAC-PUB-10632; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available

Particle Production; Particle Decay

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20050110224 NASA Langley Research Center, Hampton, VA, USA

Model-Scale Aerodynamic Performance Testing of Proposed Modifications to the NASA Langley Low Speed Aeroacoustic Wind Tunnel

Booth, Earl R., Jr.; Coston, Calvin W., Jr.; March 2005; 21 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WU 23-781-30-12

Report No.(s): NASA/TM-2005-213534; L-19093; No Copyright; Avail: CASI; A03, Hardcopy

Tests were performed on a 1/20th-scale model of the Low Speed Aeroacoustic Wind Tunnel to determine the performance effects of insertion of acoustic baffles in the tunnel inlet, replacement of the existing collector with a new collector design in

the open jet test section, and addition of flow splitters to the acoustic baffle section downstream of the test section. As expected, the inlet baffles caused a reduction in facility performance. About half of the performance loss was recovered by addition the flow splitters to the downstream baffles. All collectors tested reduced facility performance. However, test chamber recirculation flow was reduced by the new collector designs and shielding of some of the microphones was reduced owing to the smaller size of the new collector. Overall performance loss in the facility is expected to be a 5 percent top flow speed reduction, but the facility will meet OSHA limits for external noise levels and recirculation in the test section will be reduced. Author

Aeroacoustics; Low Speed Wind Tunnels; Scale Models; Wind Tunnel Tests; Jet Aircraft Noise

20050110347 Naval Postgraduate School, Monterey, CA USA

Estimation of Geoacoustic Properties in the South China Sea Shelf Using a Towed Source and Vertical Line Hydrophone Array

Marburger, John M.; Dec. 2004; 49 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429832; No Copyright; Avail: Defense Technical Information Center (DTIC)

Linear sound sweeps from a towed J15-3 sound source were collected at a moored VLA hydrophone array in the South China Sea during the ASIAEX experiment in May 2001. Measured signals were filtered and pulse compressed. The processed data showed a high signal to noise ratio. Given an a priori chirp sonar survey, a two layer bottom first guess model was constructed. A broadband coupled-mode model was used to perform an exhaustive frequency variant sensitivity study of VLA pressures to changes in bottom properties as a basis for the geoacoustic inverse problem. Study results provided information on the observability of the various geoacoustic parameters and a procedure for the inversion. Matched field processing of the VLA data, using the same coupledmode model, was then performed to calculate ambiguity diagrams from which geoacoustic parameter estimates were obtained. Since VLA pressure fields were not sensitive to changes in the sediment attenuation coefficient, a matched field technique that correlated the slope of modeled transmission loss to the negative slope of 10log of the observed energy was performed in order to obtain estimates of the attenuation. These estimates showed a frequency dependent attenuation coefficient in the 50-600Hz frequency band.

DTIC

Acoustic Measurement; Arrays; China; Estimates; Hydrophones; Seas

20050110371 Naval Postgraduate School, Monterey, CA USA

The U.S. Navy Submarine Hydrodynamics/ Hydroacoustic Community: A Case Study in Strategic Planning for a Decentralized, Multi-Organizational, Military Community

Stout, Margaret C.; Dec. 2004; 160 pp.; In English; Original contains color illustrations

Report No.(s): AD-A429872; No Copyright; Avail: Defense Technical Information Center (DTIC)

The USA Navy Submarine Hydrodynamic/Hydroacoustic community is a decentralized, multi-organizational, geographically distributed enterprise. Strategic planning and management, whether formal or ad hoc, is necessary for effective functioning of any organization. However, formal strategic planning is particularly difficult in multi-organizational, geographically diverse enterprises. Enterprise-wide performance measurement and a shared understanding of enterprise performance is necessary to devise compelling and effective strategies. During the Cold War, the U.S. Navy submarine force had a clear mission and compelling goals, with resulting clarity on performance metrics. The Submarine Hydrodynamic/ Hydroacoustic workforce was focused on helping the submarine force achieve these goals. In the post-Cold War era, the submarine force mission in the integrated battle space is less defined. The percentage of the military budget that can be spent on discretionary spending is decreasing. The Submarine Hydrodynamics/Hydroacoustic community has been directly impacted by the recent lack of focus and budget reductions. The purpose of this thesis is to research the past processes used to perform strategic planning for the Submarine Hydrodynamic/Hydroacoustic community, identify current strategic issues for the community, and document strategic lessons learned that can be identified through the evaluation of product successes and failures.

DTIC

Hydrodynamics; Management Planning; Navy; Submarines; Underwater Acoustics

20050110402 Planning Systems, Inc., Reston, VA USA

Using Adaptive Simulated Annealing to Estimate Ocean Bottom Acoustic Properties from Acoustic Data

Neumann, Peter D.; Muncill, Gregory; Sep. 2004; 137 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-C-0087

Report No.(s): AD-A429917; No Copyright; Avail: Defense Technical Information Center (DTIC)

Report developed under SBIR contract for topic N99-217. The effective use of active sonar systems in littoral environments relies on the accurate knowledge of the acoustic environment. This Phase II SBIR provides a solution to the problem of estimating the local, in-situ geoacoustic properties of the ocean bottom from measured acoustic data. The approach used in the Phase I and Phase II SBIR has been to use Navy standard models for transmission loss and reverberation prediction paired with the Adaptive Simulated Annealing (ASA) algorithm. The use of the ASA algorithm, first tested under the Phase I SBIR, produced significantly reduced run times compared to other variations of simulated annealing. The ASA based inversion software is now called GAIT GS (geoacoustic Inversion Toolkit - Global Search) and PMW-150 has been funding its transition into an OAML product since FY 02. The current software includes ASTRAL 5.1, PE 5.1 and ASPM 5.1 with plans to add Nautilus 1.0 in FY 05. A report from the GAIT V&V committee is expected in late 2004 summarizing the results of their extensive testing of GAIT GS inversion results. Future plans include an extension to inversion of bistatic and multistatic reverberation data.
DTIC
Acoustic Properties; Annealing; Ocean Bottom; Simulated Annealing

20050110415 Washington Univ., Seattle, WA USA
DRI internal Wave Simulations
Reynolds, Stephen A.; Levine, Murray D.; Jan. 2005; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-G-0001
Report No.(s): AD-A429940; APL-UM-TM-5-04; No Copyright; Avail: Defense Technical Information Center (DTIC)
The ocean is a stratified medium and thus filled with internal gravity waves. Even though the statistics of these fluctuations are fairly well known, these waves fluctuate randomly and hence represent true uncertainty. When an acoustic prediction is needed for an ocean region, knowledge of the background sound speed profile is an additional uncertainty. A processing module is developed that takes profile estimates as input and uses numerically simulated linear internal wave displacements to create two-dimensional range-dependent sound speed fields. These fields are available for use in acoustic modeling and target estimation studies. Field realizations were obtained for four ocean regions. These examples illustrate variability induced by internal waves and how this variability may be useful in some important ways.
DTIC
Internal Waves; Simulation; Underwater Acoustics

20050110569 Oregon State Univ., Corvallis, OR USA
Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES)
Miller, Robert N.; Abbot, Philip; Robinson, Allan; Feb. 2005; 3 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0821
Report No.(s): AD-A430211; N0150A; No Copyright; Avail: CASI; A01, Hardcopy
The objective of this phase of the project was to characterize the transfer of uncertainties from the acoustic environment to the sonar and its signal processing in probabilistic terms. This involved construction, calibration, and evaluation of uncertainty and variability models for the system and its components. It also involved developing generic methods for efficiently and simply characterizing, parameterizing, and prioritizing variabilities in the end-to-end system (ETES) and uncertainties arising from regional scales and processes. The authors applied a model ETES of modular design to investigate the combined effect of mesoscale structure and short-wavelength internal waves on acoustic transmission loss at low to moderate frequencies in the coastal environment. As a first guess, they viewed the internal wave field as being superimposed on the mesoscale field. Since these two fields can be expected to interact physically as well as acoustically, a proper simulation would account for exchange of energy, momentum, and heat between the mesoscale field and the small-scale internal wave field. The modular design of their prototype ETES system allows them to make incremental but steady progress by increasing the complexity and level of detail represented in each component of the model. In their study of uncertainty due to a random internal wave field, they found that some very small-scale features show differences of the order of 10db between the perturbed and unperturbed cases. The effect of the perturbation on the ray structure is particularly evident in shorter wavelength cases. The differences in the range-averaged transmission losses are smaller, typically a few db at 25Hz, but fields obtained by slightly different methods of range averaging can also differ by a few db.
DTIC
End-to-End Data Systems; Internal Waves; Regions; Signal Processing; Sonar; Transmission Loss

20050111483 Helsinki Univ. of Technology, Espoo, Finland

Aspects in Analysis and Model-Based Sound Synthesis of Plucked String Instruments

Erkut, C.; Oct. 2002; 66 pp.; In English

Report No.(s): PB2005-103593; Copyright; Avail: National Technical Information Service (NTIS)

This thesis consists of an introduction and nine articles. The general framework of the articles is the analysis and synthesis of plucked string instruments. The articles document acoustical analysis and model-based sound synthesis of the tanbur, the kantele, the lute, and the ud that are all traditional or historical plucked string instruments. In addition, the author's contributions to the development of an integrated model-based plucked string synthesis system is presented. As a key study, the integrated system concentrates on model-based sound synthesis of the acoustic guitar. However, the sound synthesis models of other plucked string instruments are also implemented within the system. Finally, two alternative techniques that can be used in model-based sound synthesis are covered. The first technique focuses on the loop filter design based on a polynomial damping model. The second technique presents a synthesis model based on finite differences that can be used in real-time sound synthesis.

NTIS

Acoustics; Synthesis; Systems Integration; Real Time Operation

20050111539 NASA Langley Research Center, Hampton, VA, USA

High Speed Research Program Structural Acoustics Multi-Year Summary Report

Beier, Theodor H.; Bhat, Waman V.; Rizzi, Stephen A.; Silcox, Richard J.; Simpson, Myles A.; March 2005; 61 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WU 537-06-37-20

Report No.(s): NASA/TM-2005-213536; L-19087; No Copyright; Avail: CASI; A04, Hardcopy

This report summarizes the work conducted by the Structural Acoustics Integrated Technology Development (ITD) Team under NASA's High Speed Research (HSR) Phase II program from 1993 to 1999. It is intended to serve as a reference for future researchers by documenting the results of the interior noise and sonic fatigue technology development activities conducted during this period. For interior noise, these activities included excitation modeling, structural acoustic response modeling, development of passive treatments and active controls, and prediction of interior noise. For sonic fatigue, these activities included loads prediction, materials characterization, sonic fatigue code development, development of response reduction techniques, and generation of sonic fatigue design requirements. Also included are lessons learned and recommendations for future work.

Author

Acoustics; Research and Development; Civil Aviation; Supersonic Wind Tunnels

20050123604 NASA Langley Research Center, Hampton, VA, USA

Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis

Nguyen, Duc T.; Tungkahotara, Siroj; Watson, Willie R.; Rajan, Subramaniam D.; Journal of Computational and Applied Mechanics; 2005; Volume 4, No. 2, pp. 189-201; In English

Contract(s)/Grant(s): NAG1-01033; Copyright; Avail: Other Sources

A domain decomposition (DD) formulation for solving sparse linear systems of equations resulting from finite element analysis is presented. The formulation incorporates mixed direct and iterative equation solving strategics and other novel algorithmic ideas that are optimized to take advantage of sparsity and exploit modern computer architecture, such as memory and parallel computing. The most time consuming part of the formulation is identified and the critical roles of direct sparse and iterative solvers within the framework of the formulation are discussed. Experiments on several computer platforms using several complex test matrices are conducted using software based on the formulation. Small-scale structural examples are used to validate thc steps in the formulation and large-scale (l,000,000+ unknowns) duct acoustic examples are used to evaluate the ORIGIN 2000 processors, and a duster of 6 PCs (running under the Windows environment). Statistics show that the formulation is efficient in both sequential and parallel computing environmental and that the formulation is significantly faster and consumes less memory than that based on one of the best available commercialized parallel sparse solvers.

Author

Acoustic Measurement; Decomposition; Finite Element Method; Parallel Processing (Computers); Algorithms; Structural Analysis

20050123656 NASA Langley Research Center, Hampton, VA, USA

Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics

Watson, W. R.; Nguyen, D. T.; Reddy, C. J.; Vatsa, V. N.; Tang, W. H.; September 2001; 10 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

An algorithm for symmetric sparse equation solutions on an unstructured grid is described. Efficient, sequential sparse algorithms for degree-of-freedom reordering, supernodes, symbolic/numerical factorization, and forward backward solution phases are reviewed. Three sparse algorithms for the generation and assembly of symmetric systems of matrix equations are presented. The accuracy and numerical performance of the sequential version of the sparse algorithms are evaluated over the frequency range of interest in a three-dimensional aeroacoustics application. Results show that the solver solutions are accurate using a discretization of 12 points per wavelength. Results also show that the first assembly algorithm is impractical for high-frequency noise calculations. The second and third assembly algorithms have nearly equal performance at low values of source frequencies, but at higher values of source frequencies the third algorithm saves CPU time and RAM. The CPU time and the RAM required by the second and third assembly algorithms are two orders of magnitude smaller than that required by the sparse equation solver. A sequential version of these sparse algorithms can, therefore, be conveniently incorporated into a substructuring for domain decomposition formulation to achieve parallel computation, where different substructures are handles by different parallel processors.

Author

Aeroacoustics; Algorithms; Matrices (Mathematics); Unstructured Grids (Mathematics)

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20050109846 Forschungszentrum Karlsruhe G.m.b.H., Karlsruhe, Germany

Dismantling of the Upper RPV Components of the Karlsruhe Multi-Purpose Research Reactor (MZFR), Germany

Prechtl, E.; Suebdorf, W.; 2003; 12 pp.; In English

Report No.(s): DE2004-827060; No Copyright; Avail: Department of Energy Information Bridge

The Multi-purpose Research Reactor was a pressurized-water reactor cooled and moderated with heavy water. It was built from 1961 to 1966 and went critical for the first time on 29 September 1965. After nineteen years of successful operation, the reactor was de-activated on 3 May 1984. The reactor had a thermal output of 200 MW and an electrical output of 50 MW. The MZFR not only served to supply electrical power, but also as a test bed for: - research into various materials for reactor building (e. g. zirkaloy), - the manufacturing and operating industry to gain experience in erection and operation, - training scientific and technical reactor staff, and - power supply (first nuclear combined-heat-and-power system, 1979-1984). The experience gained in operating the MZFR was very helpful for the development and operation of power reactors. At first, safe containment and enclosure of the plant was planned, but then it was decided to dismantle the plant completely, step by step, in view o f the clear advantages of this approach. The decommissioning concept for the complete elimination of the plant down to a green-field site provides for eight steps. A separate decommissioning license is required for each step. As part of the dismantling, about 72,000 Mg (metric tons) of concrete and 7,200 Mg of metal (400 Mg RPV) must be removed. About 700 Mg of concrete (500 Mg biological shield) and 1300 Mg of metal must be classified as radioactive waste.

NTIS

Pressurized Water Reactors; Radioactive Wastes; Liquid Cooling; Heavy Water

20050110339 California Inst. of Tech., Pasadena, CA USA

Femtosecond Real-Time Probing of Energetic Reactions: Complex Organics and Advanced Techniques

Zewail, Ahmed H.; Jan. 2005; 9 pp.; In English

Contract(s)/Grant(s): N00014-97-1-0901

Report No.(s): AD-A429816; No Copyright; Avail: CASI; A02, Hardcopy

The research was focused on two major areas. The first area is the advancement of new techniques to elucidate elementary steps of reactions in complex molecular systems. In the second area, the effort was on the applications of these techniques to: (i) the studies of reactive intermediates of energetic reactions, and (ii) the dynamics of prototype molecular explosives. We have succeeded in advancing the new techniques for the studies of structure and dynamics of highly-excited and energetic

molecules, and the progress in theoretical and experimental studies has been published in a series of papers.
DTIC
Molecular Structure; Real Time Operation

20050110420 Illinois Univ. at Urbana-Champaign, Urbana, IL USA
Ultrafast Spectroscopy of Energetic Materials: Toward a Molecular Understanding of Impact Sensitivity
Dlott, Dana D.; Jan. 2005; 8 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0036
Report No.(s): AD-A429950; ARO-40444.26-CH; No Copyright; Avail: Defense Technical Information Center (DTIC)

We have progress to report in three areas: (1) fast vibrational spectroscopy of nanoenergetic material ignition; (2) ultrafast surface spectroscopy; (3) 3D spectroscopy of ultrafast vibrational energy transfer. The original goals of this project have not changed, however we have extended our work to include nanotechnology energetic materials. We developed a fast laser-ignition technique for these materials and have successfully probed the time and space dependence of chemistry of Al+ oxidizer systems. Using vibrational sum-frequency generation (SFG) we have probed the structure of shock fronts with 1.5 Angstrom resolution. With 3D spectroscopy we have studied vibrational energy transfer in water and for the first time we have been able to watch vibrational energy flow across the interface between a molecular nanostructure and its surroundings.
DTIC
Impact Resistance; Spectroscopy

20050110442 Princeton Scientific Instruments, NJ USA
Silicon-Based Visible/Near-Infrared Affordable Missile Warning
Lowrance, John; Miles, Richard; Jan. 2005; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-M-0308
Report No.(s): AD-A429984; No Copyright; Avail: Defense Technical Information Center (DTIC)

The concept of the refluorescent atomic filter is shown in figure 2. Only photons at the resonant frequency of the atomic transition line are absorbed; all other photons pass through the cell without interference. If the atomic vapor is optically thick on the resonance absorption line, then photons absorbed by the atoms are trapped within the optical depth the entrance window of the cell. This trapping occurs at the same wavelength independent of the angle at which the photons arrive. In the absence of quenching. these photons undergo a random walk as they are absorbed and entitled the potassium atoms.
DTIC
Atomic Spectra; Missiles; Near Infrared Radiation; Photons; Warning Systems

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

20050109886 NASA Marshall Space Flight Center, Huntsville, AL, USA
RF Stabilization for Storage of Antiprotons
Pearson, J. Boise; Lewis, Raymond A.; [2005]; 1 pp.; In English; Space Technology and Applications International Forum, 13-17 Feb. 2005, Albuquerque, NM, USA; Copyright; Avail: Other Sources; Abstract Only

Portable storage of antimatter is an important step in the experimental exploration of antimatter in propulsion applications. The High Performance Antiproton Trap (HiPAT) at NASA Marshall Space Flight Center is a Penning-Malmberg ion trap being developed to trap and store low energy antiprotons for a period of weeks. The antiprotons can then be transported for use in experiments. HiPAT is being developed and evaluated using normal matter, before an attempt is made to store and transport antiprotons. Stortd ions have inherent instabilities that limit the storage lifetime. RF stabilization at cyclotron resonance frequencies is demonstrated over a period of 6 days for normal matter ion clouds. A variety of particles have been stored, including protons, C+ ions, and H2+ ions. Cyclotron resonance frequencies are defined and experimental evidence presented to demonstrate excitation of cyclotron waves in the plasma for all three species of ions.
Author
Radio Frequencies; Ion Traps (Instrumentation); Ion Storage

20050110417 Spectra Research Systems, Inc., Newport Beach, CA USA
Novel Techniques for the Production of Gamma Rays
Roberts,; Jun. 2004; 14 pp.; In English
Contract(s)/Grant(s): FA9550-04-C-0006; Proj-2301
Report No.(s): AD-A429944; AFRL-SR-AR-TR-05-0022; No Copyright; Avail: CASI; A03, Hardcopy

Important fundamental research over the past two decades has proven that the energy stored in metastable energy states of some nuclear isomers can be caused to be released from the isomer state by illuminating the nucleus with x-rays. Research ha proven that the long-lived naturally abundant isomer of t8OTa can be triggered to release the stored energy by irradiation with Bremsstrahlung x-irradiation. An understanding of this phenomenon within the standard model has now emerged, placing the physics of triggered energy release from isomer states upon a strong experimental and theoretical basis. The data from the March 2001 Bum-up experiment has now been fully analyzed. No bum-up duc to xynchrotron radiation was detected in this experiment due to both experimental limitations and the unlikelihood of ever observing bum-up in the Hf-i78m2 system for triggering enhancements of less than 10%. We suggest looking at alterative isomer systems with shorter half-lives, such as the Lu-I77m isomer.
DTIC
Energy Storage; Gamma Rays

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20050092413 Swedish Defence Research Establishment, Linkoeping
Database of Material Properties for Optical Signature Modelling
Nelsson, C.; Forssell, G.; Hermansson, P.; Hhekn, A.; Hedborg-Karlsson, E.; Jun. 2004; In English
Report No.(s): PB2005-101904; FOI-R-1257-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes a database for material properties that has been measured by FOI Sensor Technology or its partners. The database does not contain the data itself but a list of the data available. It includes file information (file names, dates etc), information about the measurement object and information about the data (type of data, spectral range, etc). The database can be used to search for data with certain properties, for example wavelength range, paint type etc. At a first stage about 400 measurements will be registered in the database. As new data is obtained at FOI Sensor Technology the database will be extended. The report contains a background on optical signature modeling and the need for data. There is also a background on optical and thermal properties of materials given. The fields of the database are presented as well as suggestions for a procedure to maintain good quality. Finally conversion programs are discussed.
NTIS
Optical Properties; Signatures; Thermodynamic Properties

20050109938 Pennsylvania State Univ., University Park, PA, USA
Efficient MoM Analysis of Polarization Selective Surfaces Using Trefoil Knot Arrays
Hagen, J. v; Mittra, R.; Werner, D. H.; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1202-1205; In English; See also 20050109927; Copyright; Avail: Other Sources

The electromagnetic properties of (p, q) torus knots consisting of perfectly conducting thin wires were investigated in. The Trefoil knot has the unique property that its forward scattering characteristics depend on the handedness of an incident circularly polarized wave. This property is conserved when placing the knots in an array. In this paper, we describe an efficient Method of Moments (MoM) approach that is especially suited for the analysis of arrays comprised of these knots. In MoM, solving the linear system of equations is the most time consuming part when the number of unknowns becomes large. For certain classes of problems, the use of preconditioning techniques allows us to reduce the solve time considerably. Array-type of structures can be efficiently analyzed when using the block-LU preconditioner, as outlined in Sec. 2. Also in Sec. 2, we present the spectral radius as a criterion for assessing the convergence of the method. Finally, in Sec. 3, we apply the block-LU method to investigate the electromagnetic scattering properties of a medium sized array of trefoil knots.
Author
Method of Moments; Polarization (Charge Separation); Electromagnetic Properties

20050109946 Hosei Univ., Tokyo, Japan

Theoretical and Experimental Investigations on Focusing Properties of the Fresnel Zone Lens and Plate

Yamauchi, Junji; Nakano, Hisamatsu; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 746-749; In English; See also 20050109927; Copyright; Avail: Other Sources

Research on a Fresnel zone lens and plate has a long history. In this article, we discuss focusing properties of conducting and dielectric cylinders that are placed on the basis of the Fresnel zone principle. The radiation patterns when the cylinders are excited with an isotropic source are evaluated using the boundary element method. Helix antennas combined with a Fresnel zone plate (FZP) are also reported. Enhanced gain characteristics are experimentally demonstrated.

Derived from text

Antenna Radiation Patterns; Fresnel Lenses; Dielectrics; Boundary Element Method

20050110214 NASA Marshall Space Flight Center, Huntsville, AL, USA

Slow and Fast Light in Coupled Microresonators

Chang, Hongrok; Smith, David D.; Fuller, Kirk A.; Dimmock, John O.; Gregory, Don A.; Frazier, Donald O.; [2005]; 1 pp.; In English; The International Society for Optical Engineering Photomic West Conference, 22-27 Jan. 2005, San Jose, CA, USA; Copyright; Avail: Other Sources; Abstract Only

We predict the propagation of slow and fast light in two co-resonant coupled optical resonators. In coupled resonators, slow light can propagate without attenuation by a cancellation of absorption as a result of mode splitting and destructive interference, whereas transparent fast light propagation can be achieved by the assistance of gain and splitting of the intracavity resonances, which consequently change the dispersion from normal to anomalous. The effective steady-state response of coupled-resonators is derived using the temporal coupled-mode formalism, and the absorptive and dispersive responses are described. Specifically, the occurrence of slow light via coupled-resonator-induced transparency and gain-assisted fast light are discussed.

Author

Optical Resonators; Light Transmission; Coupled Modes; Transparence

20050110567 Idaho Univ., Moscow, ID USA

Two-Dimensional Photonic Crystals for Near IR and Visible Optoelectronics Applications

McIlroy, David; Jan. 2005; 7 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0475

Report No.(s): AD-A430192; AFRL-SR-AR-TR-05-0029; No Copyright; Avail: CASI; A02, Hardcopy

The focus of this project is to develop a process for constructing two-dimensional (2D) photonic crystals, which will be amenable to commercialization. Our approach has been to utilize nanochannel glass (NCG), which consists of a 2D hexagonal arrays of cylindrical voids that traverse the entire thickness of the glass. A 2D photonic can be realized with NCG if high index materials with good transmission properties can be introduced into the channels. This is the primary mission and focus of this project. In addition, e-beam lithography techniques are also being utilized to construct prototype two-dimensional photonic crystals that operate in the UV to low IR wavelength region of the light spectrum. The primary discoveries of this work have been theoretical modelling of gas flows in nanoscale structures and models for the formation of novel nanoparticles and nanowires in high aspect ratio structures. The findings of this work suggest that novel chemical sensors could be constructed with channel glass where nanoparticles or nanowires with specific properties have been formed within the channels. In terms of the ultimate goal of the project, 2-D photonic crystals based on nanochannel glass, the final conclusion is that nanochannel glass is not an appropriate foundation with which to construct 2D photonic crystals.

DTIC

Crystals; Electron Beams; Electro-Optics; Infrared Radiation; Near Infrared Radiation; Optical Equipment

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20050109771 Lawrence Livermore National Lab., Livermore, CA

Numerical Solution of Plasma Fluid Equations Using Locally Refined Grids

Colella, P.; Dorr, M. R.; Wake, D. D.; Jan. 1997; 36 pp.; In English

Report No.(s): DE2004-16136; UCRL-JC-126401; No Copyright; Avail: Department of Energy Information Bridge

This paper describes a numerical method for the solution of plasma fluid equations on block-structured, locally refined grids. The plasma under consideration is typical of those used for the processing of semiconductors. The governing equations consist of a drift-diffusion model of the electrons and an isothermal model of the ions coupled by Poisson's equation. A discretization of the equations is given for a uniform spatial grid, and a time-split integration scheme is developed. The algorithm is then extended to accommodate locally refined grids. This extension involves the advancement of the discrete system on a hierarchy of levels, each of which represents a degree of refinement, together with synchronization steps to ensure consistency across levels. A brief discussion of a software implementation is followed by a presentation of numerical results.
NTIS
Computational Grids; Numerical Analysis; Plasma Flux Measurement; Measure and Integration; Diffusion

20050109796 Princeton Univ., NJ
Diamond Wire Cutting of the Tokamak Fusion Test Reactor
Rule, K.; Perry, E.; Parsells, R.; 2003; In English
Report No.(s): DE2004-827054; No Copyright; Avail: National Technical Information Service (NTIS)

The Tokamak Fusion Test Reactor (TFTR) is a one-of-a-kind, tritium-fueled fusion research reactor that ceased operation in April 1997. As a result, decommissioning commenced in October 1999. The 100 cubic meter volume of the donut-shaped reactor makes it the second largest fusion reactor in the world. The deuterium-tritium experiments resulted in contaminating the vacuum vessel with tritium and activating the materials with 14 Mev neutrons. The total tritium content within the vessel is in excess of 7,000 Curies while dose rates approach 50 mRem/hr. These radiological hazards along with the size of the Tokamak present a unique and challenging task for dismantling. Engineers at the Princeton Plasma Physics Laboratory (PPPL) decided to investigate an alternate, innovative approach for dismantlement of the TFTR vacuum vessel: diamond wire cutting technology. In August 1999, this technology was successfully demonstrated and evaluated on vacuum vessel surrogates.
NTIS
Tokamak Devices; Contamination; Decommissioning; Diamonds; Wire; Cutting

20050109825 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermal N+ in the Inner Magnetosphere
Craven, P. D.; Moore, T. E.; Gallagher, D. L.; [2004]; 1 pp.; In English; American Geophysical Union 2004 Fall Annual Meeting, 13-17 Dec. 2004, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

There has been much interest in O+ in the magnetosphere since it was first reported by Shelley et al. [1971]. However, relatively little has been done with N+ even though it is the second most abundant ion in the ionosphere at the F2 peak. What observations there are show that there is a large range in the magnitude of the ratio of the N+ density to the O+ density, that N+ is a significant ion in the ionosphere, and that the concentration of this ion vanes with season, time of day, solar cycle, latitude, and geomagnetic conditions. Most observational studies have not been used with a large database, nor have they been of a statistical nature. We use the DE1 RIMS observations to survey where N+ is found, in what concentrations relative to O+, and how this concentration varies with changes in the solar input, season, and time of day. We also gauge our understanding of N+ in the ionosphere and plasmasphere by comparing model (FLIP) results with the observations.
Author
Oxygen Ions; Nitrogen Ions; Solar Cycles; Geomagnetism; Plasmasphere; Ionospheres

20050110503 State Research Center of Russia, Moscow, Russia
Investigation of Characteristics of High-Power Wide-Band Plasma-Filled Traveling Wave Tubes (TWT)
Perevodchikov, Vladimir; May 2004; 75 pp.; In English
Report No.(s): AD-A430063; EOARD-ISTC-00-7037; No Copyright; Avail: CASI; A04, Hardcopy

This report results from a contract tasking The Russian Federation State Research Center - All Russian Electrotechnical Institute as follows: A non-relativistic beam-plasma microwave amplifier (Plasma-Filled TrVT) based on a hybrid coupled-cavity slow-wave structure (CCSWS) with a plasma-filled transit channel has been developed in VEI. Needed improvements of these microwave tubes for their commercial and industrial applications in communication systems and microwave technology require special investigations of the main features of these tubes including noise and spectral purity parameters, and hybrid slow-wave structure electrodynamics.
DTIC
Broadband; Plasma Waves; Traveling Wave Tubes

20050110528 Air Force Research Lab., Wright-Patterson AFB, OH USA

Volume and Surface Plasmas

Ganguly, Biswa N.; Sep. 2004; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2301

Report No.(s): AD-A430099; AFRL-PR-WP-TR-2004-2128; No Copyright; Avail: Defense Technical Information Center (DTIC)

Scaling of volume and surface dominated plasmas were quantified by electrical, microwave and optical measurements. The application of these plasma devices range from RF plasma processing, high flux atom production, plasma switch and plasma assisted combustion.

DTIC

Plasmas (Physics)

20050111560 Princeton Univ., NJ

Deposition Diagnostics for Next-Step Devices

Skinner, C. H.; Roquemore, A. L.; Bader, A.; Wampler, W. R.; Jun. 2004; 34 pp.; In English

Report No.(s): DE2004-828039; PPPL-3965; No Copyright; Avail: Department of Energy Information Bridge

The scale-up of deposition in next-step devices such as ITER will pose new diagnostic challenges. Codeposition of hydrogen with carbon needs to be characterized and understood in the initial hydrogen phase in order to mitigate tritium retention and qualify carbon plasma facing components for DT operations. Plasma facing diagnostic mirrors will experience deposition that is expected to rapidly degrade their reflectivity, posing a new challenge to diagnostic design. Some eroded particles will collect as dust on interior surfaces and the quantity of dust will be strictly regulated for safety reasons - however diagnostics of in-vessel dust are lacking. We report results from two diagnostics that relate to these issues. Measurements of deposition on NSTX with 4 Hz time resolution have been made using a quartz microbalance in a configuration that mimics that of a typical diagnostic mirror. Often deposition was observed immediately following the discharge suggesting that diagnostic shutters should be closed as soon as possible after the time period of interest. Material loss was observed following a few discharges. A novel diagnostic to detect surface particles on remote surfaces was commissioned on NSTX.

NTIS

Deposition; Diagnosis; Hydrogen; Carbon

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20050109887 NASA Marshall Space Flight Center, Huntsville, AL, USA

Fluorescent Approaches to High Throughput Crystallography

Pusey, Marc L.; Forsythe, Elizabeth; [2005]; 1 pp.; In English; Protein Production and Crystallization Workshop, 1-3 Feb. 2005, Bethesda, MD, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

X-ray crystallography remains the primary method for determining the structure of macromolecules. The first requirement is to have crystals, and obtaining them is often the rate-limiting step. The numbers of crystallization trials that are set up for any one protein for structural genomics, and the rate at which they are being set up, now overwhelm the ability for strictly human analysis of the results. Automated analysis methods are now being implemented with varying degrees of success, but these typically cannot reliably extract intermediate results. By covalently modifying a subpopulation, 51%, of a macromolecule solution with a fluorescent probe, the labeled material will add to a growing crystal as a microheterogeneous growth unit. Labeling procedures can be readily incorporated into the final stages of purification. The covalently attached probe will concentrate in the crystal relative to the solution, and under fluorescent illumination the crystals show up as bright objects against a dark background. As crystalline packing is more dense than amorphous precipitate, the fluorescence intensity can be used as a guide in distinguishing different types of precipitated phases, even in the absence of obvious crystalline features, widening the available potential lead conditions in the absence of clear hits. Non-protein structures, such as salt crystals, will not incorporate the probe and will not show up under fluorescent illumination. Also, brightly fluorescent crystals are readily found against less fluorescent precipitated phases, which under white light illumination may serve to obscure the crystals. Automated image analysis to find crystals should be greatly facilitated, without having to first define crystallization drop boundaries and by having the protein or protein structures all that show up. The trace fluorescently labeled crystals will

also emit with sufficient intensity to aid in the automation of crystal alignment using relatively low cost optics, further increasing throughput at synchrotrons. This presentation will focus on the methodology for fluorescent labeling, the crystallization results, and the effects of the trace labeling on the crystal quality.
Author
Crystallography; Fluorescence; X Rays

20050110537 California Univ., Berkeley, CA USA
Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures
Whaley, K. B.; Dec. 2004; 4 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0612
Report No.(s): AD-A430114; ARO-42641.2-PH-QC; No Copyright; Avail: Defense Technical Information Center (DTIC)

The authors have developed microscopic theory for analysis of spin excitations in semiconductor nanocrystals and endohedral fullerenes based on atomistic electronic structure calculations. They have made calculations of shape and size dependence of electronic and excitonic g-factors; examined magnetic properties of Mn:ZnS dilute magnetic semiconductor nanocrystals; made atomistic calculation of coherent spin transfer between nanocrystals linked by organic molecules; calculated structural, magnetic, and transport properties of a high-spin endohedral metallofullerene GdC82; and calculated hyperfine coupling constants for endohedral nitrogen atoms in fullerenes of variable size. The authors make comparisons with experimental data, finding good agreement in all cases validating the microscopic methods developed in this project.
DTIC
Crystals; Electron Transfer; Fullerenes; Magnetic Properties; Nanostructures (Devices); Particle Spin; Quantum Numbers; Semiconductors (Materials)

20050111553 Carnegie-Mellon Univ., Pittsburgh, PA, Brookhaven National Lab., Upton, NY, University of Central Florida, Orlando, FL, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
Relationship of Magnetocrystalline Anisotropy and Stoichiometry in Epitaxial L1(sup 0) CoPt(001) and FePT (001) Thin Films
Barmak, K.; Kim, J.; Lewis, L. H.; Coffey, K. R.; Toney, M. F.; Aug. 2004; 38 pp.; In English
Report No.(s): DE2004-829753; SLAC-PUB-10614; No Copyright; Avail: Department of Energy Information Bridge

Two series of epitaxial CoPt and FePt films, with nominal thicknesses of 42 or 50 nm, were prepared by sputtering onto single crystal MgO(001) substrates in order to investigate the chemical ordering and the resultant magnetic properties as a function of alloy composition. In the first series, the film composition was kept constant, while the substrate temperature was increased from 144 to 704 C. In the second series the substrate temperature was kept constant at 704 C for CoPt and 620 C for FePt, while the alloy stoichiometry was varied in the nominalrange of 40-60 at% Co(Fe). Film compositions and thicknesses were measured via Rutherford backscattering spectrometry. The lattice and long-range order parameter for the L1(sub 0) phase were obtained for both sets of films using x-ray diffraction. The room-temperature magnetocrystalline anisotropy constants were determined for a subset of the films using torque magnetometry. The order parameter was found to increase with increasing temperature, with ordering occurring more readily in FePt when compared with CoPt. A perpendicular anisotropy developed in CoPt for substrate temperatures above 534 C and in FePt above 321 C. The structure and width of the magnetic domains in CoPt and FePt, as seen by magnetic force microscopy, also demonstrated an increase in magnetic anisotropy with increasing temperature. For the films deposited at the highest temperatures (704 C for CoPt and 620 C for FePt), the order parameter reached a maximum near the equiatomic composition, whereas the magnetocrystalline anisotropy increased as the concentration of Co or Fe was increased from below to slightly above the equiatomic composition. It is concluded that non-stoichiometric L1(sub 0) CoPt and FePt, with a slight excess of Co or Fe, are preferable for applications requiring the highest anisotropies.
NTIS
Anisotropy; Epitaxy; Stoichiometry

20050123551 Clarkson Univ., Potsdam, NY, USA
Residual Gas Effects on Detached Solidification in Microgravity
Wilcox, William R.; Regel, Liya L.; Ramakrishnan; Kota, Arun; Anand, Gaurav; [2004]; 50 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG8-1703; No Copyright; Avail: CASI; A03, Hardcopy

Our long term goal has been to make detached solidification reproducible, which requires a full understanding of the

mechanisms underlying it. Our Moving Meniscus Model of steady-state detachment predicts that it depends strongly on the surface tension of the melt and the advancing contact angle with the ampoule wall. Thus, the objective of the current project was to determine the influence of residual gases on the surface tension and contact angle of molten semiconductors on typical ampoule materials. Our focus was on the influence of oxygen on indium antimonide on clean silica ('quartz'). The research was performed by three chemical engineering graduate students, the third of whom will complete his research in the summer of 2005. Originally, we had planned to use a sealed silica cell containing a zirconia electrochemical element to control the oxygen partial pressure. However, zirconia requires an operating temperature above the 530 C melting point of InSb and is difficult to form a gas-tight seal with silica. Thus, we decided instead to flow an oxygen-containing gas through the cell. A special apparatus was designed, built and perfected. A piece of InSb was placed on a horizontal silica plate in a quartz cell. High purity argon, helium or hydrogen-containing gas is passed continuously through the cell while the oxygen concentration in the effluent gas is measured. The shape of the resulting drop was used to determine contact angle and surface tension of Ga-doped and high purity InSb. Oxygen appeared to decrease the contact angle, and definitely did not increase it. The following section gives the background for the research. Section 2 summarizes the results obtained on Ga-doped InSb with relatively high oxygen concentrations. Section 3 describes recent improvements made to the apparatus and methods of analysis. Section 4 gives recent results for high-purity InSb at low oxygen concentrations. Final results will be obtained only this summer (2005). Each section has its own references.
Author
Indium Antimonides; Solidification; Interfacial Tension; Microgravity; Oxidation; Residual Gas

20050123725 Rennes Univ., France
Mixed Metallic Photonic Band-gap Material and Bragg Mirror
Poilasne, G.; Ponliguen, P.; Mahdjoubi, K.; Desclos, L.; Terret, C.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 19041907; In English; See also 20050123676; Copyright; Avail: Other Sources

Metallic photonic band-gap materials have been widely studied either theoretically or experimentally. In this work. we consider the possibility to mix a metallic photonic bandgap material (MPBG) composed by a square lattice of metallic wires with a Bragg mirror. The mixed structure is elaborated taking into account the characteristics of both structures isolated. On one hand, this study presents interesting results on mixed PBG designed in an easy way. On the other hand, it also brings precious information to realize MPBG by multiple layer technology. First of all, recalls on MPBG and Bragg mirrors are presented. Then, both structures are dimensioned in order to suppress the authorized band of the MPBG. Experimental and numerical results of the mixed structure are presented. Finally, the study is extended to different other mixed structures composed by MPBG and 2D dielectric photonic crystals or MPBG composed by continuous wires and discontinuous wires. Superimposition of band-gaps and propagation bands of the mixed structures are also studied.
Author
Bragg Reflectors; Energy Gaps (Solid State)

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20050110396 Naval Postgraduate School, Monterey, CA USA
Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine
Wittmers, Nicole K.; Dec. 2004; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429908; No Copyright; Avail: Defense Technical Information Center (DTIC)

Operational characteristics of a valveless pulse detonation engine system were characterized by experimental measurements of thrust, fuel flow, and internal gas dynamics. The multi-cycle detonation experiments were performed on an axis-symmetric engine geometry operating on an ethylene/air mixture. The detonation diffraction process from a small initiator combustor to a larger diameter main combustor in a continuous airflow configuration was evaluated during multi-cycle operation of a pulse detonation engine and was found to be very successful at initiating combustion of the secondary fuel/air mixture at high frequencies. The configuration was used to demonstrate the benefit of generating an overdriven detonation condition near the diffraction plane for enhanced transmission of the larger combustor. Results have shown that the addition of optical sensors, such as tunable diode lasers, to provide fuel profile data are invaluable for providing high fidelity performance results. The performance results demonstrated the ability of the valveless pulse detonation engine to run at

efficiencies similar to valved pulse detonation engine geometries and may be a low-cost alternative to conventional air-breathing propulsion systems.
DTIC
Detonation; Detonation Waves; Evaluation; Ignition; Performance Tests; Pulse Detonation Engines; Pulsejet Engines; Specific Impulse; Thermodynamics; Wave Propagation

20050110545 Army Research Lab., Aberdeen Proving Ground, MD USA
Modeling Thermal Ignition of Energetic Materials
Gerri, Norman J.; Berning, Ellen; Nov. 2004; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430130; ARL-TR-3369; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report documents an attempt to computationally simulate the mechanics and thermal regimes created when a threat perforates an armor envelope and comes in contact with stowed energetic material (M30 granular propellant). Fragment simulating penetrators (FSP) of 208 and 830 gr were fired into plates of AISI 4340 steel hardened to a Rockwell C + 40. The existing fragment were captured in a polymetric material with a melting point equivalent to the ignition temperature of the propellant. Paralleling the field experiment, a series of CTH 3D finite element runs were carried out using the same initial conditions as the experiments. The temperatures calculated by the CTH codes are compared to the experiment al value. Experimental shots fired into live propellant at velocities selected from the CTH runs gave ignition or no ignition as predicted within reasonable limits.
DTIC
Explosives; Ignition; Thermodynamic Properties

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20050123599 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Optimization Framework for Dynamic, Distributed Real-Time Systems
Eckert, Klaus; Juedes, David; Welch, Lonnie; Chelberg, David; Bruggerman, Carl; Drews, Frank; Fleeman, David; Parrott, David; Pfarr, Barbara; [2003]; 16 pp.; In English; Workshop on Parallel and Distributed Real-time Systems, 22-24 Apr. 2003, Nice, France; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Abstract. This paper presents a model that is useful for developing resource allocation algorithms for distributed real-time systems .that operate in dynamic environments. Interesting aspects of the model include dynamic environments, utility and service levels, which provide a means for graceful degradation in resource-constrained situations and support optimization of the allocation of resources. The paper also provides an allocation algorithm that illustrates how to use the model for producing feasible, optimal resource allocations.
Author
Optimization; Framing Cameras; Real Time Operation; Dynamic Models

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20050092368 George Washington Univ., Washington, DC, USA
Core Program in the Joint Institute for Advancement of Flight Sciences
[2003]; 15 pp.; In English
Contract(s)/Grant(s): NCC1-01020; No Copyright; Avail: CASI; A03, Hardcopy

Following the precedent started several years ago, each of the graduating MS and DSc candidates in JIAFS present a seminar which is advertised throughout the area. Following the formal seminar the attendees are excused and the review committee examines the student as in a standard thesis defense. This allows the students to gain experience in presenting their research and disseminating the Institute's research results to a wider audience. A list of seminars are given in Appendix B. Some 172 excellent applications for the Graduate Research Scholar Assistantships were received during this period. Forty-nine

new GRSA were appointed by Professor Whitesides to JTAFS under the various research grants and contracts.
Derived from text
Aerodynamics; Education; Flight Mechanics

20050092371 NASA Marshall Space Flight Center, Huntsville, AL, USA, Science Applications International Corp., USA
Advanced Technology Lifecycle Analysis System (ATLAS) Technology Tool Box (TTB)
Doyle, Monica; ONeil, Daniel A.; Christensen, Carissa B.; [2005]; 16 pp.; In English; Space Technology and Applications Forum, 12-17 Feb. 2005, Albuquerque, NM, USA; Original contains color illustrations
Contract(s)/Grant(s): GS-23F0107J; Copyright; Avail: CASI; A03, Hardcopy

The Advanced Technology Lifecycle Analysis System (ATLAS) is a decision support tool designed to aid program managers and strategic planners in determining how to invest technology research and development dollars. It is an Excel-based modeling package that allows a user to build complex space architectures and evaluate the impact of various technology choices. ATLAS contains system models, cost and operations models, a campaign timeline and a centralized technology database. Technology data for all system models is drawn from a common database, the ATLAS Technology Tool Box (TTB). The TTB provides a comprehensive, architecture-independent technology database that is keyed to current and future timeframes.
Derived from text
Decision Support Systems; Life Cycle Costs; Systems Simulation; Data Bases

20050109799 General Accounting Office, Washington, DC
Core Financial System Requirements: Checklist for Reviewing Systems under the Federal Financial Management Improvement Act
Feb. 2005; 140 pp.; In English
Report No.(s): PB2005-103216; GAO-05-225G; No Copyright; Avail: CASI; A07, Hardcopy

The Federal Financial Management Improvement Act of 1996 (FFMIA) requires, among other things, that agencies implement and maintain financial management systems that substantially comply with federal financial management system requirements. These requirements are detailed in the Federal Financial Management System Requirements series issued by the Joint Financial Management Improvement Program (JFMIP) and in the guidance issued by the Office of Management and Budget (OMB): Circular No. A-127, Financial Management Systems, and the January 4, 2001, Revised Implementation Guidance for the Federal Financial Management Improvement Act (FFMIA) of 1996. JFMIP intended for the requirements to promote understanding of key financial management systems concepts and requirements, to provide a framework for establishing integrated financial management systems to support program and financial managers, and to describe specific requirements of financial management systems. We are issuing this checklist, which reflects JFMIPs revised Core Financial System Requirements (JFMIP-SR-02-01, November 2001), to assist (1) financial systems analysts, systems accountants, systems developers, program managers, and others who design, develop, implement, operate, or maintain financial management systems and (2) management and auditors in reviewing agency core systems to determine if the systems substantially comply with FFMIA.
NTIS
Information Systems; Financial Management; Management Systems; Systems Integration

20050110361 RAND Corp., Santa Monica, CA USA
Information Sharing Among Military Headquarters. The Effects on Decisionmaking
Perry, Walter L.; Moffat, James; Jan. 2004; 154 pp.; In English
Report No.(s): AD-A429853; No Copyright; Avail: CASI; A08, Hardcopy

New information technologies introduced into military operations provide the impetus to explore alternative operating procedures and command structures. New concepts such as network-centric operations and distributed and decentralised command and control have been suggested as technologically enabled replacements for platform-centric operations and for centralised command and control. As attractive as these innovations seem, it is important that military planners responsibly test these concepts before their adoption. To do this, models, simulations, exercises, and experiments are necessary to allow proper scientific analysis based on the development of both theory and experiment. The primary objective of this work is to propose a theoretical method to assess the effects of information gathering and collaboration across an information network on a group of local decision-making elements (parts of, or a complete, headquarters). The effect is measured in terms of the

reduction in uncertainty about the information elements deemed critical to the decisions to be taken.
DTIC
Command and Control; Decision Making; Military Operations

20050110362 RAND Corp., Santa Monica, CA USA
Understanding the Insider Threat. Proceedings of a March 2004 Workshop
Brackney, Richard C.; Anderson, Robert H.; Jan. 2004; 127 pp.; In English
Report No.(s): AD-A429854; No Copyright; Avail: CASI; A07, Hardcopy

A major research thrust of the Advanced Research and Development Activity (ARDA) of the U.S. intelligence community (IC) involves information assurance (A). Perhaps the greatest threat that A activities within the IC must address is the 'insider threat'-malevolent (or possibly inadvertent) actions by an already trusted person with access to sensitive information and information systems. This unclassified workshop, held March 24, 2004, focused on the insider threat and possible indicators and warnings, observables, and actions to mitigate that threat. The ARDA researchers participating gave special attention to the activities, processes, and systems used within the intelligence community. A combination of plenary and breakout sessions discussed various aspects of the problem, including IC system models, vulnerabilities and exploits, attacker models, and characterization of events associated with an insider attack. A set of presentations by members of the IC and its contractors on Intelink (Appendix G) and such research activities as the development of 'Glass Box' software (see Appendix H) and ARDA's 'Novel Intelligence from Massive Data' (NIMD) research program (Appendix I) aided the workshop discussions. The present workshop built upon the availability of materials generated in an earlier workshop focused on the insider threat (Appendix F). Several overall themes emerged from these deliberations, discussed below under the headings of 'Research Questions and Challenges' and 'Databases Needed' (by researchers).
DTIC
Conferences; Intelligence

20050110363 RAND Corp., Santa Monica, CA USA
California's K-12 Public Schools. How Are They Doing?
Carroll, Stephen J.; Krop, Cathy; Arkes, Jeremy; Morrison, Peter A.; Flanagan, Ann; Jan. 2005; 246 pp.; In English
Report No.(s): AD-A429855; No Copyright; Avail: CASI; A11, Hardcopy

As recently as the 1970s, California's public schools were reputed to be excellent. Today, that reputation no longer stands. Instead, there is widespread concern that California's schools have slipped in quality over the years and that they are no longer performing as well as they did previously or as well as schools in other states. The primary objective of our study was to look closely at California's public system of kindergarten through twelfth grade (K-12) schools in order to provide an accurate, comprehensive picture of the system as it is today. We describe in this report the student population and the schools' resources, including their financial resources, teachers, and facilities. We also describe the schools' outcomes, initially focusing on student academic achievement as measured by standardized tests, and then turning to other outcomes that may be influenced by schools and are not adequately captured in test scores. These include both educational attainment measures-high school graduation and continuation on to college-and a variety of non-academic measures teenage pregnancy, substance abuse, and juvenile delinquency on the grounds that the purpose of schooling goes beyond academic achievement to include students' broader preparation for adult success and citizenship.
DTIC
Evaluation; Schools; Scoring; System Effectiveness

20050110381 Naval Postgraduate School, Monterey, CA USA
China's Development of Asymmetric Warfare and the Security of Taiwan, Republic of China
Jinn, Guo-Woei; Dec. 2004; 107 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429889; No Copyright; Avail: Defense Technical Information Center (DTIC)

The military changes that have transformed global politics in recent years - especially since the end of the Cold War - have brought about a new revolution in military affairs (RMA) by the USA. The PLA has begun to study the RMA by focusing on asymmetric warfare capabilities under high technological conditions. China believes that asymmetric operations have the advantages of enabling a swift and precise attack and avoiding mass destruction on Taiwan's infrastructure and hightech industry. They also have the benefits of low intensity, low collateral damage, high efficiency, fast attack, and fast victory. In summary, asymmetric operations are regarded by the PLA as a kind of warfare that conforms both with the dictum of China's ancient war theorist Sun Tzu to 'defeat the enemy without bloodshed and fighting' and the demands of a modern economy.

In the face of China's development of asymmetric capabilities, Taiwan should think about how best to confront and counter China's threats and to gain a military edge over China.
DTIC
Asymmetry; China; Security; Taiwan; Warfare

20050110441 Naval Postgraduate School, Monterey, CA USA
Secure Distribution of Open Source Information
Rogers, Jason; Dec. 2004; 76 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429981; No Copyright; Avail: Defense Technical Information Center (DTIC)

Cryptographic protocols provide security services through the application of cryptography. When designing a cryptographic protocol, the requirements are, often, specified informally. Informal specification can lead to incorrect protocols from misinterpreting the security requirements and environmental assumptions. Formal tools have been shown to reduce ambiguity. In this paper, a cryptographic protocol, called the Secure Open Distribution Protocol (SODP), is developed to provide authentication services for open source information. A formal development process is proposed to aid in the design of the SODP. The Strand Space method has been selected as the formal mechanism for specifying requirements, architecting a protocol design, and assuring the correctness of the protocol. First, the informal authentication requirements are modeled as agreement properties. Next, Authentication Tests, a Strand Space concept, are introduced to aid in the design of the SODP. Finally, a formal proof is constructed to assure that the SODP has satisfied all requirements. The result of the development process proposed in this paper is a cryptographic protocol that can be used to securely distribute open source information. Also, the Strand Space method is demonstrated as a viable option for the formal development of a cryptographic protocol.
DTIC
Cryptography; Security

20050110521 Army Research Lab., Aberdeen Proving Ground, MD USA
A Model-Based Approach to Battle Execution Monitoring
Kaste, Richard C.; Hansen, Charles E.; Jan. 2005; 80 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430087; ARL-TR-3394; No Copyright; Avail: Defense Technical Information Center (DTIC)

The work set forth in this report is intended to lead to portions of an integrated system to dynamically link automated plan generation and analysis with execution monitoring. The report deals with algorithms for, and interfaces to, a prototype battle-trajectory decision aid. We explored complexities of navigating parameter tradeoff spaces and performed detailed studies of strength/ attrition parameter estimation and calibration techniques. We investigated software for solving differential systems and for visualizing and interacting with decision aid data. We considered aspects of the analytical theory of dynamic systems: mathematical chaos, stability, and control. We set the groundwork for formulation of models to produce systems exhibiting inherently chaotic behavior and for studying qualitative aspects of phase plane trajectories. It is probable that nonlinear analytic techniques will soon be considered as invaluable to commanders.
DTIC
Decision Making; Decision Support Systems; Information Systems; Military Operations; Planning

20050110539 Rome Univ., Rome, Italy
Situation Assessment and Information Fusion: An Experimental Framework for Performance Evaluation
Nardi, Daniele; Oct. 2004; 40 pp.; In English
Contract(s)/Grant(s): FA8655-03-1-3065
Report No.(s): AD-A430118; EOARD-SPC-03-3065; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Universita di Roma as follows: The Grantee will perform high-level Information Fusion research based on multi-agent information monitoring and fusion. The goal is to develop situation assessment techniques and strategies which focus on evolving, dynamic scenarios such as natural disasters (e.g. earthquakes or other catastrophic events). Complete details of expected results and technical contributions are found the research proposal.
DTIC
Evaluation; Multisensor Fusion; Performance Tests

20050110562 Air Force Research Lab., Wright-Patterson AFB, OH USA
An Assessment of Alternative SAR Display Formats: Orientation and Situational Awareness
Kuperman, Gilbert G.; Brickner, Michael S.; Nadler, Itzhak; Jul. 1999; 9 pp.; In English
Report No.(s): AD-A430160; No Copyright; Avail: Defense Technical Information Center (DTIC)

This study explores the operational utility of fusing synthetic aperture radar (SAR) imagery and digital terrain map (DTM) data. Specifically, the two-dimensional (2D) display of SAR imagery was compared against a two and a half dimension (21/2D) display of SAR overlaid on corresponding DTM data. Eight imagery analysts (IAs), assigned to the Israeli Ground Corps Command Imagery Analysis Unit and to the Israeli Air Force, and two weapon system officers served as subject matter experts. The measures employed in this comparison included both an assessment of operator situational awareness (SA) and of performance in an information extraction task. Based on the SAR imagery which was used in the experiment, performance measures (accuracy and speed in feature location) and SA measures did not yield significant performance differences between the 2D and the 2-D displays.
DTIC
Digital Data; Maps; Situational Awareness; Synthetic Aperture Radar

20050111430 Naval Postgraduate School, Monterey, CA USA
An Architecture for Network Centric Operations in Unconventional Crisis: Lessons Learnt from Singapore's SARS Experience
Tay, Chee B.; Mui, Whye K.; Dec. 2004; 101 pp.; In English; Original contains color illustrations
Report No.(s): AD-A429839; No Copyright; Avail: Defense Technical Information Center (DTIC)

Singapore and many parts of Asia were hit with Severe Acute Respiratory Syndrome (SARS) in March 2003. The spread of SARS lead to a rapidly deteriorating and chaotic situation. Because SARS was a new infection, there was no prior knowledge that could be referenced to tackle such a complex, unknown and rapidly changing problem. Fortunately, through sound measures coupled with good leadership, quick action and inter-agency cooperation, the situation was quickly brought under control. This thesis uses the SARS incident as a case study to identify a set of network centric warfare methodologies and technologies that can be leveraged to facilitate the understanding and management of complex and rapidly changing situations. The same set of methodologies and technologies can also be selectively reused and extended to handle other situations in asymmetric and unconventional warfare.
DTIC
Multisensor Fusion; Warfare

20050111455 George Mason Univ., Fairfax, VA USA
Collaborative Assistant for Rapid Knowledge Formation and Reasoning
Tecuci, Gheorghe; Dec. 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0546; DARPA ORDER-K176; Proj-RKFM
Report No.(s): AD-A429803; AFRL-IF-RS-TR-2004-352; No Copyright; Avail: Defense Technical Information Center (DTIC)

This research has developed a collaborative assistant for rapid knowledge formation and reasoning, called Disciple-RKF. Disciple-RKF enables a team of subject matter experts who do not have prior knowledge engineering experience to build an integrated knowledge base, with limited assistance from a knowledge engineer. Each subject matter expert teaches a personal Disciple-RKF agent while collaborating with it in solving specific problems. During this process, each Disciple-RKF agent learns from its expert and builds its knowledge base. All these knowledge bases are then merged into an integrated knowledge base for Disciple-RKF. Disciple-RKF has being successfully applied to develop knowledge-based agents for military center of gravity analysis which have been used in several courses at the US Army War College. Experimental results with Disciple-RKF demonstrate that the developed approach facilitates the acquisition of knowledge directly from subject matter experts and improves the knowledge base development process. The emphasis of this research was on acquiring expert's problem solving knowledge that is not normally represented in written documents. This task is complementary to that of acquiring knowledge that has already been expressed in textbooks or other documents.
DTIC
Knowledge Based Systems; Knowledge Representation; Problem Solving

20050111460 National Defense Univ., Washington, DC USA
Information Operations as a Core Competency (Joint Force Quarterly)
Lamb, Christopher J.; Jan. 2004; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A430074; No Copyright; Avail: Defense Technical Information Center (DTIC)

The USA fields the most capable military the world has seen. Some are concerned that the Nation will settle into complacency and wait for the historic norm--for the high cost of military failure to stimulate change. Such repose would be

inconsistent with the record of innovation the Armed Forces have realized over the past two decades and with the goals of current Department of Defense (DoD) leadership. Secretary Donald Rumsfeld and senior military leaders are intent on transforming U.S. forces to better prepare for 21st century challenges. Among other things, according to the DoD Transformation Planning Guidance of April 2003, pursuing transformation means 'the Department must align itself with the information revolution not just by exploiting information technology, but by developing information-enabled organizational relationships and operating concepts.' Put differently, the emerging American way of war means fighting first for information dominance.
DTIC
Information Systems; Defense Program; Military Operations

20050111464 Newcastle-upon-Tyne Univ., Newcastle
Notations for the Specification and Verification of Composite Web Services
Woodman, S. J.; Palmer, D. J.; Shrivastava, S. K.; Wheater, S. M.; 2004; 16 pp.; In English
Report No.(s): PB2005-103562; CS-TR-721; Copyright; Avail: National Technical Information Service (NTIS)
Availability of a wide variety of Web services over the Internet offers opportunities of providing new value added services built by composing them out of existing ones. Service composition poses a number of challenges. A composite service can be very complex in structure, containing many temporal and data-flow dependencies between their constituent services. Furthermore, each individual service is likely to have its own sequencing constraints over its operations. It is highly desirable therefore to be able to validate that a given composite service is well formed: proving that it will not deadlock or livelock and that it respects the sequencing constraints of the constituent services. With this aim in mind, the paper proposes simple extensions to web service definition language (WSDL) enabling the order in which the exposed operations should be invoked to be specified. In addition, the paper proposes a composition language for defining the structure of a composite service. Both languages have an XML notation and a formal basis in the pi-calculus (a calculus for concurrent systems). The paper presents the main features of these languages, and shows how it is possible to validate a composite service by applying the pi-calculus reaction rules.
NTIS
World Wide Web; Internets; Programming Languages; Program Verification (Computers)

20050111581 Defence Science and Technology Organisation, Edinburgh, Australia
Tracking and Sensor Fusion Issues in the Tactical Land Environment
Legg, Jonathan A.; January 2005; 30 pp.; In English
Report No.(s): DSTO-TN-0605; DODA-AR-013-300; Copyright; Avail: Other Sources
This preliminary report discusses sensor fusion in the Tactical Land environment, de- scribing several examples and identifying key issues related to the automated estimation of target characteristics including location, velocity and identity using disparate sensors or information sources.
Author
Multisensor Fusion; Targets; Estimating; Information Systems; Identifying

20050123548 NASA Marshall Space Flight Center, Huntsville, AL, USA
Development of Risk Assessment Matrix for NASA Engineering and Safety Center
Malone, Roy W., Jr.; Moses, Kelly; [2004]; 22 pp.; In English; Risk Analysis: The Profession and the Future, 5-8 Dec. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): NNL04AA29T; No Copyright; Avail: CASI; A03, Hardcopy
This paper describes a study, which had as its principal goal the development of a sufficiently detailed 5 x 5 Risk Matrix Scorecard. The purpose of this scorecard is to outline the criteria by which technical issues can be qualitatively and initially prioritized. The tool using this score card has been proposed to be one of the information resources the NASA Engineering and Safety Center (NESC) takes into consideration when making decisions with respect to incoming information on safety concerns across the entire NASA agency. The contents of this paper discuss in detail each element of the risk matrix scorecard, definitions for those elements and the rationale behind the development of those definitions. This scorecard development was performed in parallel with the tailoring of the existing Futron Corporation Integrated Risk Management Application (IRMA) software tool. IRMA was tailored to fit NESC needs for evaluating incoming safety concerns and was renamed NESC

Assessment Risk Management Application (NAFMA) which is still in developmental phase.
Author
Risk; Assessments; Information Management; Applications Programs (Computers)

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20050123691 EMAG Technologies, Inc., Ann Arbor, MI, USA
Polarimetric Radar Measurements for Vehicle Control and Warning Applications
Li, Eric S.; Sarabandi, Kamal; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 2004-2007; In English; See also 20050123676; Copyright; Avail: Other Sources

The idea to use a radar for automotive braking and even steering is not new. Some 35 years ago, in mid-sixties, the Radiation Laboratory made RCS measurements on tree trunks, stop signs, cement walls, and humans to determine if the targets could be identified from the (limited) RCS data. Unfortunately the results were not encouraging. For example, a tree truck along the side of a road could have similar return magnitude as a human. At that time only single-frequency and co-polarized data are available. The introduction of radar polarimetry technique provides a new approach to achieve the goal of the early study. Since 1995, the Sarabandi group from the Radiation Laboratory has successfully developed models to predict the backscatter response from road surfaces and to detect debris and faults on road surfaces. In what follows, the theory behind the analytical modeling is explained. Then the experimental results are presented to justify the validity of the developed models.
Author
Radar Measurement; Radar Navigation; Motor Vehicles; Distance Measuring Equipment; Surface Navigation; Polarimetry

20050123748 Helsinki Univ. of Technology, Helsinki, Finland
An Efficient Technique for Modelling Wideband Propagation in an Urban Parallel Street Microcellular Environment
El-Sallabi, Hassan M.; Zhang, Wei; Vainikainen, Pertti; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1490-1493; In English; See also 20050123676; Copyright; Avail: Other Sources

This paper suggests an extended technique for modeling of wideband propagation in an urban parallel street microcellular environment. This technique is based on multiple equivalent sources. It makes parallel street propagation predictable by using a simple yet accurate method which has been successful for a side-street environment.
Author
Effectiveness; Broadband; Mathematical Models

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20050092390 Universities Space Research Association, Columbia, MD, USA
Cooperative Agreement in Space Sciences (CPSS) NCC5-637
Black, David; July 31, 2004; 32 pp.; In English
Contract(s)/Grant(s): NCC5-637; No Copyright; Avail: CASI; A03, Hardcopy

This report describes research undertaken by USRA scientists working in the NASA Space Science Directorate laboratories at Goddard Space Flight Center.
Author
Aerospace Sciences; Research and Development; NASA Space Programs; Education

20050092394 NASA Ames Research Center, Moffett Field, CA, USA

Two Trees: Migrating Fault Trees to Decision Trees for Real Time Fault Detection on International Space Station

Lee, Charles; Alena, Richard L.; Robinson, Peter; October 20, 2004; 6 pp.; In English; IEEE Aerospace 2005, 2005, Big Sky, MT, USA; No Copyright; Avail: CASI; A02, Hardcopy

We started from ISS fault trees example to migrate to decision trees, presented a method to convert fault trees to decision trees. The method shows that the visualizations of root cause of fault are easier and the tree manipulating becomes more programmatic via available decision tree programs. The visualization of decision trees for the diagnostic shows a format of straight forward and easy understands. For ISS real time fault diagnostic, the status of the systems could be shown by mining the signals through the trees and see where it stops at. The other advantage to use decision trees is that the trees can learn the fault patterns and predict the future fault from the historic data. The learning is not only on the static data sets but also can be online, through accumulating the real time data sets, the decision trees can gain and store faults patterns in the trees and recognize them when they come.

Derived from text

Fault Detection; Fault Trees; International Space Station; Real Time Operation; Decision Making

20050109894 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA Celebrates the World Year of Physics

Adams, M. L.; [2005]; 1 pp.; In English; American Association of Physics Teachers, 8-12 Jan. 2005, Albuquerque, NM, USA; Copyright; Avail: Other Sources; Abstract Only

Celebrating the World Year of Physics presents NASA with an opportunity to inform educators of the importance of physics in our everyday lives. indeed, almost all NASA programs fake advantage of physical concepts in some fashion. Special programs throughout the year, affiliated with the World Year of Physics, are identifed to inform and inspire educators, students, and the general public. We will discuss these programs in detail and outline how educators may become more involved.

Author

NASA Programs; Physics

20050109897 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Human Exploration Initative: Space Radiation Measurement Needs

Adams, Jim; Barghouty, Nasser; Bhattacharya, Manojeet; Lin, Zi-Wei; [2004]; 1 pp.; In English; American Geophysical Union Fall Meeting, 13-17 Dec. 2004, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

NASA's Space Exploration Initiative envisions human exploration missions to the Moon and Mars. To accomplish these missions safely, they must be designed and planned to limit the acute and long term health risks posed by ionizing radiation. This requires knowledge of the relevant components of the ionizing radiation environment in deep space, on the Moon and on Mars. In this talk we will identify what must be known about the ionizing radiation environment, discuss what knowledge already exists and suggest what new measurements may be needed before manned missions can be conducted safely.

Author

Extraterrestrial Radiation; Manned Space Flight; Radiation Measurement; Space Exploration; NASA Space Programs

20050110121 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration

Grugel, R. N.; Luz, P.; Smith, G. A.; Spivey, R.; Mingo, C.; Jeter, L.; Volz, M. P.; [2005]; 1 pp.; In English; Continuing the Voyage of Discovery: 1st Space Exploration Conference, 2-4 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

The Pore Formation and Mobility Investigation (PFMI) is being conducted in the Microgravity Science Glovebox (MSG) aboard the International Space Station (ISS) with the goal of understanding bubble generation and interactions during controlled directional solidification processing. Through the course of the experiments, beginning in September 2002, a number of key factors pertinent to solidification processing of materials in a microgravity environment have been directly observed, measured, and modeled. Though most experiments ran uninterrupted, on four separate occasions malfunctions to the PFMI hardware and software were experienced that required crew intervention, including in-space repair. Fortunately, each repair attempt was successful and restored the PFMI apparatus to a fully functional condition. Based on PFMI results and lessons learned, the intent of this presentation is to draw attention to the role ISS experiments/hardware can play in providing

insight to potential fabrication processing techniques and repair scenarios that might arise during long duration space transport and/or on the lunar/Mars surface.
Author
Bubbles; Directional Solidification (Crystals); Fabrication; Malfunctions; Microgravity; Mobility

20050110137 Morgan Research Corp., Huntsville, AL, USA
GRAM Series of Atmospheric Models for Aeroentry and Aeroassist
Duvall, Aleta; Justus, C. G.; Keller, Vernon W.; [2005]; 1 pp.; In English; 43rd AIAA Aerospace Sciences Meeting, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): NNM04AA02C; No Copyright; Avail: Other Sources; Abstract Only

The eight destinations in the Solar System with sufficient atmosphere for either aeroentry or aeroassist, including aerocapture, are: Venus, Earth, Mars, Jupiter, Saturn; Uranus. and Neptune, and Saturn's moon Titan. Engineering-level atmospheric models for four of these (Earth, Mars, Titan, and Neptune) have been developed for use in NASA's systems analysis studies of aerocapture applications in potential future missions. Work has recently commenced on development of a similar atmospheric model for Venus. This series of MSFC-sponsored models is identified as the Global Reference Atmosphere Model (GRAM) series. An important capability of all of the models in the GRAM series is their ability to simulate quasi-random perturbations for Monte Carlo analyses in developing guidance, navigation and control algorithms, and for thermal systems design. Example applications for Earth aeroentry and Mars aerocapture systems analysis studies are presented and illustrated. Current and planned updates to the Earth and Mars atmospheric models, in support of NASA's new exploration vision, are also presented.
Author
Atmospheric Models; Aeroassist; Aerocapture; Neptune (Planet); Titan; Mars Atmosphere; Earth (Planet); Solar System; Reference Atmospheres

20050110141 NASA Marshall Space Flight Center, Huntsville, AL, USA
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission
Fox, Nicola J.; Goldberg, Richard; Barnes, Robin J.; Sigwarth, John B.; Beisser, Kerri B.; Moore, Thomas E.; Hoffman, Robert A.; Russell, Christopher T.; Scudder, Jack D.; Spann, James F., et al.; [2004]; 1 pp.; In English; Fall AGU 2004 Meeting, 13-17 Dec. 2004, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

To showcase the on-going and wide-ranging scope of the Polar science discoveries, the Polar science team has created a one-stop shop for a thorough introduction to geospace physics, in the form of a DVD with supporting website. The DVD, Earth's Dynamic Space: Solar-Terrestrial Physics & NASA's Polar Mission, can be viewed as an end-to-end product or split into individual segments and tailored to lesson plans. Capitalizing on the Polar mission and its amazing science return, the Polar team created an exciting multi-use DVD intended for audiences ranging from a traditional classroom and after school clubs, to museums and science centers. The DVD tackles subjects such as the aurora, the magnetosphere and space weather, whilst highlighting the science discoveries of the Polar mission. This platform introduces the learner to key team members as well as the science principles. Dramatic visualizations are used to illustrate the complex principles that describe Earth's dynamic space. In order to produce such a wide-ranging product on a shoe-string budget, the team poured through existing NASA resources to package them into the Polar story. Team members also created visualizations using Polar data to complement the NASA stock footage. Scientists donated their time to create and review scripts to make this a real team effort, working closely with the award winning audio-visual group at JHU/Applied Physics Laboratory. The team was excited to be invited to join NASA's Sun-Earth Day 2005 E/PO program and the DVD will be distributed as part of the supporting educational packages.
Author
Space Weather; Visual Aids; Education; Rangefinding; Auroras

20050123645 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA
Initial On-Orbit Spatial Resolution Characterization of OrbView-3 Panchromatic Images
Blonski, Slawomir; October 28, 2004; 1 pp.; In English; High Spatial Resolution Commercial Imagery Workshop, 8-10 Nov. 2004, Reston, VA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0029; No Copyright; Avail: CASI; A01, Hardcopy

A viewgraph presentation of five OrbView-3 panachromatic images of the permanent Stennis Space Center edge targets painted on a concrete surface is shown.
CASI
Spatial Resolution; Characterization; Image Processing

20050123914 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA GES DISC DAAC Satellite Data for GIS
Nickless, Darryl; Leptoukh, Gregory; Morahan, Michael; Pollack, Nathan; Savtchenko, Andrey; Teng, William; [2005]; 1 pp.; In English; ASPRS 2005 Annual Conference, 7-11 Mar. 2005, Baltimore, MD, USA; Copyright; Avail: Other Sources; Abstract Only

NASA's Goddard Earth Science (GES) Data and Information Services Center (DISC) Distributed Active Archive Center (DAAC) makes available a large and continually growing collection of spatially continuous global satellite observations of environmental parameters. These products include those from the MODIS (Moderate Resolution Imaging Spectroradiometer) on both Terra and Aqua platforms, and the Tropical Rainfall Measuring Mission (TRMM). These data products are well suited for use within Geographic Information Systems (GIS), as both backdrops to cartographic products as well as spatial analysis. However, data format, file size, and other issues have limited their widespread use by traditional GIS users. To address these data usability issues, the GES DISC DAAC recently updated tools and improved documentation of conversion procedures. In addition, the GES DISC DAAC has also been working with a major GIS software vendor to incorporate the ability to read the native Hierarchial Data Format (HDF), the format in which most of the NASA data is stored. The result is the enabling of GIS users to realize the benefit of GES DISC DAAC data without a substantial expenditure in resources to incorporate these data into their GIS. Several documents regarding the potential uses of GES DISC DAAC satellite data in GIS have recently been created. These show the combinations of concurrent data from different satellite products with traditional GIS vector products for given geographic areas. These map products include satellite imagery of Hurricane Isabel and the California wildfires, and can be viewed at http://daac.gsfc.nasa.gov/MODIS/GIS/.
Author
Earth Sciences; Geographic Information Systems; NASA Space Programs

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20050092392 NASA Marshall Space Flight Center, Huntsville, AL, USA
Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328
Vreeswijk, P. M.; Smette, A.; Fruchter, A. S.; Palazzi, E.; Rol, E.; Wijers, R. A. M. J.; Kouveliotou, C.; Kaper, L.; Pian, E.; Masetti, N., et al.; [2005]; 2 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We present low-resolution VLT spectroscopy of the aftergiow position of the gamma ray bursts 991216, 011211, 021211 and 030328. The spectmm of GRB 991216 shows two probable absorption systems at z = 0.80 and z = 1.02, where the highest redshift most likely reflects the distance to the host galaxy. A third, more uncertain, system may be detected at z = 0.77. HST imaging of the field obtained 4 months later, show two amorphous regions of emission, one at the projected OT position, the presumed host galaxy at z = 1.02, and the other 0‘6 away. All significant lines in the spectrum of GRB 011211 are identified with lines originating in a single absorption system at z = 2.142 plus or minus 0.002, the redshift of the GRB 011211 host galaxy. We also detect Lya in the host, for which we fit a neutral hydrogen column density of log N(HI)=20.4 plus or minus 0.2, which indicates that it is a damped Lya system. For GRB021211, we detect a single emission line in a spectrum tens of days after the burst, which we identify as [OII] at z = 1.006. The galaxy 1‘5 away from the afterglow location has z = 0.800, and is therefore unrelated to the GRB. Finally, for GRB030328 at least two absorption systems are required to explain all significant lines: one at z = 1.522, the likely redshift of the GRB, and the other at z = 1.295. For the latter system we only detect two lines, and we consider the reality of this system to be uncertain.
Author
Spectral Resolution; Gamma Ray Bursts; Emission Spectra; Spectroscopy

20050092400 NASA Marshall Space Flight Center, Huntsville, AL, USA

Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources

Wilson, Colleen A.; Fishman, Gerald; Hong, Jae-Sub; Gridlay, Jonathan; Krawczynski, Henric; [2005]; 1 pp.; In English; 205th Meeting of the American Astronomical Society, 9-13 Jan. 2005, San diego, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The EXIST active shields, now being planned for the main detectors of the coded aperture telescope, will have approximately 15 times the area of the BATSE detectors; and they will have a good geometry on the spacecraft for viewing both the leading and training Earth's limb for occultation observations. These occultation observations will complement the imaging observations of EXIST and can extend them to higher energies. Earth occultatio observations of the hard X-ray sky with BATSE on the Compton Gamma Ray Observatory developed and demonstrated the capabilities of large, flat, uncollimated detectors for this method. With BATSE, a catalog of 179 X-ray sources was monitored twice every spacecraft orbit for 9 years at energies above about 25 keV, resulting in 83 definite detections and 36 possible detections with 5-sigma detection sensitivities of 3.5-20 mcrab (20-430 keV) depending on the sky location. This catalog included four transients discovered with this technique and many variable objects (galactic and extragalactic). This poster will describe the Earth occultation technique, summarize the BATSE occultation observations, and compare the basic observational parameters of the occultation detector elements of BATSE and EXIST.

Author

X Ray Astronomy; X Ray Telescopes; Shielding; Occultation; X Ray Sources

20050109878 NASA Marshall Space Flight Center, Huntsville, AL, USA

Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226

Klose, S.; Greiner, J.; Rau, A.; Henden, A. A.; Hartmann, D. H.; Zeh, A.; Ries, C.; Masetti, N.; Malesani, D.; Guenther, E., et al.; Astronomical Journal; November 2004; Volume 128, pp. 1942-1954; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NSF INT-01-28882; DFG-KI-766/11; DAA-D/0237747; DAA-D/0103745; AYA-2004-01515; Copyright; Avail: Other Sources

We report results from a comprehensive follow-up observing campaign of the afterglow of GRB 030226 including VLT spectroscopy, VLT polarimetry, and Chandra X-ray observations. In addition, we present BOOTES-1 wide-field observations at the time of the occurrence of the burst. First observations at ESO started 0.2 days after the event when the gamma ray burst (GRB) afterglow was at a magnitude of R approximately 19 and continued until the afterglow had faded below the detection threshold (R greater than 26). No underlying host galaxy was found. The optical light curve shows a break around 0.8 days after the burst, which is achromatic within the observational errors, supporting the view that it was due to a jetted explosion. Close to the break time the degree of linear polarization of the afterglow light was less than 1.1%, which favors a uniform-jet model rather than a structured one. VLT spectra show two absorption line systems at redshifts z = 1.962 plus or minus 0.001 and 1.986 plus or minus 0.001, placing the lower limit for the redshift of the GRB close to 2. We emphasize that the kinematics and the composition of the absorbing clouds responsible for these line systems are very similar to those observed in the afterglow of GRB 021004. This corroborates the picture in which at least some GRBs are physically related to the explosion of a Wolf-Rayet star.

Author

Afterglows; Gamma Ray Bursts; Red Shift; Gamma Ray Astronomy

20050110144 NASA Marshall Space Flight Center, Huntsville, AL, USA

Compact Flares and CMEs

Moore, Ronald; Sterling, Alphonse; [2004]; 1 pp.; In English; Coordinated Observations of Flares and CMFs, 8-11 Dec. 2004, Sonoma, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

From a search of the SOHO/LASCO CME Catalog, we found several flares that were strong but short-lived in GOES X-ray flux (peak flux \g C5, duration \happrox.2 hr), and produced no CME. We also found several equally strong and short-lived flares that did initiate CMEs. All of the flares were located in strong magnetic fields near sunspots and were spatially compact (brightened only a small part of the active region). From the magnetic location and magnetic surroundings determined from MDI magnetograms, it appears that the non-CME flares were confined deep within surrounding strong closed magnetic fields, while the CME-producing flares either triggered neighboring sheared fields to erupt into a CME, or were able to erupt out of the active region and directly drive a CME. Compact ejective flares of this last type may produce a large CME

by driving the eruption of a large coronal loop such as a trans-equatorial loop. We present an example of such a flare and CME.
Author
Solar Flares; Magnetic Fields; Magnetic Signatures; X Rays; Coronal Loops; Confinement

20050110204 NASA Marshall Space Flight Center, Huntsville, AL, USA
Five Years of Observations with the Chandra X-Ray Observatory
Weisskopf, M. C.; [2005]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The Chandra X-ray Observatory is the X-ray component of NASA's Great Observatory Program. The Chandra X-Ray Observatory has now been operating successfully for over five years. We present here brief overview of the technical performance and some of the remarkable discoveries that have been made.
Author
X Ray Astrophysics Facility; X Ray Astronomy

20050110213 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20
Gaensler, B. M.; Kouveliotou, C.; Gelfand, J. D.; Taylor, G. B.; Eichler, D.; Wijers, R. A. M. J.; Granot, J.; Ramirez-Ruiz, E.; Lyubarsky, Y. E.; Hunstead, R. W., et al.; [2005]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Soft gamma repeaters (SGRs) are 'magnetars', a small class of slowly spinning neutron stars with extreme surface magnetic fields, B approx. 10(sup 15) gauss. On 2004 December 27, a giant flare was detected from the magnetar SGR 1806-20, the third such event ever recorded. This burst of energy, which resulted in the highest flux of gamma-rays ever measured from a celestial object, was detected by a variety of instruments and even caused an ionospheric disturbance in the Earth's upper atmosphere recorded around the globe. Here we report the detection of a very bright but rapidly-fading radio source at the position of SGR 1806-20 following this outburst. From day 6 to day 19 after the flare, we see a resolved, linearly polarized, radio nebula, expanding at a velocity of approximately 0.3c. To create this nebula, at least 4 x 10(exp 43) ergs of energy must have been emitted by the giant flare in the form of magnetic fields and relativistic particles. The steep decline of the radio flux may indicate episodic particle acceleration followed by adiabatic expansion, as could occur if the ejecta have energized a thin shell surrounding a preexisting cavity.
Author
Soft Gamma Repeaters; Gamma Ray Astronomy; Magnetars; Stellar Flares; Radio Sources (Astronomy)

20050110425 Naval Observatory, Washington, DC USA
Possible Role of the Oceans in the Variations of Length of Day at High Frequencies
Johnson, Thomas J.; Nov. 2002; 4 pp.; In English
Report No.(s): AD-A429956; No Copyright; Avail: Defense Technical Information Center (DTIC)

At the U.S. Naval Observatory (USNO), there are a few research studies as well as operational tasks that use data available from Global Geophysical Fluid Center (GGFC) web and ftp sites. This research includes investigating the excitation mechanisms of Earth rotation variability on all time scales, examining the global water budget and its role in exciting Earth rotation, researching the usefulness of ocean model nowcast/forecast models in predicting Earth rotation, and investigating the role of geophysical fluids in gravity field variations on GPS satellites. This presentation briefly covers the USNO's ongoing research to examine high frequency variations in excess Length of Day (LOD). It also will highlight the GGFC datasets used in the study as well as raise some issues with respect to the currently available GGFC datasets and what the author would like to see in the future to make this type of research easier. In closing, the author would like to make the following two suggestions on what the GGFC could do to improve the usefulness of the GGFC datasets. First, the GGFC must make sure that the special bureaus properly document their existing datasets. This includes correcting the dataset documentation that is clearly inaccurate and incomplete. Finally, the IERS GGFC could work on expanding the number of regularly updated atmospheric datasets that are currently available, adding near-real time/daily updated atmospheric AM datasets that use Non-IB, IB, and dynamic barometer corrections, and adding nowcast/forecast global oceanic AM datasets. These improvements would greatly increase the usefulness of IERS GGFC datasets in addressing current and future research needs.
DTIC
Atmospheric Models; Forecasting; High Frequencies; Ocean Models; Oceans; Rotation

20050110558 International Astronomical Union, Germany
IERS Conventions (2003)
McCarthy, Dennis D.; Petit, Gerard; Jan. 2004; 128 pp.; In English
Report No.(s): AD-A430152; No Copyright; Avail: Defense Technical Information Center (DTIC)

This document is intended to define the standard reference systems realized by the International Earth Rotation Service (IERS) and the models and procedures used for this purpose. It is a continuation of the series of documents begun with the Project MERIT Standards (Melbourne et al., 1983) and continued with the IERS Standards (McCarthy, 1989; McCarthy, 1992) and IERS Conventions (McCarthy, 1996). The current issue of the IERS Conventions is called the IERS Conventions (2003). When referenced in recommendations and articles published in past years, this document may have been referred to as the IERS Conventions (2000). All of the products of the IERS may be considered to be consistent with the description in this document. If contributors to the IERS do not fully comply with these guidelines, they will carefully identify the exceptions. In these cases, the contributor provides an assessment of the elects of the departures from the conventions so that its results can be referred to the IERS Reference Systems. Contributors may use models equivalent to those specified herein. Products obtained with different observing methods have varying sensitivity to the adopted standards and reference systems, but no attempt has been made in this document to assess this sensitivity. The reference systems and procedures of the IERS are based on the resolutions of international scientific unions. The celestial system is based on IAU (International Astronomical Union) Resolution A4 (1991). It was officially initiated and named by IAU Resolution B2 (1997) and its definition was further refined by IAU Resolution B1 (2000). The terrestrial system is based on IUGG Resolution 2 (1991). The transformation between celestial and terrestrial systems is based on IAU Resolution B1 (2000).
DTIC
Conventions; Earth Orbits; Geodesy

20050123575 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Development of High Resolution Hard X-Ray Telescope with Multi-Layer Coatings
Gorenstein, Paul; Brinton, John C., Technical Monitor; March 2005; 5 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG5-5354; No Copyright; Avail: CASI; A01, Hardcopy

This is the annual report for the third year of a three-year program. Previous annual reports have described progress achieved in the first and second years. The major objective of this program is the development of a focusing hard X-ray telescope with moderately high angular resolution, i.e. comparable to the telescopes of XMM-Newton. The key ingredients of the telescope are a depth graded multilayer coatings and electroformed nickel substrates that are considerably lighter weight than those of previous missions such as XMM-Newton, which have had conventional single metal layer reflective coatings and have operated at much lower energy X-rays. The ultimate target mission for this technology is the Hard X-Ray Telescope (HXT) of the Constellation X-Ray Mission. However, it is applicable to potential SMEX and MIDEX programs as well. We are building upon technology that has proven to be successful in the XMM-Newton and SWIFT missions. The improvements that we are adding are a significant reduction in mass without much loss of angular resolution and an order of magnitude extension of the bandwidth through the use of multilayer coatings. The distinctive feature of this approach compared to those of other hard X-ray telescope programs is that we expect the angular resolution to be superior than telescopes made by other methods thanks to the structural integrity of the substrates. They are thin walled complete cylinders of revolution with a Wolter Type 1 figure; the front half is a parabola, the rear half a hyperbola.
Author
X Ray Astronomy; X Ray Telescopes; Mirrors; Metal Coatings

20050123716 National Radio Astronomy Observatory, Charlottesville, VA, USA
An Overview of the Green Bank Telescope
Srikanth, S.; Norrod, R.; King, L.; Parker, D.; IEEE Antennas and Propagation Society International Symposium, Volume 3; [1999], pp. 1548-1551; In English; See also 20050123676; Copyright; Avail: Other Sources

The Green Bank Telescope (GBT) currently under construction at the National Radio Astronomy Observatory (NRAO) site in Green Bank, WV is scheduled for completion by the end of 1999. When completed, it will be the largest, fully-steerable telescope in the world. The GBT has a main reflector 100xll0 meters with unblocked aperture. The telescope will operate at prime focus in the 290 MHz-1200 MHz frequency range and at Gregorian focus in the 1.15 GHz to \g 100 GHz range. The performance of the GBT above 15 GHz will be enhanced by the use of an active surface and a metrology system. The location of the surface panels will be measured and adjusted to minimize the surface error as measured from a best-fit paraboloid. Switching between prime focus and secondary focus operation, as well as selection of different receivers, will be achieved in a few minutes giving the telescope a rapid frequency agility.
Author
Radio Telescopes; Reflector Antennas

20050123857 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Eta Carinae: What We have learned recently with HST/STIS, VLT/UVES and VLTI: What We Might Learn with VLT/VLTI across the 2008/9 Minimum

Gull, Theodore R.; [2005]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Eta Carinae, the LBV that we have learned to love and hate, has revealed many clues of its character over the past seven years by studies with HST and VLT. Based upon X-Ray, optical and IR observations, Eta Carinae is convincingly a massive binary system that uniquely has major nebular ejecta that are connected with historical outbursts. We have successhlly followed the stellar and nebular changes over the 5.5 year cycle, especially with STIS and RXTE, and across the spectroscopic minimum in 2003.5 with STIS, CHANDRA, RXTE, FUSE, and VLT/UVES. The HST/STIS high spatial resolution, combined with appropriate spectral resolving powers from 1150 to 10300 A, has revealed much about the Central Source and especially the spatially resolved extended stellar atmosphere and the ejecta, known as the Homunculus. Indeed the neutral, dusty outer Homunculus, ejected in the 1840s, envelops the newly discovered ionized Little Homunculus, ejected in the 1890s. In line of sight, multiple hot clumps, both ionized and neutral, are seen in absorption and provide much information on the physical conditions of these massive ejecta. Against the nebular-scattered starlight, wind and nebular absorptions provide views at different angles from line of sight. The VLT/UVES studies from 2002 through 2004 provided very important time-sampled spectra of both the star as seen directly and as seen by the SE lobe viewing the polar region of the star. The VLTI 2.2 micron measures of the central source are consistent with a prolate spheroid with its axis extending along the axis of the Homunculus. This is consistent with the noticeably larger wind mass and higher terminal velocity along the axis of the Homunculus compared to that measured in line of sight at about 45 degrees from the polar axes. We understand the system to be a massive primary with an O or WR companion in a very highly elliptical orbit. The spectroscopic minimum occurs during periastron, when the greatly extended primary atmosphere and wind bottles up the ionizing uv radiation of the companion star. This transient drop in uv photons leads to recombination of much of the wind structure and of the nearby ejecta. Doubly-ionized elements (iron, neon, argon, vanadium) recombine to singly ionized forms and extended structures on the scales of below 0.03 arcseconds to an arcsecond change, appear, or disappear. With the loss of the STIS on HST, ground-based observations, especially with high spatial-resolution facilities, including the VLT and VLTI will be key to further studies across the minimum centered on 2009.0. Now is the time to plan for these studies.

Author

Hubble Space Telescope; Variable Stars; Astronomical Interferometry; Spectrographs; Imaging Techniques

20050123858 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Long-Lag, Wide-pulse Gamma-Ray Bursts

Norris, J. P.; Bonnell, J. T.; Kazanas, D.; Scargle, . D.; Hakkila, J.; Giblin, T. W.; [2004]; 76 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A05, Hardcopy

Currently, the best available probe of the early phase of gamma-ray burst (GRB) jet attributes is the prompt gamma-ray emission, in which several intrinsic and extrinsic variables determine GRB pulse evolution. Bright, usually complex bursts have many narrow pulses that are difficult to model due to overlap. However, the relatively simple, long spectral lag, wide-pulse bursts may have simpler physics and are easier to model. In this work we analyze the temporal and spectral behavior of wide pulses in 24 long-lag bursts, using a pulse model with two shape parameters - width and asymmetry - and the Band spectral model with three shape parameters. We find that pulses in long-lag bursts are distinguished both temporally and spectrally from those in bright bursts: the pulses in long spectral lag bursts are few in number, and approximately 100 times wider (10s of seconds), have systematically lower peaks in vF(v), harder low-energy spectra and softer high-energy spectra. We find that these five pulse descriptors are essentially uncorrelated for our long-lag sample, suggesting that at least approximately 5 parameters are needed to model burst temporal and spectral behavior. However, pulse width is strongly correlated with spectral lag; hence these two parameters may be viewed as mutual surrogates. We infer that accurate formulations for estimating GRB luminosity and total energy will depend on several gamma-ray attributes, at least for long-lag bursts. The prevalence of long-lag bursts near the BATSE trigger threshold, their predominantly low vF(v) spectral peaks, and relatively steep upper power-law spectral indices indicate that Swift will detect many such bursts.

Author

Gamma Ray Bursts; Pulse Duration; Gamma Ray Astronomy

20050123859 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Emission From Rotation-Powered Pulsars and Magnetars

Harding, Alice K.; [2004]; 1 pp.; In English; 22nd Texas Symposium on Relativistic Astrophysics, 13-17 Dec. 2004, Stanford, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

I will review the latest developments in understanding the high-energy emission of rotation-powered pulsars and magnetically-powered Anomalous X-ray Pulsars (AXPs) and Soft Gamma-Ray Repeaters (SGRs). These fields have been extremely active in the last few years, both observationally and theoretically, driven partly by new X-ray data from Chandra, XMM-Newton and RXTE. At the same time, the Parkes Multibeam Survey has discovered over 700 new radio pulsars, some of them young, coincident with EGRET sources and others having magnetar-strength magnetic fields. These new observations are raising important questions about neutron star birth and evolution, as well as the properties of their high-energy emission.
Author
Magnetars; Pulsars; Stellar Rotation; Soft Gamma Repeaters; Radio Astronomy

20050123866 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content
Georganopoulos, Markos; Kazanas, Demosthenes; Perlman, Eric; Stecker, Floyd W.; [2004]; 10 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

We propose a method for estimating the composition, i.e. the relative amounts of leptons and protons, of extragalactic jets which exhibit Chandra - detected knots in their kpc scale jets. The method relies on measuring, or setting upper limits on, the component of the Cosmic Microwave Background (CMB) radiation that is bulk-Comptonized by the cold electrons in the relativistically flowing jet. These measurements, along with modeling of the broadband knot emission that constrain the bulk Lorentz factor GAMMA of the jets, can yield estimates of the jet power carried by protons and leptons. We provide an explicit calculation of the spectrum of the bulk-Comptonized (BC) CMB component and apply these results to PKS 0637 - 752 and 3C 273, two superluminal quasars with Chandra - detected large scale jets. What makes these sources particularly suited for such a procedure is the absence of significant non-thermal jet emission in the 'bridge', the region between the core and the first bright jet knot, which guarantees that most of the electrons are cold there, leaving the BC scattered CMB radiation as the only significant source of photons in this region. At lambda = 3.6 - 8.0 microns, the most likely band to observe the BC scattered CMB emission, the Spitzer angular resolution (approximately 1' - 3') is considerably smaller than the the 'bridges' of these jets (approximately 10'), making it possible to both measure and resolve this emission.
Author
Cosmic Microwave Background Radiation; Radio Jets (Astronomy); Astrophysics; Radio Emission; Compton Effect

20050123877 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Recent Results on Ultra-Luminous X-ray Sources
Mushotzky, Richard; [2005]; 1 pp.; In English; COSPAR Meeting, 17-21 Jan. 2005, Mumbai, India; No Copyright; Avail: Other Sources; Abstract Only

I will summarize what is known about the properties of the ultra-luminous x-ray sources with particular emphasis on their x-ray spectral and temporal properties, their radio counterparts and the environments in which they are located. These results are based on a large XMM survey of nearby galaxies VLA radio observations, recent XMM timing and spectral observations as well has HST and Gemini observations and a review of the literature. I will discuss how our present knowledge fits in with estimates of their mass and whether these objects are 'intermediate mass' black holes or stellar mass black holes in a very unusual state.
Author
X Ray Sources; Radio Astronomy; Black Holes (Astronomy); Stellar Luminosity

20050123916 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Optical Counterpart of M101 ULX-1
Kuntz, K. D.; Gruendi, Robert A.; Chu, You-Hua; Chen, C.-H. Rosie; Still, Martin; Mukai, Koji; Musuotzky, Richard F.; [2004]; 4 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): GO-5600587; Copyright; Avail: CASI; A01, Hardcopy

We have identified the optical counterpart of the Ultra-Luminous X-ray source Ml0l ULX-1 (CX- OKM101 J140332.74+542102), by comparing HST ACS images with Chandra ACIS-S images. The optical counterpart has V= 23.75 and colours consistent with those for a mid-B supergiant. Archival WFPC2 observations show that the source brightness is constant to within approximately 0.1 mag. The physical association of this source with the ULX is confirmed by Gemini GMOS spectroscopic observations which show spatially unresolved He II lambda4686 and He I lambda5876 emission. These

results suggest that M10l ULX-1 is a HMXB but deep spectroscopic monitoring observations are needed to determine the detailed properties of this system.
Author
X Ray Sources; Stellar Luminosity; Spectroscopy; Optical Properties

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20050092373 NASA Marshall Space Flight Center, Huntsville, AL, USA
Observations of Soft Gamma Repeaters
Kouveliotou, Chryssa; [2004]; 1 pp.; In English; XXII Texas Symposium on Relativistic Astrophysics, 13-17 Dec. 2004, Stanford, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Magnetars (Soft Gamma Repeaters and Anomalous X-ray Pulsars) are a subclass of neutron stars characterized by their recurrent X-ray bursts. While in an active (bursting) state (lasting anywhere between days and years), they are emit&ng hundreds of predominantly soft (kT=30 kev), short (0.1-100 ms long) events. Their quiescent source x-ray light ewes exhibit puhlions rotational period rate changes (spin-down) indicate that their magnetic fields are extremely high, of the order of 10^14- 10^l5 G. Such high B-field objects, dubbed 'magnetars', had been predicted to exist in 1992, but the first concrete observational evidence were obtained in 1998 for two of these sources. I will discuss here the history of Soft Gamma Repeaters, and their spectral, timing and flux characteristics both in the persistent and their burst emission.
Author
Soft Gamma Repeaters; Magnetars

20050092377 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Chandra X-Ray Observatory: The Past, the Present, and the Future
Weisskopf, Martin C.; Tananbaum, Harvey; [2005]; 1 pp.; In English; 205th Meeting of the American Astronomical Society, 9-13 Jan. 2005, San Diego, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Chandra X-ray Observatory had its origins in a 1963 proposal led by Riccardo Giacconi that called for a 1-meter diameter, 1-arcsecond class X-Ray telescope for studying the Universe. We will briefly discuss the history of the mission, the development of the hardware, its testing, and the launch on 1999, July 23. The majority of the talk will be an admittedly eclectic review of some of the most exciting scientific highlights. These include the detection and identification of the first source seen with Chandra - an unusual Seyfert 1 we nicknamed Leon X-1, the detailed study of the Crab Nebula and its pulsar, and spectacular images of other supernova remnants including the recent 1-Million second exposure on Cas A. We also will summarize some of the major Chandra findings for normal and active galaxies and we will illustrate the breadth of science enabled by Chandra observations of clusters of galaxies. We will close with a brief look towards the future of the field.
Author
X Ray Astrophysics Facility; Supernova Remnants; Seyfert Galaxies; Pulsars

20050092435 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
The Warm-Hot Intergalactic Medium
Hayes, Jeffrey, Technical Monitor; February 2005; 3 pp.; In English
Contract(s)/Grant(s): NNG04GD49G; No Copyright; Avail: CASI; A01, Hardcopy

This grant is associated to a 5-year LTSA grant, on 'Studying the Largest Reservoir of Baryons in the Universe: The Warm-Hot Intergalactic Medium'. The first year of work within this program has been very rich, and has already produced several important results, as detailed in this paper. Table 2 of our original proposal justification, listed the planned year-by-year program, divided into two sub-fields: (A) the study of the z=0 (or Local Group WHIM) system, and (B) the study of the z greater than 0 (i.e- intervening WHIM) systems. For each of the two sub-fields we had planned to analyze, in the first year, a number of archival (Chandra, XMM and FUSE) and new (if observed) sightlines. Moreover, the plan for the z=0 system included the search for new interesting sightlines. We have accomplished all these tasks.
Derived from text
Intergalactic Media; Astrophysics; Stellar Temperature

20050092436 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Chemical Compositions and Anomalies in Stellar Coronae ADP99
Oliversen, Ronald J., Technical Monitor; Drake, Jeremy; February 2005; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9105; No Copyright; Avail: CASI; A01, Hardcopy

Recent progress includes a paper accepted by the ApJ on AB Dor and V471 Tau, and papers on xi UMa and on giant stars submitted but still under ApJ revision. Atomic data has been investigated for line ratio abundance diagnostics, and in particular to determine the contributions of radiative recombination to observed line fluxes. Effects have generally been found to be less than 10%. Further investigations have been in into the possibility of modelling some of the recent coronal abundance anomally results in terms of Alven wave-driven separation of neutrals and ions in the upper chromosphere. Papers being readied for publication include one on active binary stars, and one on the Ne/O ratio in stellar coronae. The Ne/O is found to be approximately constant in all stars examined, and suggests that the current local ISM ratio might be too low by a factor of two. In summary, the work to-date is making good progress in mapping abundance anomalies as a function of spectral type and activity level. We are also making good progress with modelling that we will be able to test with our observational results. Author

Anomalies; Chemical Composition; Stellar Coronas; Astrophysics

20050109836 NASA Marshall Space Flight Center, Huntsville, AL, USA
Experiments on Dust Grain Charging
Abbas, M. N.; Craven, P. D.; Spann, J. F.; Tankosic, D.; LeClair, A.; West, E. A.; [2004]; 1 pp.; In English; American Geophysical Union 2004 Fall Annual Meeting, 13-17 Dec. 2004, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Dust particles in various astrophysical environments are charged by a variety of mechanisms generally involving collisional processes with other charged particles and photoelectric emission with UV radiation from nearby sources. The sign and the magnitude of the particle charge are determined by the competition between the charging processes by UV radiation and collisions with charged particles. Knowledge of the particle charges and equilibrium potentials is important for understanding of a number of physical processes. The charge of a dust grain is thus a fundamental parameter that influences the physics of dusty plasmas, processes in the interplanetary medium and interstellar medium, interstellar dust clouds, planetary rings, cometary and outer atmospheres of planets etc. In this paper we present some results of experiments on charging of dust grains carried out on a laboratory facility capable levitating micron size dust grains in an electrodynamic balance in simulated space environments. The charging/discharging experiments were carried out by exposing the dust grains to energetic electron beams and UV radiation. Photoelectric efficiencies and yields of micron size dust grains of SiO2, and lunar simulates obtained from NASA-JSC will be presented.
Author

Cosmic Dust; Ultraviolet Radiation; Astrophysics

20050109892 NASA Marshall Space Flight Center, Huntsville, AL, USA
Observations of Compact X-Ray Binaries with Chandra
Weisskopf, Martin C.; [2005]; 1 pp.; In English; Spectra and Timing of Compact X-Ray Binaries, 17-21 Jan. 2005, Mumbai, India; Copyright; Avail: Other Sources; Abstract Only

We review the the past five years of observations of compact X-ray binaries with NASA's chandra X-Ray Observatory. Author

X Ray Astrophysics Facility; X Ray Binaries; Observation

20050110084 Zagreb Univ., Zagreb, Croatia
Analysis of Reflection from Multilayer Cylinder by Using a Black-hole Approach
Sipus, Zvonimir; Kildal, Per-Simon; IEEE Antennas and Propagation Society International Symposium, Volume 2; [1999], pp. 1198-1201; In English; See also 20050109927; Copyright; Avail: Other Sources

Scattering from circular dielectric cylinders can be analyzed by expanding the incident fields in a Fourier series around the cylinder and by using a Fourier transformation in the longitudinal direction. The scattered field is then calculated as a superposition of scattered fields caused by each of these spectral components of the incident field. We have developed an algorithm (and computer program) called GIDMULT for analyzing multilayer dielectric structures in the spectral domain. By using the above approach (and therefore GIDMULT) the spectral Green's functions of multilayer structures can be determined and used when analyzing e.g. periodic metal elements inside the structure with the moment method. Such a loaded multilayer

structure could for example be a curved radome. However, this kind of scattering analysis will only provide the scattered field from a complete cylinder, whereas in practice a curved radome may not form a full cylinder and there will be an antenna inside. For example, the radome may be cut longitudinally to provide only a half cylinder and this may be mounted to the ground plane of an antenna. In such eases the curved radome must he characterized by reflection and transmission coefficients rather than a scattered field.
Derived from text
Reflectance; Circular Cylinders; Black Holes (Astronomy)

20050110153 NASA Marshall Space Flight Center, Huntsville, AL, USA
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets
Nishikawa, K. I.; Hardee, P.; Hededal, C. B.; Richardson, G.; Sol, H.; Preece, R.; Fishman, G. J.; [2004]; 4 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

Shock acceleration is a ubiquitous phenomenon in astrophysical plasmas. Plasma waves and their associated instabilities (e.g., Buneman, Weibel and other two-stream instabilities) created in collisionless shocks are responsible for particle (electron, positron, and ion) acceleration. Using a 3-D relativistic electromagnetic particle (REMP) code, we have investigated particle acceleration associated with a relativistic jet front propagating into an ambient plasma. We find that the growth times depend on the Lorenz factors of jets. The jets with larger Lorenz factors grow slower. Simulations show that the Weibel instability created in the collisionless shock front accelerates jet and ambient particles both perpendicular and parallel to the jet propagation direction. The small scale magnetic field structure generated by the Weibel instability is appropriate to the generation of 'jitter' radiation from deflected electrons (positrons) as opposed to synchrotron radiation. The jitter radiation resulting from small scale magnetic field structures may be important for understanding the complex time structure and spectral evolution observed in gamma-ray bursts or other astrophysical sources containing relativistic jets and relativistic collisionless shocks.
Author
Magnetic Field Configurations; Particle Acceleration; Relativistic Electron Beams; Plasma Jets

20050111477 NASA Marshall Space Flight Center, Huntsville, AL, USA
3-D GRMHD Simulations of Disk-Jet Coupling and Associated Variabilities and Emission
Nishikawa, K. I.; [2005]; 1 pp.; In English; International Workshop on Magnetohydrodynamic Accretion Flows and Jets, 25-27 Jan. 2005, Kyoto, Japan; Copyright; Avail: Other Sources; Abstract Only

We have performed the fully three-dimensional general relativistic magnetohydrodynamic (GRMHD) simulation of jet formation from a thin accretion disk around a Schwarzschild black hole with a free-falling corona. The initial simulation results show that a bipolar jet is created as shown by previous two-dimensional axisymmetric simulations with mirror symmetry at the equator. The 3-D simulation ran over one hundred light-crossing time units which is considerably longer than the previous simulations. We show that the jet is initially formed as predicted due in part to magnetic pressure from the twisting the initially uniform magnetic field and from gas pressure associated with shock formation in the region around r = 3 r_S. At later times, the accretion disk becomes thick and the jet fades resulting in a wind that is ejected from the surface of the thickened (torus-like) disk. It should be noted that no streaming matter from a donor is included at the outer boundary in the simulation (an isolated black hole not binary black hole). The wind flows outwards with a wider angle than the initial jet. The widening of the jet is consistent with the outward moving torsional Alfven waves (TAWs). This evolution of disk-jet coupling suggests that the jet fades with a thickened accretion disk due to the lack of streaming material from an accompanying star. We will report initial results of emission calculated based on simulations with Kerr metric using a new ray-tracing method developed by S. Feurst and K. Wu. Images include free-free emission, absorption, and electron scattering. Fluorescent iron line emission and its variabilities from black holes will also be calculated based on simulation results.
Author
Black Holes (Astronomy); Astronomical Models; Three Dimensional Models; Accretion Disks; Plasma Jets

20050111557 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA, Stanford Linear Accelerator Center, CA, USA, California Univ., Berkeley, CA, USA, Renaissance Technologies, Inc., PA, USA
X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years
Fruscione, A.; Greenhill, L. J.; Filippenko, A. V.; Moran, J. M.; Herrnstein, J. R.; Jul. 2004; In English
Report No.(s): DE2004-829725; SLAC-PUB-10572; No Copyright; Avail: National Technical Information Service (NTIS)

The authors report monitoring of the 0.3-10 keV spectrum of NGC 4258 with the XMM-Newton observatory at five

epochs over 1.5 years. They also report reprocessing of an overlapping four epoch series of archival Chandra observations (0.5-10 keV). By including earlier ASCA and Beppo-SAX observations, they present a new, nine year time-series of models fit to the X-ray spectrum of NGC 4258. They model the Chandra and XMM-Newton data self-consistently with partially absorbed, hard power-law, soft thermal plasma, and soft power-law components. Over the nine years, the photo-electric absorbing column ((approx) 10(sup 23) cm(sup -2)) did not vary detectably, except for a (approx) 40% drop between two ASCA epochs separated by 3 years (in 1993 and 1996) and a (approx) 60% rise between two XMM-Newton epochs separated by just 5 months (in 2001 and 2002). In contrast, factor of 2-3 changes are seen in absorbed flux on the timescale of years. These are uncorrelated with changes in absorbing column and indicative of central engine variability. The most rapid change in luminosity (5-10 keV) that the authors detect (with XMM-Newton and Chandra) is on the order of 30% over 19 days. The warped disk that is a known source of H(sub 2)O maser emission in NGC 4258 is believed to cross the line of sight to the central engine. They propose that the variations in absorbing column arise from inhomogeneities in the rotating disk, as they sweep across the line of sight. They estimate that the inhomogeneities are (approx) 10(sup 15) cm in size.
NTIS
X Rays; Galaxies; Line of Sight; Time Measurement

20050123649 Michigan Univ., Ann Arbor, MI, USA
Galactic Winds and Intragroup Medium Energetics
Dupke, Renato; Lloyd-Davies, Ed; Bregman, Joel; [2004]; 3 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-13157; No Copyright; Avail: CASI; A01, Hardcopy

The main objective of this proposal was to study the metallicity distribution of HCG 97 with the goals of determining the SN Type enrichment, the strength of galactic winds and how it impacts on the evolution of cluster's ICM within the framework of hierarchical formation scenarios.
Derived from text
Galactic Winds; Metallicity; Astrophysics

20050123910 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
A Survey of Helium Accreting White Dwarfs
Steeghs, Daniel; March 2005; 2 pp.; In English
Contract(s)/Grant(s): NNG04GG30G; No Copyright; Avail: CASI; A01, Hardcopy

We have initiated a survey of the X-ray spectral properties of double white binaries using XMM-Newton. Three of our sources were indeed observed with XMM during AO-3. We have analyzed these data using the latest data reduction software and have also extracted several archival data sets of similar systems from the XMM archive. The first paper presenting the X-ray spectral and variability properties of four of these binary systems has been submitted in January 2005. We have also secured some optical ground-based spectroscopy and are currently analyzing the spectral signatures in more detail. We are also continuing this survey with additional approved XMM observations during AO-4 and anticipate additional publications in the near future.
Author
Helium; White Dwarf Stars; Binary Stars

20050123917 Massachusetts Inst. of Tech., MA, USA
Simultaneous X-Ray and UV Spectroscopy of the Symbiotic HD 154791
Chakrabarty, Deepto; [2005]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-13249
Report No.(s): MIT-6894696; No Copyright; Avail: Other Sources; Abstract Only

Our program consisted of three observations of the symbiotic neutron stadred giant binary 4U 1700+24/HD154791. Using an earlier 2002 TOO observation made in response to a new transient X-ray outburst, we had previously discovered a redshifted O VII line and submitted a paper on this discovery to the journal Astronomy and Astrophysics. In these new observations, we from analysis of the 2002 TOO observation of the symbiotic neutron-star binary 4U 1700+24, made in response to detection of a new transient outburst, we discovered a redshifted Oxygen VIII line (in collaboration with A. Tiengo of UVA), and submitted a paper on this result to A&A. Analysis of the three subsequent observations has found a number of other features also due to ionized oxygen, which we have found to vary as the source transits from outburst to quiescence.

A paper describing these observations is being prepared for submission to the Astrophysical Journal, led by Co-I Duncan Galloway.
Author
Astrophysics; Neutron Stars; Symbiotic Stars; Ultraviolet Spectroscopy; X Ray Spectroscopy

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20050092374 NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems, Huntsville, AL, USA
A Viable Scheme for Elemental Extraction and Purification Using In-Situ Planetary Resources
Sen, S.; Schofield, E.; ODell, S.; Ray, C. S.; [2005]; 1 pp.; In English; 1st Space Exploration Conference: Continuing the Voyage of Discovery, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-02096; Copyright; Avail: Other Sources; Abstract Only

NASA's new strategic direction includes establishing a self-sufficient, affordable and safe human and robotic presence outside the low earth orbit. Some of the items required for a self-sufficient extra-terrestrial habitat will include materials for power generation (e.g. Si for solar cells) and habitat construction (e.g. Al, Fe, and Ti). In this paper we will present a viable elemental extraction and refining process from in-situ regolith which would be optimally continuous, robotically automated, and require a minimum amount of astronaut supervision and containment facilities, The approach is based on using a concentrated heat source and translating sample geometry to enable simultaneous oxide reduction and elemental refining. Preliminary results will be presented to demonstrate that the proposed zone refining process is capable of segregating or refining important elements such as Si (for solar cell fabrication) and Fe (for habitat construction). A conceptual scheme will be presented whereby such a process could be supported by use of solar energy and a precursor robotic mission on the surface of the moon.
Author
Extraction; Purification; Space Exploration; Planetary Geology

20050092375 NASA Marshall Space Flight Center, Huntsville, AL, USA, Jacobs Sverdrup Technology, Inc., Huntsville, AL, USA
Reuse International Space Station (ISS) Modules as Lunar Habitat
Miernik, Janie; Owens, James E.; Floyd, Brian A.; Strong, Janet; Sanford, Joseph; [2005]; 1 pp.; In English; 1st Space Exploration Conference, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-00187; Copyright; Avail: Other Sources; Abstract Only

NASA currently projects ending the ISS mission in approximately 2016, due primarily to the expense of re-boost and re-supply. Lunar outposts are expected to be in place in the same timeframe. In support of these mission goals, a scheme to reuse ISS modules on the moon has been identified. These modules could function as pressurized volumes for human habitation in a lunar vacuum as they have done in low-earth orbit. The ISS hull is structurally capable of withstanding a lunar landing because there is no atmospheric turbulence or friction. A compelling reason to send ISS modules to the moon is their large mass; a large portion of the ISS would survive re-entry if allowed to de-orbit to Earth. ISS debris could pose a serious risk to people or structures on Earth unless a controlled re-entry is performed. If a propulsive unit is devised to be attached to the ISS and control re-entry, a propulsion system could be used to propel the modules to the moon and land them there. ISS modules on the lunar surface would not require re-boost. Radiation protection can be attained by burying the module in lunar regolith. Power and a heat removal system would be required for the lunar modules which would need little support structure other than the lunar surface. With planetary mass surrounding the module, heat flux may be controlled by conductance. The remaining requirement is the re-supply of life-support expendables. There are raw materials on the moon to supplement these vital resources. The lunar maria is known to contain approximately 40% oxygen by mass in inorganic mineral compounds. Chemical conversion of moon rocks to release gaseous oxygen is known science. Recycling and cleaning of air and water are currently planned to be accomplished with ISS Environmental Control & Life Support Systems (ECLSS). By developing a Propulsion and Landing Module (PLM) to dock to the Common Berthing Mechanism (CBM), several identical PLMs could be produced to rescue and transfer the ISS modules to the lunar surface, one by one. The propulsion does not need to be as swift as Apollo, nor would the modules need to be manned during transportation to the moon. The trajectory from low-Earth to lunar orbit would avoid or quickly pass through the Van Allen belts to minimize radiation

exposure to electronics onboard. A landing technology similar to Apollo's could be utilized to land an ISS module on the moon. Since the mission will be unmanned, system redundancy could be minimized to keep the cost down. If the mission failed and a module crashed landed on the moon, the risk of debris landing on Earth would be avoided and the raw materials could be used in future lunar missions.
Derived from text
International Space Station; Reuse; Habitats; Space Station Modules

20050092380 NASA Marshall Space Flight Center, Huntsville, AL, USA
Strategic Research Partnerships for Exploration
Nall, Mark; [2005]; 1 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA s Space Product Development Program has completed a significant transformation from an industry driven program focused on the commercial use of space, to a NASA space exploration driven program focused on providing research and technologies for space exploration through leveraged research partnerships. Initiated in 1985 under the NASA Office of Commercial Programs, the Space Product Development Program and associated Research Partnership Centers have worked with private industry to fulfill the NASA objective of '. . .enabling io the maximum extent possible the fullest commercial use of space.' In 2001, the program began to place greater emphasis on dual use activities. In particular, those activities that enable commercial use of space, while at the Same time fulfill a NASA mission need. With the President s exploration, announcement in January 2004, the transformation of the Space Product Development program further focused on NASA exploration requirements. The Program s experience in successfully assisting industry with technology maturation is now being utilized by the Agency to affordably develop the technologies needed for sustainable human and robotic space exploration.
Author
Space Exploration; NASA Space Programs; Space Commercialization; Research and Development

20050092385 NASA Marshall Space Flight Center, Huntsville, AL, USA
Space Resource Utilization and Extending Human Presence Across the Solar System
Curreri, Peter A.; [2005]; 1 pp.; In English; 1st Space Exploration Conference: Continuing the Voyage of Discovery, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

The Presidents Vision for Exploration is not a single mission, but an open ended journey that seeks to answer 'How can we live on other worlds?' Using space resources is the only known approach for affordable, sustained, flexible, and self sufficient, human occupation beyond Earth orbit. Earth is a large planet. A simple analysis using the rocket equation shows that if Earth were a bit larger, chemical propulsion as a mechanism to access space would become impractical. Thus, even with the most efficient chemical rocket launch capability, the cost of lifting massive payloads into space will remain very steep (currently about $l00k/lb to the Moon and greater than $500k/lb to Mars). Space resource utilization should begin with an aggressive broad based demonstration program as afforded by the precursor missions implementation of the President's Vision of Exploration. Ion engine upper stages, for example, were studied for over 30 years, but only implemented in design after the Deep Space 1 in space demonstration. These demonstrations should include: extraction of elements from lunar regolith, and Martian soil and atmosphere, demonstration of power break even and growth from lunar or Mars moons derived photovoltaics, oxygen extraction for life support and propellant, and metals and alloys for in space repair and the production of habits and radiation shielding. Space resource utilization yields operational dividends through the subsequent programs including: propellant from lunar oxygen which could cut transportation costs from Earth in half, mega watts per year of power grown from lunar photovoltaics at decreasing cost per kW, decreased cost for human Mars missions by a factor of 10 by using propellant derived from Mars atmosphere for return, and in space manufacturing and food production with space resources yielding safe sustained and eventually self sufficient human presence in space. After the demonstration and implementation, the space resource utilization investment enables commercial and private viability beyond Earth orbit. For example, analysis has shown the lunar oxygen production for propellant becomes commercially viable after the exploration program completes the R&D, and power from lunar derived photovoltaics could, according to past NASA sponsored studies, pay for themselves while supplying most of Earth's electrical energy after about 17 years. Besides the Moon and Mars the resources of the near Earth asteroids enable the building of large space structures and science payloads. Analysis has shown that one of the thousands of these objects (some as easily accessible in space as the Moon and Mars), 2 km dia, the size of a typical open pit mine, would cost the total global financial product of Earth for 30,000 years if we were to launch it from Earth. Beyond Mars, the belt asteroids have been calculated to contain enough materials for habitat and life to support 10 quadrillion people.

Thus, the development and use of space resources enables the extension of human life through the solar system allowing humanity to move from a planetary to a solar system society.
Author
Solar System; Manned Space Flight

20050109869 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thin Films and Inflatable Applications in Exploration Habitat Structures
Frazier, Donald O.; Paley, Mark S.; Strong, Janet D.; [2005]; 1 pp.; In English; AIAA Conference, 30 Jan. - 2 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA's vision to return to the Moon and then extend human exploration to Mars will benefit from human habitat technology development using new and creative applications of polymer materials and concepts. Thin Film and Inflatable (TFVI) materials are particularly interesting for exploration applications due to their light weight and low volume. Whereas TF/I materials can be launched and carried from Earth to multiple and distant exploration sites without the constraints of upmass limitations, eventually, with recycling and reclamation efforts, these materials may be developed using in-situ resources. These materials can be useful for fabricating, patching and repairing vehicles, replacement parts and even habitat structures, as well as for developing stand-alone habitat structure technologies and for nested and integrated applications. TF/Is can also be ideal environmental containment vessels within lunar or Martian regolith walls or as liners inside caves or raw regolith exterior structures for the provisions of atmosphere containment, debris protection and cleanliness. Further, TFOs can be specialized and matured for various and diverse applications. The desired range of applications will require materials specification for such properties as transparency, elasticity, thermal conductivity, mechanical strength, heat capacity, chemical resistance, and permeability. This paper will discuss Marshall Space Flight Center's plans to analyze and prioritize TF/I materials properties and classifications and to develop applications for these highly desirable materials in human habitat construction projects on the Moon and Mars.
Author
Fabrication; Habitats; Thin Films; Planetary Geology; Inflatable Structures; NASA Space Programs; Space Exploration

20050109875 NASA Marshall Space Flight Center, Huntsville, AL, USA
Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair
Bassler, Julie A.; Grugel, Richard N.; Bodiford, Melanie P.; Fiske, Michael R.; Gilley, Scott D.; Epps, Stephen J.; Evans, Brian W.; Ezell, David D.; [2005]; 1 pp.; In English; AIAA Conference, 30 Jan. - 2 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

Scientists, engineers, and the general public have always speculated and dreamed about living and working on other planets. The allure and challenges of this endeavor have generated innumerable Conferences, feasibility studies and six manned Moon landings. As NASA prepares to return to the Moon and eventually Mars, it is only natural to stand on the shoulders of those giants who have gone before us. This time, as we go to stay, the development of processes that maximize the use of in-situ resources will become even more important. On demand fabrication of piece-parts to reduce required spares, development of habitat structures, and the ability to make repairs will all benefit from the use of in-situ materials including raw regolith and metals and/or gases extracted from regolith or planetary atmospheres. To support these activities, there will also be a need for recycling as well as non-destructive evaluation technologies. This paper will present a historical overview of technology development associated with In-Situ Fabrication and Repair (ISFR) elements described above and discuss the ISFR program implemented at NASA/Marshall Space Flight Center.
Author
Fabrication; In Situ Measurement; Planetary Geology; NASA Space Programs; Mars (Planet); Lunar Surface

20050109883 NASA Marshall Space Flight Center, Huntsville, AL, USA
Lunar and Martian Sub-surface Habitat Structure Technology Development and Application
Boston, Penelope J.; Strong, Janet D.; [2005]; 1 pp.; In English; AIAA Conference, 30 Jan. 2 Feb. 2005, Orlando, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA's human exploration initiative poses great opportunity and great risk for manned missions to the Moon and Mars. Subsidace structures such as caves and lava tubes offer readily available and existing in-situ habitat options. Sub-surface dwellings can provide complete radiation, micro-meteorite and exhaust plume shielding and a moderate and constant temperature environment; they are, therefore, excellent pre-existing habitat risk mitigation elements. Technical challenges to subsurface habitat structure development include surface penetration (digging and mining equipment), environmental

pressurization, and psychological environment enhancement requirements. Lunar and Martian environments and elements have many beneficial similarities. This will allow for lunar testing and design development of subsurface habitat structures for Martian application; however, significant differences between lunar and Martian environments and resource elements will mandate unique application development. Mars is NASA's ultimate exploration goal and is known to have many very large lava tubes. Other cave types are plausible. The Moon has unroofed rilles and lava tubes, but further research will, in the near future, define the extent of Lunar and Martian differences and similarities. This paper will discuss Lunar and Martian subsurface habitation technology development challenges and opportunities.
Author
Habitats; Lunar Environment; Lunar Topography; Mars Environment; Mars Surface; Technology Utilization; NASA Space Programs

20050110125 NASA Marshall Space Flight Center, Huntsville, AL, USA
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View
Bhardwal, Anil; Elsner, Ron; Gladstone, Randy; Waite, Hunter, Jr.; Lugaz, Noe; Cravens, Tom; Branduardi-Raymont, Graziella; Ramsay, Gavin; Soria, Rob; Ford, Peter, et al.; [2004]; 1 pp.; In English; American Geophysical Union Fall Meeting, 13-17 Dec. 2004, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

Jovian X-rays can be broadly classified into two categories: (1) auroral emission, which is confined to high-latitudes (approximately greater than 60 deg.) at both polar regions, and (2) dayglow emission, which originates from the sunlit low-latitude (approximately less than 50 deg.) regions of the disk (hereafter called disk emissions). Recent X-ray observations of Jupiter by chandra and XMM-Newton have shown that these two types of X-ray emission from Jupiter have different morphological, temporal, and spectral characteristics. In particular: 1) contrary to the auroral X-rays, which are concentrated in a spot in the north and in a band that runs half-way across the planet in the south, the low-latitude X-ray disk is almost uniform; 2) unlike the approximately 40 plus or minus 20-min periodic oscillations seen in the auroral X-ray emissions, the disk emissions do not show any periodic oscillations; 3) the disk emission is harder and extends to higher energies than the auroral spectrum; and 4) the disk X-ray emission show time variability similar to that seen in solar X-rays. These differences and features imply that the processes producing X-rays are different at these two latitude regions on Jupiter. We will present the details of these and other features that suggest the differences between these two classes of X-ray emissions from Jupiter, and discuss the current scenario of the production mechanism of them.
Author
Auroras; X Rays; Jupiter (Planet)

20050110128 NASA Marshall Space Flight Center, Huntsville, AL, USA
Sabatier Methanation Reactor for Space Exploration
Murdoch, Karen; Goldblatt, Loel; Carrasquillo, Robyn; Harris, Danny; [2005]; 2 pp.; In English; Space Exploration Conference, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA; Copyright; Avail: Other Sources; Abstract Only

The Sabatier Methanation Reactor technology is of vital importance to the success of the human and robotic exploration program. In order to achieve an affordable program, the logistics supply to support the mission must be minimized to the fullest extent possible. One area of potential reduction with high return on investment is the closure of life support loops, particularly oxygen and water. The Sabatier system accomplishes this by utilizing hydrogen and carbon dioxide, waste products from the life support system, to produce water and methane. The recovered water is then recycled back into the life support system to provide oxygen; while the methane can be used for propulsion, or can be broken down further to recover the hydrogen. This technology is applicable not only to transit phases of exploration, but surface habitats as well as in-situ propellant production. The Sabatier Reactor system has been developed for ground based demonstration experiments extensively over the past 30 years. Over the past three years, NASA has funded development of the Sabatier Carbon Dioxide Reduction Assembly (CRA) for use on the ISS. Currently this system is at TRL 5 and it is expected that the system will be flown on the ISS as a flight experiment, The purpose of the flight experiment is to integrate the Sabatier CRA into a synchronized system with the oxygen generation system and the carbon dioxide concentrator. The flight experiment will verify the integration of the different systems working together plus it will verify the capability of the system to operate, and effectively separate its products in a micro-gravity environment. Subsequent to design validation, the flight experiment can remain onboard the ISS providing valuable water to offset logistics re-supply requirements. Some of the challenges facing the development of the Sabatier system include handling vibration induced particulates, microgravity phase separation and containment of hazardous gases. Plans for adequately addressing these issues will be presented. The Sabatier carbon dioxide reduction process will greatly benefit any of the extended duration human exploration missions because of the tremendous savings of consumables realized. Any of these mission scenarios, be they transit or surface based, must consider closing the

life support loops in order to make the mission achievable, let alone affordable. Carbon dioxide reduction technology will be necessary for future outpost habitats, and the technology needs to be proven viable in a space application. The Sabatier methanation reaction is also a desirable method for producing propellant from the Mars atmosphere. The common system could be designed to accept carbon dioxide from an indoor air revitalization loop concentrator, or from an outdoor atmosphere compressor. Carbon dioxide reduction validation is but one step in the spiral development of the in-situ propellant production system desired for future planetary exploration.
Author
Methanation; Reactor Technology; Sabatier Reaction; Space Exploration

20050110129 NASA Marshall Space Flight Center, Huntsville, AL, USA
Present Status of Lunar Regolith Simulants, Workshop Overview and Objectives
Sibille, L.; [2005]; 1 pp.; In English; Lunar Regolith Materials Simulant Workshop, 24-26 Jan. 2005, Madison, AL, USA
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

As NASA embarks on a new phase of Space Exploration aiming at establishing a long- term human presence on the Moon and Mars, we face some immediate challenges in the development of tbe technologies that will take us there. Among these challenges, the lack of accepted reference materials that simulate the lunar soil and regolith is a significant one that must be addressed now. The workshop organized today focuses on defining these materials for the use of NASA and other organizations involved in research and development efforts of lunar technologies. The range of these technologies is vast and so is the variety of lunar materials. The gathering of experts from a large number of disciplines is a pre-requisite to achieve a credible consensus on this issue and be able to make the right recommendations for NASA management as they consider solutions to the development and usage of these specific materials.
Author
Lunar Rocks; Lunar Soil; Regolith; NASA Space Programs; General Overviews

20050110130 NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems, Huntsville, AL, USA
Characterization Strategies and Requirements for Lunar Regolith Simulant Materials
Carpenter, Paul K.; [2005]; 1 pp.; In English; Lunar Regolith Simulant Workshop, 24-26 Jan. 2005, Madison, AL, USA
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Lunar samples returned from the Apollo missions represent a wide range of geological materials and processes, and have been studied in considerable detail using a wide range of characterization techniques. In contrast, lunar regolith simulant materials lag far behind in source material matching, and generally have been utilized as engineering test materials with secondary emphasis on extensive supporting chemical and mineralogical analysis. Presented here is a brief roadmap of analytical characterization approaches coupled with a breakdown of lunar simulant requirements developed in the past and anticipated in support of upcoming NASA missions.
Author
Characterization; Lunar Geology; Lunar Rocks; Regolith

20050110152 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Status of Lunar Simulants: Conclusions and Recommendations from the 2005 Lunar Regolith Simulant Materials Workshop
Sibille, L.; Schlagheck, R.; [2005]; 1 pp.; In English; Workshop on Granular Materials for Exploration, 1-3 Feb. 2005, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

No coordinated program currently exists in the U.S.A to define reference materials to be used as analogs of lunar materials. While such efforts have existed at different times in the past (Apollo Landing Module and Lunar Rover programs and NASA's Space Initiative in the early 1990's), the need for mineral materials chosen to simulate the characteristics of lunar regoliths is a pressing issue that must be addressed today through the collaboration of scientists, engineers and program managers. The 2005 Lunar Regolith Materials Workshop was held at Marshall Space Flight Center in Huntsville, AL on January 24-26,2005 to launch a focused effort of defining the requirements of lunar \gsimulant materials and make specific recommendations to NASA Headquarters for their production. Nearly 100 scientists and engineers worked during 3 days to accomplish these goals. Their conclusions and recommendations will be presented.
Author
Lunar Programs; Landing Modules; Lunar Soil; Minerals

20050110159 NASA Marshall Space Flight Center, Huntsville, AL, USA

Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications

Ramachandran, Narayanan; Ray, Chandra; Rogers, Jan; [2004]; 1 pp.; In English; Materials Research Society Meeting, 29 Nov. - 3 Dec, 2004, Boston, MA, USA

Contract(s)/Grant(s): NAS8-02096; Copyright; Avail: Other Sources; Abstract Only

The long-term exploration goals of NASA include developing human habitation on Mars and conducting scientific investigations on Mars and other planetary bodies. In situ resource processing is a key objective in this area We focus OR the possibility of making magnetic glasses in situ for potential applications development. The paper will focus on ongoing work at NASA Marshall Space Flight Center on making magnetic glass h m Mars soil simulants and its characterization. Analysis of the glass morphology, strength, chemistry and resulting magnetic properties will provide a fi.mdamenta1 understanding ofthe synthesized materiai that can be used for pomtiai appiications cieveiopment. In an effort to characterize the magnetic properbes of the Mars glasses, a series of tests were performed at NASA MSFC. Preliminary tests indicated that the glasses were attracted to a magnet and also had a small amount of residual magnetism. They were opaque (almost black in color). As the first step, a sample of Mars 1 glass (-lm x lmm x 5 mm length) was machined, weighed and its hysteresis curve was measured using a Vibration Sample Magnetometer 0. Next, a small furnace was designed and built and the sample was baked in a graphite (reducing agent) crucible at 800 C in an Argon atmosphere for 3 hours in the presence of a uniform, transverse (transverse to the 5mm length of the sample) magnetic field of 0.37 Tesla. The treated sample showed reddening on the outside and showed substantially increased residual magnetism. This sample was again analyzed in the VSM. The data clearly showed that some chemical change occurred during the heat treatment (color change) and that both the glasses have useful magnetic properties. Although no orientation effects of the magnetic field were considered, the data showed the following: 1. Both glass samples are primarily soft magnets and display ferromagnetic behavior (hysteresis, saturation, etc.) 2. The treated glass has improved saturation magnetism (order of magnitude increase), retentivity (factor of 6 increase) and susceptibility (order of magnitude increase) compared to the untreated glass 3. The untreated sample has higher coercivity (-50% that of Nickel) than the treated sample

Author

Glass; Mars (Planet); Soils; In Situ Resource Utilization

20050111573 NASA Marshall Space Flight Center, Huntsville, AL, USA

In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC

Bodiford, Melanie P.; Fiske, Michael R.; McGregory, Walter; Pope, Regina D.; [2005]; 7 pp.; In English; AIAA 1st Exploration Conference, 31 Jan. - 1 Feb. 2005, Orlando, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS8-00187

Report No.(s): AIAA Paper 2005-2704; Copyright; Avail: CASI; A02, Hardcopy

As the nation prepares to return to the Moon and subsequently to Mars, it is apparent that the viability of long duration visits with appropriate radiation shielding/crew protection, hinges on the development of habitat structures, preferably in advance of a manned landing, and preferably utilizing in-situ resources. A relatively large number of habitat structure configurations can be developed from a relatively small set of in-situ resource-based construction products, including, blocks, raw regolith, reinforced concrete, and glass products. A much larger group of habitat designs can be developed when 'imported' material are brought from Earth, including thin films and liners, and foldable, or expandable metal structures. These, and other technologies have been identified, and subjected to a rigorous trade study evaluation with respect to exploration and other performance criteria. In this paper, results of this trade study will be presented, as well as various habitat structure design concepts and concepts for construction automation. Results of initial tests aimed at concrete, block and glass production using Lunar regolith simulants will also be presented. Key issues and concerns will be discussed, as well as design concepts for a Lunar environment testbed to be developed at MSFC's Microgravity Development Laboratory. (MDL).

Author

Habitats; In Situ Resource Utilization; Lunar Environment; Mars (Planet); Radiation Shielding; Expandable Structures; Composite Materials

20050123606 NASA Marshall Space Flight Center, Huntsville, AL, USA

Smart Structures for Vibration Control on Long-Term Space Exploration and Habitation Missions

Gattis, Christy B.; Shepard, W. Steve, Jr.; October 12, 2004; 1 pp.; In English; AIAA 1st Space Exploration Conference, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA

Contract(s)/Grant(s): 398-30-10; Copyright; Avail: Other Sources; Abstract Only

The current vision for space exploration focuses on human missions to the Moon, Mars, and beyond. To support these

goals, it is certain that new vehicles and intermediate bases will be developed, whether that means simply re-direction of the ISS as a 'mission research facility' or construction of a lunar base. Since these facilities are expected to be constructed from inherently light-weight materials, this work examines some of the potential sources of vibration and noise as well as means for controlling these vibrations. Many of the operating components within these facilities, such as pumps, fans, and motors, will produce vibrations during operation. These vibrations become structure in which they are housed. Resonances can impact acoustic noise levels and noise quality within the environment, possibly affecting crew health and productivity. For long-term missions in particular, it is expected that crew members will spend significant portions of their time restrained in the structure, such as in seats. As a result, the general health and well-being of the crew can be improved by limiting the harmful effects of human exposure to long-term audible and tactile vibration input. Besides the human factor, this work also examines some operational considerations in which vibrations play an important role. Vibrations can impact the environment for science and in-situ manufacturing research within these vehicles. Since a benign vibratory environment is beneficial for most types of science experiments, there is a need for various forms of vibration control. Because the operational characteristics of a vehicle can change during a long-term mission, it is further expected that the characteristics of many of the vibratory excitations will change with time. Consequently, the form of vibration control needed to improve overall habitability and usefulness of the vehicle or element for exploration missions will rely to some degree on the vibration control system's ability to adapt. To address these needs, this work also examines the development and use of smart materials to tune the dynamic characteristics of the structure in a passive sense. One prime example is the use of an adaptive electrical shunt connected to a piezoelectric patch in order to provide tuned passive vibration damping. The work also examines the use of active vibration control, such as by applying power to that same piezoelectric patch. The overall goal is to examine the use of smart structures that can react to the environment thereby improving the overall living, working, and learning environment for these long-term missions. Author

Habitability; Space Missions; Smart Structures; Vibration Damping; Long Duration Space Flight; Space Exploration

20050123643 Michigan Univ., Ann Arbor, MI, USA

Solar Cycle/Seasonal Variations of H, D, H2 and He Distributions and Escape on Mars as Determined by the Mars Thermosphere Global Circulation Model (MTGCM)

Bougher, Stephen; March 04, 2005; 8 pp.; In English

Contract(s)/Grant(s): NNG04GA04G; No Copyright; Avail: CASI; A02, Hardcopy

The Mars Thermosphere General Circulation Model (MTGCM) was exercised for Ls = 90 (aphelion) solar minimum, and Ls = 270 perihelion) solar maximum conditions. Simulated MTGCM outputs (i.e. helium density distributions) were compared to those previously observed for Earth and Venus. Winter polar night bulges of helium are predicted on Mars, similar to those observed on the nightside of Venus and in the winter polar regions of Earth. A poster on this research was presented at the European Geophysical Society Meeting (EGS) in 2003. This research paves the way for what might be expected in the polar night regions of Mars during upcoming aerobraking and mapping Campaigns. Lastly, Mars thermosphere (approx. 100-130 km) winter polar warming was observed at high Northern latitudes during the perihelion season, but not at high Southern latitudes during the opposite aphelion season. Presumably, the Mars thermospheric circulation is responsible for the dynamically controlled heating needed to warm polar night temperatures above radiative equilibrium values. Again, MTGCM simulations were conducted for Ls = 90 and Ls = 270 conditions; polar temperatures were examined and found to be much warmer at Northern high latitudes (perihelion) than at Southern high latitudes (aphelion), similar to Mars aerobraking datasets. The Mars thermospheric circulation is found to be stronger during perihelion solstice conditions than during aphelion conditions, owing to both stronger seasonal solar and dust heating during Mars perihelion. An invited talk was given at the Spring AGU 2004 on this research. A forthcoming GRL paper was drafted on this same topic, but not submitted before the termination of this 1-year grant.

Derived from text

Mars Atmosphere; Planetary Meteorology; Solar Cycles; Annual Variations; Atmospheric Composition; Solar Activity Effects

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20050092387 NASA Marshall Space Flight Center, Huntsville, AL, USA

Current Sheet Evolution in the Aftermath of a CME Event

Bemporad, A.; Poletto, G.; Suess, S. T.; Ko, Y.-K.; Schwadron, N. A.; Elliott, H. A.; Raymond, J. C.; [2005]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We report on SOHO-UVCS observations of the coronal restructuring following a Coronal Mass Ejection (CME) on November 26,2002, at the time of a SOHO-Ulysses quadrature campaign. Starting about 3 hours after a CME in the NW quadrant, UVCS began taking spectra at 1.7 solar radius, covering emission from both cool and hot plasma. Observations continued, with occasional gaps, for more than 2 days. Emission in the 974.8 Angstrom line of [Fe XVIII], indicating temperatures above 6 x 10(exp 6) K, was observed throughout the campaign in a spatially limited location. Comparison with EIT images shows the Fe XVIII emission to overlie a growing post-flare loop system formed in the aftermath of the CME. The emission most likely originates in a current sheet overlying the arcade. Analysis of the [Fe XVIII] emission allows us to infer the evolution of physical parameters in the current sheet over the entire span of our observations: in particular, we give the temperature vs. time in the current sheet and estimate the density. At the time of the quadrature, Ulysses was directly above the location of the CME and intercepted the ejecta. High ionization state Fe was detected by Ulysses-SWICS throughout the magnetic cloud associated with the CME. Both the remote and in situ observations are compared with predictions of theoretical CME models.
Author
Coronal Mass Ejection; Current Sheets; Ultraviolet Radiation; Evolution (Development)

20050092391 NASA Marshall Space Flight Center, Huntsville, AL, USA
Slow-rise and Fast-rise Phases of an Erupting Solar Filament and Flare Emission Onset
Sterling, Alphonse C.; Moore, Ronald L.; [2005]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We observe the eruption of an active-region solar filament of 1998 July 11 using high time cadence and high spatial resolution EUV observations from the TRACE satellite, along with soft X-ray images from the soft X-ray telescope (SXT) on the Yohkoh satellite, hard X-ray fluxes from the BATSE instrument on the Compton Gamma Ray Observatory (CGRO) satellite and from the hard X-ray telescope (HXT) on Yohkoh, and ground-based magnetograms. We concentrate on the initiation of the eruption in an effort to understand the eruption mechanism. Prior to eruption the filament undergoes slow upward movement in a 'slow rise' phase with an approximately constant velocity of about 15 km/s that lasts about 10 min. It then erupts in a 'fast-rise' phase, accelerating to a velocity of about 200 km/s in about 5 min, and then decelerating to approximately 150 km/s over the next 5 min. EUV brightenings begin about concurrent with the start of the filament's slow rise, and remain immediately beneath the rising filament during the slow rise; initial soft X-ray brightenings occur at about the same time and location. Strong hard X-ray emission begins after the onset of the fast rise, and does not peak until the filament has traveled to a substantial altitude (to a height about equal to the initial length of the erupting filament) beyond its initial location. Additional information is available in the original extended abstract.
Author (revised)
Solar Flares; X Ray Astronomy; Ultraviolet Astronomy; Solar Prominences

20050110150 NASA Marshall Space Flight Center, Huntsville, AL, USA
How Large Scales Flows May Influence Solar Activity
Hathaway, D. H.; [2004]; 1 pp.; In English; NSO Workshop No. 22: Large Scale Structures and Their Role in Solar Acitivity, 18-22 Oct. 2004, Sunspot, NM, USA; Copyright; Avail: Other Sources; Abstract Only

Large scale flows within the solar convection zone are the primary drivers of the Sun's magnetic activity cycle and play important roles in shaping the Sun's magnetic field. Differential rotation amplifies the magnetic field through its shearing action and converts poloidal field into toroidal field. Poleward meridional flow near the surface carries magnetic flux that reverses the magnetic poles at about the time of solar maximum. The deeper, equatorward meridional flow can carry magnetic flux back toward the lower latitudes where it erupts through the surface to form tilted active regions that convert toroidal fields into oppositely directed poloidal fields. These axisymmetric flows are themselves driven by large scale convective motions. The effects of the Sun's rotation on convection produce velocity correlations that can maintain both the differential rotation and the meridional circulation. These convective motions can also influence solar activity directly by shaping the magnetic field pattern. While considerable theoretical advances have been made toward understanding these large scale flows, outstanding problems in matching theory to observations still remain.
Author
Solar Activity; Solar Magnetic Field; Solar Convection (Astronomy)

20050123572 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Seismic Study of the Solar Interior: Inferences from SOI/MDI Observations During Solar Activity
Korzennik, Sylvain G.; Wagner, William J., Technical Monitor; March 2005; 4 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-9819; No Copyright; Avail: CASI; A01, Hardcopy

Work on the structure, asphericity and dynamics of the solar interior from p-mode frequencies and frequency splittings was carried out primarily in collaboration with Dr. Eff-Darwich (University of La Laguna, Tenerife). This ongoing collaboration produced new results for the inversion of the internal solar rotation rate and further development in inversion methodologies. It also resulted in inferences on the solar stratification. Substantial progress towards the characterization of high-degree p-modes has been achieved. In collaboration with Drs. Rabello-Soares and Schou (Stanford University), we have gained a clear conceptual understanding of the various elements that affect the leakage matrix of the SOI/MDI instrument. This work has precise implications on the properties and the characterization of the HMI instrument being developed for the SDO mission.
Derived from text
Helioseismology; Solar Interior

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20050123659 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Nanosensors to Monitor Space Radiation Exposure
Flinn, Edward D.; Aerospace America; January 2005; ISSN 0740-722X, pp. 14-15; In English; Original contains color illustrations; Copyright; Avail: Other Sources

In the non-too-distant future, molecule size sensors, built using nanomaterials called dendrimers, could be placed inside the cells of astronauts to warn of health impacts from space radiation. At the University of Michigan-Ann Arbor, the technology that would allow this is now under development for NASA by scientists at the Center for Biologic Nanotechnology. This nanotechnology would prompt the cells in the body to signal when the person is starting to get sick before visible symptoms appear. It would indicate when a tumor is growing while the tumor is still microscopic and relatively harmless. The ability to detect changes inside individual cells while those cells are still inside the body would be boon to medicine. The NASA-supported technology could, if it works, provide exactly that. The idea is to place 'nanoparticles' inside the cells to function as molecule-size sensors. Whenever these sensors encounter certain signs of trouble-a fragment of an invading virus, perhaps-they would begin to glow, signaling a monitor that something is wrong. It is an elegant technology. Moreover, because it can be customized to target many combinations of specific cell types and specific problems, it is also a very potent one. Research in this area has blossomed in recent years, with scientists exploring how nanoparticles can be used to treat everything from cancer to genetic diseases such as cystic fibrosis.
Derived from text
Nanotechnology; Radiation Dosage; Extraterrestrial Radiation; Detection

20050123894 NASA Marshall Space Flight Center, Huntsville, AL, USA, National Space Science and Technology Center, Huntsville, AL, USA
Space-Borne Observations of Intense Gamma-Ray Flashes Above Thunderstorms
Fishman, Jerry; [2005]; 1 pp.; In English; Union Radio-Scientifique Internationale National Meeting, 5-8 Jan. 2005, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Intense millisecond flashes of MeV photons were discovered with the space-borne detectors of the Burst and Transient Source Experiment (BATSE) aboard the Compton Gamma-Ray Observatory (CGRO). These flashes originate at altitudes above at least 30 km, in order to be observable by the orbiting detectors. Over the entire CGRO mission, from 1991 until 2000, about 70 of these events were observed. Nearly all TGFs had short (millisecond) durations and sub-ms rise-times and fall-times, however a small fraction of them had longer timescales associated with them. Most were single pulses, but about a dozen had double pulses and a few had more than two pulses. The TGFs are observed in a photon-by-photon recording mode, with each photon from eight independent detectors being tagged to the nearest two microseconds in four energy channels. The TGFs show very hard spectra, in most cases there are more photons recorded above 300 keV than below. Several of the TGFs were also recorded by the thicker (but smaller area) spectroscopy detectors that provided improved spectral resolution than the large area detectors. The temporal and spectral characteristics of the events and the capabilities of the detectors will be described in more detail than the in the original paper. The association of TGFs with thunderstorms is primarily statistical; the TGFs show a strong correlation with the global distribution of lightning, as observed with recent satellites. There has also been an association based upon coincidences with spheric events, however, this association is debatable due to the high spherics

rate and the non-directionality of the detectors. This talk gives an update of the BATSE observations of TGFs were published by the BATSE instrument team over ten years ago.
Author
Gamma Rays; Lightning; Gamma Ray Bursts; Atmospherics; Thunderstorms

Subject Term Index

ABSORBERS (MATERIALS)
Employing PML Absorbers in the Design and Simulation of Ground Penetrating Radars – 266

ABSORBERS
Reciprocity in Perfectly Matched Absorbers – 278

ACCELERATION (PHYSICS)
Turbulence Hazard Metric Based on Peak Accelerations for Jetliner Passengers – 8

ACCELEROMETERS
Design of Two-Axis Capacitive Accelerater Using MEMS – 262

ACCEPTABILITY
Moving-Map Composers System Version 3.4P Acceptance Test Procedures Developed for the Finnish Air Force Modification for FIAF MMC System Without DMUI/DMU – 177

ACCIDENT INVESTIGATION
EPA Chemical Accident Investigation Report: Shell Chemical Company, Deer Park, Texas – 190

EPA Chemical Accident Investigation Report: Surpass Chemical Co., Inc., Albany, NY – 189

EPA Chemical Accident Investigation Report: Tosco Avon Refinery Martinez, California – 189

U.S. Chemical Safety and Hazard Investigation Board Case Study. Explosion at Biochemical Facility: Liquid Nitric Oxide Release: ISOTEC, Miami Township, Ohio, September 21, 2003 – 190

ACCIDENTS
Site-Specific Analysis of a Spent Nuclear Fuel Transportation Accident – 184

ACCRETION DISKS
3-D GRMHD Simulations of Disk-Jet Coupling and Associated Variabilities and Emission – 316

ACCURACY
A Comparison of Solution Accuracy Resulting from Factoring and Inverting Ill-conditioned Matrices – 233

Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements – 156

Oxygen Monitoring Cells at FERMILAB – 276

ACETATES
Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP) – 49

ACIDITY
Functional Interactions of the TACC2 Breast Tumor Suppressor Gene and Its Relevance to Breast Tumor Progression – 210

ACOUSTIC MEASUREMENT
Estimation of Geoacoustic Properties in the South China Sea Shelf Using a Towed Source and Vertical Line Hydrophone Array – 288

Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

ACOUSTIC PROPERTIES
Using Adaptive Simulated Annealing to Estimate Ocean Bottom Acoustic Properties from Acoustic Data – 288

ACOUSTICS
Application of Differential Geometry to Acoustics: Development of a Generalized Paraxial Ray-Trace Procedure from Geodesic Deviation – 273

Aspects in Analysis and Model-Based Sound Synthesis of Plucked String Instruments – 290

High Speed Research Program Structural Acoustics Multi-Year Summary Report – 290

Low Frequency Sonar Countermeasure – 139

ACRYLIC RESINS
Atomic Oxygen Treatment and Its Effect on a Variety of Artist's Media – 38

Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

ACTIVE CONTROL
A Prototype Actuator Concept for Membrane Boundary Vibration Control – 176

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000 – 180

ACTS
ACTS Battery and Solar Array Assembly On-Orbit Measured Performance – 27

ACTUATORS
Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

ADAPTATION
A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

Adaptive Arrays for Wideband Interference Suppression in Wireless Communications – 94

Developing Adaptive Models and Estimating the Uncertainty of Presampled Spectral Data – 241

ADAPTIVE CONTROL
A New Calibration Method of Adaptive Array for TDD Systems – 74

Adaptive Nulling with Spherical Arrays Using a Genetic Algorithm – 107

Advance Path Measurement for Automotive Radar – 102

An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

Improved Wavelet-Based Beamformers with Dynamic Subband Selection – 256

The Adaptive Control of Optical Beam Jitter – 170

ADDITIVES
Systematic Studies of Carbon Doping in High Quality GaN Grown by Molecular Beam Epitaxy – 136

ADENOSINE TRIPHOSPHATE
Moving-Map Composers System Version 3.4P Acceptance Test Procedures Developed for the Finnish Air Force Modification for FIAF MMC System Without DMUI/DMU – 177

ADENOVIRUSES
An Oncotropic Adenovirus Vector System for Breast Cancer Treatment – 218

ADHESION TESTS
Bond Testing for Effects of Silicone Contamination – 173

ADHESIVES
Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

ADSORBENTS
Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter – 43

ADSORPTION
Protective Clothing Based on Permselective Membrane and Carbon Adsorption – 230

AEROACOUSTICS
Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics – 291

Comments on the paper by Zinoviev and Bies 'On Acoustic Radiation by a Rigid Object in a Fluid Flow' – 162

Model-Scale Aerodynamic Performance Testing of Proposed Modifications to the NASA Langley Low Speed Aeroacoustic Wind Tunnel – 287

Parallel Domain Decomposition Formulation and Software for Large-Scale Sparse Symmetrical/Unsymmetrical Aeroacoustic Applications – 239

Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Validation of a High-Order Prefactored Compact Code on Nonlinear Flows with Complex Geometries – 4

AEROASSIST

GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

AEROCAPTURE

GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

AERODYNAMIC CHARACTERISTICS

MAV State-of-the-Art and Technology Drivers – 11

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

AERODYNAMIC DRAG

High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

AERODYNAMIC STABILITY

Nozzle Aerodynamic Stability During a Throat Shift – 1

AERODYNAMICS

Core Program in the Joint Institute for Advancement of Flight Sciences – 299

AEROELASTICITY

Twist Model Development and Results From the Active Aeroelastic Wing F/A-18 Aircraft – 15

AEROGELS

Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

AERONAUTICAL ENGINEERING

Computational Algorithms for High-Fidelity Multidisciplinary Design of Complex Aerospace Systems – 3

Transactions of Nanjing University of Aeronautics & Astronautics, Vol. 21, No. 4, December 2004 – 4

AERONAUTICS

Dual Purpose Simulation: New Data Link Test and Comparison With VDL-2 – 2

AEROSOLS

Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model – 197

Aerosol Optical Depth Model Assessment With High Resolution Multiple Angle Sensors – 23

Lessons Learned: The 'Pale Horse' Bioterrorism Response Exercise – 214

Microbiological Air Contamination from Machining Fluids – 181

AEROSPACE ENGINEERING

A Program of Research and Education in Astronautics – 21

IVHM Framework for Intelligent Integration for Vehicle Health Management – 250

Learning Lessons from the X-37 Project – 29

AEROSPACE ENVIRONMENTS

Accurate Model of Arbitrary Wire Antennas in Free Space, Above or Inside Lossy Ground – 97

Atmospheric/Space Environment Support Lessons Learned Regarding Aerospace Vehicle Design and Operations – 28

Development of Improved Thermal Control Coatings for Space Assets – 20

Flight and Aerospace Research: Airborne Simulation and Research Investigations, 1999 - 2004 – 11

Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

Materials Challenges in Space Exploration – 36

Materials Requirements for Advanced Propulsion Systems – 35

AEROSPACE SAFETY

A Review of Man-Rating in Past and Current Manned Space Flight Programs – 21

Vehicle Integrated Performance Analysis, the VIPA Experience: Reconnecting with Technical Integration – 175

AEROSPACE SCIENCES

Cooperative Agreement in Space Sciences (CPSS) NCC5-637 – 305

Technology Development: New DOD Space Science and Technology Strategy Provides Basis for Optimizing Investments, but Future Versions Need to Be More Robust – 20

AEROSPACE SYSTEMS

Computational Algorithms for High-Fidelity Multidisciplinary Design of Complex Aerospace Systems – 3

Hardware Progress Made in the Early Flight Fission Test Facilities (EFF-TF) To Support Near-Term Space Fission Systems – 29

Student Hands-On Training (SHOT) Workshop Summer 2003 and 2004 – 24

The AstroMesh Deployable Reflector – 154

AEROSPACE VEHICLES

Atmospheric/Space Environment Support Lessons Learned Regarding Aerospace Vehicle Design and Operations – 28

AEROSPIKE ENGINES

Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

AFTERGLOWS

Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

AIR BAG RESTRAINT DEVICES

Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs) – 231

AIR CARGO

America's Freight Transportation Gateways. Connecting Our Nation to Places and Markets Abroad – 5

AIR POLLUTION

Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings – 55

Economic Contribution of the California Air Pollution Control Industry – 190

Economic Impact Analysis of Final Iron and Steel Foundries NESHAP – 183

Energy Efficient Thermal Management for Natural Gas Engine Aftertreatment via Active Flow Control – 174

Urban Air Toxics Monitoring Program (UATMP), 2003 – 182

Using Non-Thermal Plasma to Control Air Pollutants – 183

AIR QUALITY

Developing Spatially Interpolated Surfaces and Estimating Uncertainty – 182

Economic Contribution of the California Air Pollution Control Industry – 190

Health Impact of Nitric Oxide: Effects on Lung Function and Cellular and Biochemical Processes in Healthy Humans – 179

Internal Combustion Engine (ICE) Air Toxic Emissions – 173

RACT/BACT/LAER Clearinghouse (RBLC) Clean Air Technology Center Annual Report for 2003 – 186

Using Non-Thermal Plasma to Control Air Pollutants – 183

AIR SAMPLING

Urban Air Toxics Monitoring Program (UATMP), 2003 – 182

AIR TO AIR REFUELING

Limited Evaluation of Automated Aerial Refueling Algorithm (Project Self Serve) – 7

AIR TRAFFIC CONTROL

A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic – 6

Assessment of the NASA AvSTAR Project Plan – 1

Transforming the NAS: The Next Generation Air Traffic Control System – 6

AIR TRANSPORTATION

Patient Warming Device for Casualty Care – 222

Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

AIRBORNE RADAR
Knowledge-Based Generalized Likelihood Ratio Test (KB-GLRT): Exploiting Knowledge of the Clutter Ridge in Airborne Radar – 167

AIRBORNE SURVEILLANCE RADAR
Deployment and Evaluation of the Helicopter In-Flight Tracking System (HITS) – 8

AIRCRAFT ACCIDENTS
FLIGHTFAX: Army Aviation Risk-Management Information. Volume 32, Number 12 – 7

AIRCRAFT COMMUNICATION
Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

AIRCRAFT CONFIGURATIONS
Deployment and Evaluation of the Helicopter In-Flight Tracking System (HITS) – 8

AIRCRAFT DESIGN
Demonstration and Validation of the Excited Dielectric Test (Trade Name) Method to Detect and Locate Defects in Aircraft Wiring Systems – 141

AIRCRAFT ENGINES
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

Analyses of Elemental Partitioning in Advanced Nickel-Base Superalloy Single Crystals – 14

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

AIRCRAFT FUELS
Sulfur Oxidation and Contrail Precursor Chemistry – 47

AIRCRAFT NOISE
Low Noise Exhaust Nozzle Technology Development – 2

AIRCRAFT PILOTS
Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators – 166

AIRCRAFT SAFETY
FLIGHTFAX: Army Aviation Risk-Management Information. Volume 32, Number 12 – 7

AIRFOILS
Validation of a High-Order Prefactored Compact Code on Nonlinear Flows with Complex Geometries – 4

AIRLINE OPERATIONS
Transforming the NAS: The Next Generation Air Traffic Control System – 6

AIRPORTS
A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic – 6

ALGORITHMS
3D Super Resolution Algorithm for Analysis of Multi-path Propagation Structure – 148

A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256

A Fast Multilevel Domain Decomposition Algorithm for Radar Imaging – 103

A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic – 6

Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics – 291

An Optimal Algorithm for Radar Imaging – 84

Beamspace STAP for Circular Arrays – 120

Composite Combat Identification (CCID) Common Reasoning Algorithm Development Program – 262

Computational Algorithms for High-Fidelity Multidisciplinary Design of Complex Aerospace Systems – 3

Domain Decomposition Method: A Direct Solution of Maxwell Equations – 258

Electromagnetic Parallel Processing Using the Personal Computers of a Local Area Network – 242

Extracting Dynamic Evidence Networks – 251

Fast Computation of Scattering from (Near-)Resonant Structures – 233

Fast Generalized Forward-backward Method by Using a Spectral Acceleration – 255

Fast Spectral Domain Algorithm for Hybrid Finite Element/Boundary Integral Modeling of Infinite Periodic Arrays – 260

Fast Steepest Descent Path Algorithm for Electromagnetic Scattering Problems in Layered Medium – 278

Fundamentals of Combinatorial Optimization and Algorithms Design: December Report – 263

Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268

Limited Evaluation of Automated Aerial Refueling Algorithm (Project Self Serve) – 7

Minimization of Mutual Coupling Effects in Eigenstructure Algorithms Based on Modal Analysis – 94

Modeling of Gaussian Beam Diffraction from a Thick Single-slit Perfectly Conducting Screen: Finite-Difference Time-Domain Method Versus Rigorous Theory – 269

Modeling the Transport and Chemical Evolution on Onshore and Offshore Emissions and Their Impact on Local and Regional Air Quality Using a Variable-Grid-Resolution Air Quality Model – 188

Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques – 253

Normalization of NEXRAD Antenna Gain for Overlapping Radars – 127

Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

Probe Pulse Shape Estimation in Synthetic Aperture Method – 88

Sequential Multiple Comparison Testing for Budget-Limited Applications – 263

Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

Time-domain Techniques for Reconstructing Lossy Layered Media from One-sided Scattering – 129

ALPHA DECAY
Comments on Extracting alpha from B to rho rho – 285

ALTERNATING CURRENT
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193

ALTITUDE ACCLIMATIZATION
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

ALTITUDE SICKNESS
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

ALUMINUM OXIDES
Feasibility Assessment for Pressure Casting of Ceramic-Aluminum Composites for NASA's Propulsion Applications – 39

ALUMINUM
Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

AMBIENCE
Developing Spatially Interpolated Surfaces and Estimating Uncertainty – 182

AMINES
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

AMINO ACIDS
Production and Purification of Refolded Recombinant Human IL-7 From Inclusion Bodies – 227

AMPLIFICATION
Numerical Amplification of the Excitation Source in Waveguide Structure – 266

AMPLITUDES
Optimum Amplitude and Phase Control for an Adaptive Linear Array Using a Genetic Algorithm – 65

ANALOG CIRCUITS
Surface Integral Equations for Three Dimensional Surfaces Containing Circuit Analog Sheets – 143

ANALOG SIMULATION
Developing Adaptive Models and Estimating the Uncertainty of Presampled Spectral Data – 241

ANALOG TO DIGITAL CONVERTERS
Photonic Analog-to-Digital Conversion Technology – 133

Pipeline Analog-to-Digital Converters for Wide-Band Wireless Communications – 140

Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digital Converter – 140

ANALOGS
Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps – 169

ANALYSIS (MATHEMATICS)
Computational Analysis and Simulation of Toxic Particle Deposition in the Human Respiratory System – 56

ANALYZERS
Measurement of the CKM Angles (alpha) and (gamma) at the BaBar Experiment – 283

ANGELS (RADAR)
Design and Characterization of Diagonal Horn Antennas Using UCLA Bi-Polar Near-Field Measurement and Imaging Facilities – 155

ANGLES (GEOMETRY)
A Reflector Antenna with High Gain and Wide Angle Beam Steering Capabilities – 76

ANIMALS
Anti-Angiogenesis Therapeutic Indicators in Breast Cancer – 211

Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

Vaccines and Animal Models for Arboviral Encephalitides – 222

ANISOTROPIC MEDIA
Cylindrical 3D PML-PLRC-FDTD Schemes for Frequency-dispersive and Inhomogeneous Media – 118

PML and PSTD Algorithm for Arbitrary Lossy Bianisotropic Media – 259

ANISOTROPY
Relationship of Magnetocrystalline Anisotropy and Stoichiometry in Epitaxial L1(sup 0) CoPt(001) and FePT (001) Thin Films – 297

Symmetry Synthesis of the Multiport Scattering Matrix as a First Step in the Design of Electromagnetic Devices and Components with Bianisotropic Media – 132

ANNEALING
Using Adaptive Simulated Annealing to Estimate Ocean Bottom Acoustic Properties from Acoustic Data – 288

ANNIHILATION REACTIONS
Search for the Decay B(sup 0) Yields K*(sup +)(rho)(sup -) – 287

ANNUAL VARIATIONS
Climate-Driven Deformation of the Solid Earth from GRACE and GPS – 196

Regional Deformation Studies with GRACE and GPS – 253

Solar Cycle/Seasonal Variations of H, D, H2 and He Distributions and Escape on Mars as Determined by the Mars Thermosphere Global Circulation Model (MTGCM) – 324

ANOMALIES
Chemical Compositions and Anomalies in Stellar Coronae ADP99 – 315

Revisited Generalized Wood Anomalies – 239

ANTARCTIC REGIONS
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

ANTENNA ARRAYS
A Confocal Reflector System – 77

A Conformal Spiral Array Antenna Radiating an Omnidirectional Circularly-Polarized Wave – 70

A Design Procedure for Classical Offset Dragonian Antennas with Circular Apertures – 77

A Fast and Accurate Scheme for Calibration of Active Phased-array Antennas – 117

A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

A Millimeter-wave Cavity-backed Suspended Substrate Stripline Antenna – 99

A New Calibration Method of Adaptive Array for TDD Systems – 74

A Novel Phase Conjugator for Retrodirective Array Application – 84

A Remote Calibration for DBF Transmitting Array Antennas by Using Synchronous Orthogonal Codes – 69

A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108

Adaptive Arrays for Wideband Interference Suppression in Wireless Communications – 94

Adaptive Nulling with Spherical Arrays Using a Genetic Algorithm – 107

An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz – 76

Analysis and Design of a Planar Two-Dimensional Retrodirective Array Reflector – 86

Analysis of Shielded CPW Spatial Power Combiners – 151

Array Pattern Synthesis with High Radiation Efficiency for Transmission Antenna Arrays – 89

Beamforming in Time-Domain Arrays – 106

Beamspace STAP for Circular Arrays – 120

Broadband, Robust, Low-profile Monopole Incorporating Top Loading, Dielectric Loading, and a Distributed Capacitive Feed Mechanism – 104

Calculating The Mutual Coupling Between Apertures on Convex Cylinders Using a Hybrid UTD-MoM Method – 66

Design of a Smart Antenna for Reducing Co-Channel Interference in Cellular Mobile Communications – 144

Design of Large Broadband Patch Arrays – 123

Design of Low Sidelobe Circular Ring Arrays by Element Radius Optimization – 109

Distributed Aperture Design for Low Profile Earth Station Antennas – 101

Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Experimental Validation of a Neural Network Direction Finder – 142

Fast Spectral Domain Analysis of Large Finite Microstrip Patch Arrays – 101

IEEE Antennas and Propagation Society International Symposium – 64

Inflatable Microstrip Reflectarray Antennas at X and Ka-band Frequencies – 97

Ka-Band Beam Steering Reflectarray Study – 86

Large 2-D Thinned Array for the Microwave Imaging Radiometer with Synthetic Aperture (MIRAS) – 100

Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

Low-power Low-profile Multifunction Helmet-mounted Smart Array Antenna – 107

Microstrip Patches for a Reflectarray – 96

Millimeter-wave Photodetection and Direct Integration with Microstrip Slot Antenna Array – 91

Minimization of Mutual Coupling Effects in Eigenstructure Algorithms Based on Modal Analysis – 94

Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems – 91

Surface Wave Scattering by Finite Periodic Structure of Arbitrary Profile in a Ground Plane: TE case – 84

Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Nonpalpable Breast Tumors – 158

Wideband Single Layer Microstrip Array at 28 GHz – 98

ANTENNA COMPONENTS

Accurate Model of Arbitrary Wire Antennas in Free Space, Above or Inside Lossy Ground – 97

An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz – 76

Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Low Complexity Space-frequency Rake Receivers for WCDMA – 131

Recalculating Linear Array Antennas to Compensate for Failed Elements While Maintaining Fixed Nulls – 102

ANTENNA COUPLERS

Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna – 79

ANTENNA DESIGN

2.4GHz ISM Band Antenna for PC Cards – 241

A Broadband Microstrip Antenna for SAR Applications – 75

A Low Loss, Dual Polarized Switch for Polarization State Selection – 124

A Millimeter-wave Cavity-backed Suspended Substrate Stripline Antenna – 99

A Multi-Branch Monopole Antenna for Dual-Band Cellular Applications – 105

A Novel Sleeve Monopole with Broad Bandwidth – 74

A Reflector Antenna with High Gain and Wide Angle Beam Steering Capabilities – 76

A Shaped Relector Antenna for Mobile Communications – 85

Active Integrated Antennas for New RF Architectures – 64

An Analysis and Design Tool for Evaluation of Integrated Antenna Diversity Systems in Portable Wireless Devices – 90

An Analysis of a Dual Gridded Reflector Antenna – 67

An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz – 76

Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

Antennas Feasibility Study for a LMDS Communication System – 91

ARISE: A Challenging 25-m Space Antenna Design – 88

Characteristics of Digital Terrestrial Broadcasting Antennas – 105

Design Concepts for the Radarsat-2 SAR Antenna – 88

Design Features of the Large Millimeter Telescope (LMT) – 101

Design of a Smart Antenna for Reducing Co-Channel Interference in Cellular Mobile Communications – 144

Design of Cylindrical Reflector Antennas with Caustic-located Array Feeding – 60

Design of Low Sidelobe Circular Ring Arrays by Element Radius Optimization – 109

Designs of Broadband Microstrip Antennas with Embedded Slots – 126

Development of a Tri-plate Ring-Slot Antenna for mm-Wave Frequency Band – 99

Distributed Aperture Design for Low Profile Earth Station Antennas – 101

Dual Band Dual Linear Polarization Elliptical Microstrip Ring Antenna – 145

Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar – 151

Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

ESA's Ground Breaking Synthetic Aperture Radar: The ENVISAT-1 ASAR Active Antenna – 100

Filtering Characteristics of Thin, Planar 3D Printed Element Arrays – 153

Full-wave Analysis of HF Antennas on Helicopters Using the FDTD, FEM and NEC – 128

Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

Low-power Low-profile Multifunction Helmet-mounted Smart Array Antenna – 107

Microstrip Antennas for Dielectric Property Measurement – 157

Microstrip Patch Antenna for GSM 1800 Handsets – 90

Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159

Moment Method Analysis of Parallel Plate Slot Antennas – 66

Novel Designs of Broadband Equilateral-triangular Microstrip Antennas – 68

On Inflatable Antenna State of the Art Precision – 100

Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems – 90

Precise Dielectric Properties Determination of Laminar-shaped Materials in a Partially-filled Waveguide – 146

Shaped Reflector and Multi-feed Paraboloid: A Comparison – 60

Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna – 79

Single-feed Dual-frequency Microstrip Antenna with Two Patches – 95

Surface Integral Equations for Three Dimensional Surfaces Containing Circuit Analog Sheets – 143

The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

Triple-band Planar Inverted F Antenna – 70

Wideband L-strip Fed Microstrip Antenna – 68

ANTENNA FEEDS

Design and Characterization of Diagonal Horn Antennas Using UCLA Bi-Polar Near-Field Measurement and Imaging Facilities – 155

ANTENNA GAIN

Normalization of NEXRAD Antenna Gain for Overlapping Radars – 127

On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

PBG-Assisted Gain Enhancement of Patch Antennas on High-dielectric Constant Substrate – 109

Radio Star Flux Density Expressions for Accurate Antenna Gain Measurements – 128

Significant RX Antenna Diversity Gain in 30 GHz Broadband Radio Channels Subject to Fading – 85

ANTENNA RADIATION PATTERNS

A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions – 72

A Multi-frequency Microstrip-fed Shorted Square Ring Slot Line Antenna – 71

A T-Strip Loaded Rectangular Microstrip Patch Antenna for Dual-Frequency Operation – 112

Analysis of Radiation from Two Separate Axisymmetric Horns Using the Method of Moments – 114

Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials – 132

Array Pattern Synthesis with High Radiation Efficiency for Transmission Antenna Arrays – 89

Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas – 91

Design of Large Broadband Patch Arrays – 123

Design of Two-layer Printed Reflect Arrays for Bandwidth Enhancement – 78

Dual-frequency Operation of Single-feed Triangular Microstrip Antennas – 96

Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna – 205

Efficient and Accurate Inclusion of Radomes into Antenna Analysis – 71

EIRP and Power Efficiency of Reconfigurable Active Transmit Antennas – 77

Electromagnetic Energy around Hertzian Dipoles – 81

Elemental Probes for Planar Near-field Antenna Measurements – 103

External Substrate Perforation Applied to Patch Antennas for Mitigating Surface Wave Effects – 110

Far-field Antenna Patterns Determined from Infrared Holograms – 89

Filtering Characteristics of Thin, Planar 3D Printed Element Arrays – 153

Full-wave Analysis of HF Antennas on Helicopters Using the FDTD, FEM and NEC – 128

GSM/TDMA Adaptive Antenna Field-Trial Results – 75

Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements – 156

Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment – 69

Microstrip Line Fed Slot Antenna with PBG Superstrate – 89

Multi-band Antennas – 65

Numerical Computation on Radiation Characteristics of Square Loop Antennas at the Wrist Position of a Human Body in Personal Wireless Communications – 116

Optimization of Linear Array Antenna Performance – 104

Planar Handset Antennas with Electronically Steerable Parameters – 105

Reactively Loaded Microstrip Antenna for Dual-frequency Operation – 95

Recalculating Linear Array Antennas to Compensate for Failed Elements While Maintaining Fixed Nulls – 102

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas – 150

Rigorous Analysis of Practical Reflector Antennas – 80

The Field Transmitted into a PBG Crystal due to an Electric Line Source – 108

Theoretical and Experimental Investigations on Focusing Properties of the Fresnel Zone Lens and Plate – 294

Uni-polar Scanning Method for Near-field Measurements of Antennas – 154

Variety of Cylindrical Fresnel Zone Plate Antennas – 120

ANTENNAS

A New Approach for Accurate Analysis of Antennas Above Real Ground – 152

Analysis of a Charge Probe and its Response near Metallic and Dielectric Interface – 151

Applications of Smart Antennas in Cellular Networks – 75

Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60

Electromagnetic Radiation of Antennas in the Presence of an Arbitrarily Shaped Dielectric Object: Green Dyadics and Their Applications – 132

Large Deployable Antennas: Concepts and Realization – 104

On the Planarity Errors of the Hologram of the CATR – 92

Small Antenna Efficiency by the Reflection and the Q Measurement Methods – 145

The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII – 104

ANTIBODIES

Outcome Based Screening for Prognostic Phospho-RTK (Receptor Tyrosine Kinase) Antibodies Using Tissue Microarrays) – 227

Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

ANTIGENS

Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast – 208

Development of Artificial Antigen Presenting Cells for Prostate Cancer Immunotherapy – 207

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

ANTIMISSILE DEFENSE

Homeland Security: Protecting Airliners from Terrorist Missiles – 12

ANTIRADAR COATINGS

Experiment Research On MM Wavelength Radar Absorbing Materials – 155

ANTISHIP MISSILES

Coherent Seeker Guided Antiship Missile Performance Analysis – 167

ANXIETY

A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer – 223

APERTURES

A Design Procedure for Classical Offset Dragonian Antennas with Circular Apertures – 77

An Aperture-coupled Small Microstrip Antenna with Enhanced Bandwidth – 67

Aperture Theory And The Equivalence Theorem – 233

Calculating The Mutual Coupling Between Apertures on Convex Cylinders Using a Hybrid UTD-MoM Method – 66

Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface – 66

Design of Low Sidelobe Circular Ring Arrays by Element Radius Optimization – 109

Distributed Aperture Design for Low Profile Earth Station Antennas – 101

Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159

Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna – 79

The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII – 104

APOPTOSIS

Protein Kinase Pathways That Regulate Neuronal Survival and Death – 208

Regulation of TRAIL-Mediated Apoptosis in Prostate Cancer by Overexpression in XIAP – 223

The Role of the Prohibition Gene in Apoptosis of Breast Cancer Cells – 215

APPLICATIONS PROGRAMS (COMPUTERS)
Component Middleware to Support Non-repudiable Service Interactions – 82
Development of Risk Assessment Matrix for NASA Engineering and Safety Center – 304
From Crash Tolerance to Authenticated Byzantine Tolerance: A Structured Approach, the Cost and Benefits – 82

APPROPRIATIONS
Telemarketing: Implementation of the National Do-Not-Call Registry – 232

APPROXIMATION
A New Approach for Accurate Analysis of Antennas Above Real Ground – 152
A Topological Viewpoint on Consistency Aspects of Electromagnetic Theory on a Lattice – 131
Improved Approximations for Wave Structure Functions in a Turbulent Atmosphere – 195
Revisited Generalized Wood Anomalies – 239
Transient Approximation of SAFE-100 Heat Pipe Operation – 32

ARCHITECTURE (COMPUTERS)
SJFHQ Simulation – 81

ARMED FORCES (UNITED STATES)
Analyzing and Sharing Data for Surface Combat Weapons Systems – 246

ARRAYS
A Fractal Based FSS with Dual Band Characteristics – 87
Design of a Focal Plane Dielectric Rod Array for Feeding a Multiple Beams Reflector Antenna – 76
Estimation of Geoacoustic Properties in the South China Sea Shelf Using a Towed Source and Vertical Line Hydrophone Array – 288
Radiation Properties of Two Cylindrical Conformal Arrays Isolated by a Space Filter – 59

ARRIVALS
A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic – 6

ARTHROPODS
Vaccines and Animal Models for Arboviral Encephalitides – 222

ARTIFICIAL INTELLIGENCE
Content Repurposing of Electrical Diagrams for Presentation in Handheld Devices – 241
IVHM Framework for Intelligent Integration for Vehicle Health Management – 250
Modelling Intention Recognition for Intelligent Agent Systems – 252

ARTIFICIAL SATELLITES
Aerosol Optical Depth Model Assessment With High Resolution Multiple Angle Sensors – 23
Development Of A Control Moment Gyroscope Controlled, Three Axis Satellite Simulator, With Active Balancing For The Bifocal Relay Mirror Initiative – 24
Human Interfaces for Space Situational Awareness – 25
Multiple Satellite Trajectory Optimization – 25
Time-Domain Analysis of the Electromagnetic Coupling in Satellite Environments – 31

ASSESSMENTS
Development of Risk Assessment Matrix for NASA Engineering and Safety Center – 304

ASSIMILATION
The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

ASTEROIDS
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

ASTRONAUT TRAINING
Tests Narrowed – 26

ASTRONAUTICS
Transactions of Nanjing University of Aeronautics & Astronautics, Vol. 21, No. 4, December 2004 – 4

ASTRONOMICAL INTERFEROMETRY
Eta Carinae: What We have learned recently with HST/STIS, VLT/UVES and VLTI: What We Might Learn with VLT/VLTI across the 2008/9 Minimum – 312

ASTRONOMICAL MODELS
3-D GRMHD Simulations of Disk-Jet Coupling and Associated Variabilities and Emission – 316

ASTROPHYSICS
Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content – 313
Chemical Compositions and Anomalies in Stellar Coronae ADP99 – 315
Experiments on Dust Grain Charging – 315
Galactic Winds and Intragroup Medium Energetics – 317
Simultaneous X-Ray and UV Spectroscopy of the Symbiotic HD 154791 – 317
The Warm-Hot Intergalactic Medium – 314

ASYMMETRY
China's Development of Asymmetric Warfare and the Security of Taiwan, Republic of China – 301
Measurement of CP-Asymmetries for the Decays B(sup (+-)) --\g D(sub CP)(sup 0) K*(sup (+-)) with the BABAR Detector – 286
Measurements of Branching Fraction, Polarization, and Direct CP-Violating Asymmetry in B(sup +) --\g K*(sup 0) (rho)(sup +) Decays – 283
Quasi-static Analysis of Asymmetric Cylindrical Coplanar Waveguide – 151
Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components – 153
Single-Spin Polarization Effects and the Determination of Timelike Proton Form Factors – 286

ASYMPTOTIC METHODS
The Hybrid(sup 2)-Method: Combination of the FE/BE Hybrid Method with the UTD – 267

ASYMPTOTIC SERIES
Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas – 122

ATMOSPHERIC BOUNDARY LAYER
Modeling the Transport and Chemical Evolution on Onshore and Offshore Emissions and Their Impact on Local and Regional Air Quality Using a Variable-Grid-Resolution Air Quality Model – 188

ATMOSPHERIC CHEMISTRY
Verification of Ship Emission Estimates with Monitoring Measurements to Improve Inventory and Modeling – 178

ATMOSPHERIC CIRCULATION
Improvement of an Acoustic Sounder Device Used to Measure Atmospheric Turbulence – 194

ATMOSPHERIC COMPOSITION
Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model – 197
Solar Cycle/Seasonal Variations of H, D, H2 and He Distributions and Escape on Mars as Determined by the Mars Thermosphere Global Circulation Model (MTGCM) – 324

ATMOSPHERIC CORRECTION
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

ATMOSPHERIC MODELS
Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model – 197
Aerosol Optical Depth Model Assessment With High Resolution Multiple Angle Sensors – 23
GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307
Possible Role of the Oceans in the Variations of Length of Day at High Frequencies – 310
The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

ATMOSPHERIC PHYSICS
Modeling the Transport and Chemical Evolution on Onshore and Offshore Emissions and Their Impact on Local and Regional Air Quality Using a Variable-Grid-Resolution Air Quality Model – 188

Verification of Ship Emission Estimates with Monitoring Measurements to Improve Inventory and Modeling – 178

ATMOSPHERIC TEMPERATURE
USA Climate Normals, 1971-2000. State, Regional, and National Monthly Cooling Degree Days Weighted by Population (2000 Census) 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 5-2 – 200

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Heating Degree Days Weighted by Population (2000 Census) 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 5-1 – 198

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Precipitation Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-2 – 199

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Temperature Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-1 – 199

ATMOSPHERIC TURBULENCE
Improved Approximations for Wave Structure Functions in a Turbulent Atmosphere – 195

Improvement of an Acoustic Sounder Device Used to Measure Atmospheric Turbulence – 194

ATMOSPHERICS
Space-Borne Observations of Intense Gamma-Ray Flashes Above Thunderstorms – 326

ATOMIC SPECTRA
Silicon-Based Visible/Near-Infrared Affordable Missile Warning – 292

ATTENUATION
Causality and Restrictions on the Initial-Boundary Conditions for Signal Propagation in Attenuating Medium – 147

AUDIO EQUIPMENT
Improvement of an Acoustic Sounder Device Used to Measure Atmospheric Turbulence – 194

AUDIO SIGNALS
Retrocommunication – 63

AUGMENTATION
Survivability Enhancement in a Combat Environment – 9

AURORAL ZONES
The Utility of Auroral Image-based Activities Metrics – 193

AURORAS
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

AUTOMATIC CONTROL
Concepts to Automate Fluid Transfer Capability of Low Impact Docking System (LIDS) – 27

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

On-Line Integrated Control System for Reducing Coal Costs and Coal-Related Emissions: Coal Blend Automation System (CBAS) – 187

AUTOMOBILES
Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems – 90

AUTONOMOUS NAVIGATION
Adaptive Autonomous Navigation of Mobile Robots in Unknown Environments – 238

AUTONOMY
Autonomous Assembly of Modular Structures in Space and on Extraterrestrial Locations – 251

Autonomous Underwater X-Ray – 164

Proceedings of the Workshop on Power Sources for Distributed Autonomous Systems – 137

AUXILIARY POWER SOURCES
The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

AUXILIARY PROPULSION
Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative – 34

AVIONICS
IVHM Framework for Intelligent Integration for Vehicle Health Management – 250

AWACS AIRCRAFT
Contract Management: The Air Force Should Improve How It Purchases AWACS Spare Parts – 15

AXIAL MODES
Archimedean Spiral-mode Microstrip Antenna with Improved Axial Ratio – 79

BACILLUS
Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

BACKSCATTERING
Measured Back Scattering Cross Section of Thin Wires – 156

On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

Parabolic Equation-Based Propagation Fields Near Surface Irregularities Including Backscatter – 266

Polarimetric Backscatter Characterization of Road Surface Faults at Millimeter-wave Frequencies – 80

Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Non-palpable Breast Tumors – 158

BACTERIA
Hybrid Molecular and Spin-Semiconductor Based Research – 168

Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206

BACTERIOPHAGES
Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

BALANCING
Achieving New Source Performance Standards (NSPS) Emission Standards Through Integration of Low-No(x) Burners with an Optimization Plan for Boiler Combustion. Quarterly Technical Progress Report for January 2003 - March 2003 – 183

Development Of A Control Moment Gyroscope Controlled, Three Axis Satellite Simulator, With Active Balancing For The Bifocal Relay Mirror Initiative – 24

BANDWIDTH
A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256

A Novel Sleeve Monopole with Broad Bandwidth – 74

A Procedure to Design Wide-Band Electromagnetically-coupled Stacked Microstrip Antennas Based on a Simple Network Model – 114

A Uniplanar Quasi-yagi Antenna with Wide Bandwidth and Low Mutual Coupling Characteristics – 71

Adaptive Arrays for Wideband Interference Suppression in Wireless Communications – 94

An Annular-Ring Reduced Surface Wave Microstrip Antenna – 114

An Aperture-coupled Small Microstrip Antenna with Enhanced Bandwidth – 67

Bandwidth Enhancement of Microstrip Antenna with Leaky-wave Excitation – 79

Broad Band Patch Antennas Using a Wedge-shaped Air Dielectric Substrate – 124

Design of Large Broadband Patch Arrays – 123

Designs of Broadband Microstrip Antennas with Embedded Slots – 126

Fundamental Limit on the Performance of Radar Absorbing Materials – 109

Generalized Coincident Arrays for the Direct Measurement of the Principal Solution in Radio Astronomy – 127

Low Cost Broadband Microstrip Antenna for Satellite-TV Reception – 67

Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Planar Trapezoidal and Pentagonal Monopoles with Impedance Bandwidths in Excess of 10:1 – 88

Scattering by Resistively Loaded, Multilayer Frequency Selective Surfaces over Two-octave Bandwidth – 98

Triple-band Planar Inverted F Antenna – 70

Ultrawide-band Noise Synthetic Aperture Radar: Theory and Experiment – 87

BARIUM OXIDES

Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP) – 49

BARIUM

Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP) – 49

BARYONS

Measurement of the Branching Fractions for the Decays B(sup 0)--\gD*(sup -) p(bar p)(pi)(sup +), B(sup 0)--\gD(sup -)p(bar p)(pi)(sup +), B0--\gD*(sup 0) p(bar p) and B(sup 0)--\gD(sup 0) p(bar p) – 285

BASE FLOW

Research Instrumentation for Measurements of High-Speed Separated Flows – 170

BASE HEATING

Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

BEAM INTERACTIONS

Symplectic Treatment of a Finite Crossing Angle in the Beam-Beam Collision – 282

BEAM SWITCHING

Energy Deposition Using EGS4 – 286

BEAMFORMING

A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials – 132

Application of Conjugate Gradient Algorithm to Adaptive Beamforming – 255

Beamforming by Magnetostatic Wave Microstrip Antennas – 98

Beamforming in Time-Domain Arrays – 106

Development and Evaluation Test of DBF Equipment for Transmitting – 72

Improved Wavelet-Based Beamformers with Dynamic Subband Selection – 256

On the Performance of the VESPA Algorithm for Blind Beamforming and Signal Detection of Multi-source Multipath Signals – 73

BEAMS (RADIATION)

Beam-beam Simulation Studies for PEP-II and KEKB – 284

Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas – 91

Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar – 151

Inhomogeneous Cylindrical Waves: An Approach to Complex Beams – 255

Synthesis of Shaped-Beam Pattern for Mobile Antenna – 143

BIBLIOGRAPHIES

A Program of Research and Education in Astronautics – 21

BIDIRECTIONAL REFLECTANCE

Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps – 169

BINARY STARS

A Survey of Helium Accreting White Dwarfs – 317

BIOCHEMISTRY

U.S. Chemical Safety and Hazard Investigation Board Case Study. Explosion at Biochemical Facility: Liquid Nitric Oxide Release: ISOTEC, Miami Township, Ohio, September 21, 2003 – 190

BIOENGINEERING

Fuel From Self-Degrading Bioengineering Packaging – 225

BIOLOGICAL EFFECTS

Integrated Bioenvironmental Hazards Research Program – 168

Multiple Strategy Bio-Detection Sensor Platforms Made from Carbon and Polymer Materials – 166

BIOLOGICAL WEAPONS

Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

BIONICS

Applying Petri Nets to Systems Biology using XML Technologies – 237

BIPOLAR TRANSISTORS

Demonstration of Silicon Carbide Power Devices in Practical Power Conversion Systems – 46

BIPOLARITY

A Bipolar Electrode for Use in a Semi Fuel Cell – 139

Design and Simulation of Active Spiral Inductors for RF Integrated Circuits – 145

Uni-polar Scanning Method for Near-field Measurements of Antennas – 154

BISTATIC REFLECTIVITY

Bistatic Scattering Characterization of a Complex Object – 87

BLACK HOLES (ASTRONOMY)

3-D GRMHD Simulations of Disk-Jet Coupling and Associated Variabilities and Emission – 316

Analysis of Reflection from Multilayer Cylinder by Using a Black-hole Approach – 315

Recent Results on Ultra-Luminous X-ray Sources – 313

BLOCK COPOLYMERS

Morphology and Properties of Model Block and Graft Copolymers – 54

BLOOD

Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

BOATTAILS

High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

BODIES OF REVOLUTION

Efficient and Accurate Inclusion of Radomes into Antenna Analysis – 71

Flow Over a Body of Revolution in a Steady Turn – 10

BOEING 747 AIRCRAFT

Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

BOEING AIRCRAFT

Contract Management: The Air Force Should Improve How It Purchases AWACS Spare Parts – 15

BOILERS

Boiler Materials for Ultrasupercritical Coal Power Plants. Third Quarterly Report April 1 to June 30, 2004 – 48

Guide to Low-Emission Boiler and Combustion Equipment Selection – 186

BOLTS

Influence of Stress Relaxation in Hybrid Composite/Metal Bolted Connections – 175

BONDED JOINTS

Role of E-Cadherin Homophilic Contacts in the Inhibition of Cell Growth of Primary Breast Cells – 218

BONDING

Bond Testing for Effects of Silicone Contamination – 173

BONE MINERAL CONTENT

Do Integrins Mediate the Skeletal Response to Altered Loading? – 230

BOUNDARIES

Fast Spectral Domain Algorithm for Hybrid Finite Element/Boundary Integral Modeling of Infinite Periodic Arrays – 260

BOUNDARY CONDITIONS

A New Approach for Microstrip Active Antennas Using Modal FFT-algorithm – 98

A Prototype Actuator Concept for Membrane Boundary Vibration Control – 176

Asymptotic Boundary Conditions for Strip-loaded Surfaces of Cylindrical Structures with Arbitrarily Shaped Cross-section – 123

Causality and Restrictions on the Initial-Boundary Conditions for Signal Propagation in Attenuating Medium – 147

Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports – 130

Employing PML Absorbers in the Design and Simulation of Ground Penetrating Radars – 266

Higher-order Impedance Boundary Conditions for Complex Layered Planar Coatings – 130

Implementation of Gas Bubble Loading in 2DCAV – 61

Infinite Phased Array Analysis Using FDTD Periodic Boundary Conditions: Pulse Scanning in Oblique Directions – 265

Modeling Surface Currents on Electrically Large Impedance Cylinders - 2D, TM Case – 120

Moment Method Analysis of Parallel Plate Slot Antennas – 66

The Hybrid(sup 2)-Method: Combination of the FE/BE Hybrid Method with the UTD – 267

Transient Plane Wave Scattering from Objects Near Lossy Ground with FDTD – 150

BOUNDARY ELEMENT METHOD

Moment Method Based Analysis of Dielectric-resonator Antennas – 122

The Hybrid(sup 2)-Method: Combination of the FE/BE Hybrid Method with the UTD – 267

Theoretical and Experimental Investigations on Focusing Properties of the Fresnel Zone Lens and Plate – 294

BOUNDARY INTEGRAL METHOD

Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques – 253

BOUNDARY LAYER SEPARATION

Flow Over a Body of Revolution in a Steady Turn – 10

Research Instrumentation for Measurements of High-Speed Separated Flows – 170

BOUNDARY LAYERS

Design of Two-layer Printed Reflect Arrays for Bandwidth Enhancement – 78

BOUNDARY VALUE PROBLEMS

An Efficient High-frequency Boundary Integral Equation – 260

Parameters of Microstrip Patch Antenna under the Consideration Using the Piecewise Basis Functions – 121

The General NMM Solution for 2-D EMF Problems with Arbitrary Excitations under General Coordinates – 205

BRAGG ANGLE

Revisited Generalized Wood Anomalies – 239

BRAGG GRATINGS

Distributed Sensing of Composite Overwrapped Pressure Vessel Using Fiber-Bragg Gratings at Ambient and Cryogenic Temperatures – 39

Shape Sensing a Morphed Wing with an Optical Fiber Bragg Grating – 16

BRAGG REFLECTORS

Mixed Metallic Photonic Band-gap Material and Bragg Mirror – 298

BRAIN

Protein Kinase Pathways That Regulate Neuronal Survival and Death – 208

Self-Organized Criticality and Stochastic Resonance in the Human Brain – 281

BREAST

A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer – 223

An Evaluation of Stereoscopic Digital Mammography for Earlier Detection of Breast Cancer and Reduced Rate of Recall – 208

An Oncotropic Adenovirus Vector System for Breast Cancer Treatment – 218

Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast – 208

Anti-Angiogenesis Therapeutic Indicators in Breast Cancer – 211

Applying Statistical Models to Mammographic Screening Data to Understand Growth and Progression of Ductal Carcinoma in Situ – 217

Center for Behavioral Research: Individual Interventions for Breast Cancer Patients – 211

Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection – 215

Do the Effects of Exercise on Breast Cancer Prevention Vary With Environment – 213

Functional Interactions of the TACC2 Breast Tumor Suppressor Gene and Its Relevance to Breast Tumor Progression – 210

HOXB7: An Oncogenic Gene in Breast Cancer Cells – 217

Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206

Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220

Interdisciplinary Breast Cancer Training Program – 225

Metastatic Progression of Breast Cancer by Allelic Loss on Chromosome 18q21 – 223

Modification of Epigenetic Changes in Cancer by the Stromal Environment – 228

Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer – 217

MTA1-Regulated Gene Expression: New Markers of Breast Cancer Metastasis – 228

Neoplastic Consequences of a Mutator Phenotype in Human Breast Epithelial Cells: A Prospective Analysis – 226

Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk – 214

Outcome Based Screening for Prognostic Phospho-RTK (Receptor Tyrosine Kinase) Antibodies Using Tissue Microarrays) – 227

Promotion of Epithelial to Mesenchymal Transformation by Hyaluronan – 211

Role of Brca1 in Nonhomologous DNA End Joining – 212

Role of E-Cadherin Homophilic Contacts in the Inhibition of Cell Growth of Primary Breast Cells – 218

Severe Caloric Restriction in Adolescence and Incidence of Breast Cancer – 210

Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

The Influence of Stromal Transforming Growth Factor-Beta Receptor Signaling on Mouse Mammary Neoplasia – 207

The Role of Calgranulin Overexpression in Breast Cancer Progression – 220

The Role of the Prohibition Gene in Apoptosis of Breast Cancer Cells – 215

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

Use of a Transgenic Mouse Model With a Regulatable Estrogen Receptor Alpha (ER) to Study the Role of ER in Mammary Gland Development and Cancer – 206

Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

BRIGHTNESS DISTRIBUTION

Generalized Coincident Arrays for the Direct Measurement of the Principal Solution in Radio Astronomy – 127

BROADBAND

A Broadband Microstrip Antenna for SAR Applications – 75

A New Broad-band, Dual-frequency Coplanar Waveguide Fed Slot-Antenna – 66

A Novel Design of an Ultra-Fast Wideband Polarimetric Radar – 107

A Novel Sleeve Monopole with Broad Bandwidth – 74

A Procedure to Design Wide-Band Electromagnetically-coupled Stacked Microstrip Antennas Based on a Simple Network Model – 114

A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies – 78

An Efficient Technique for Modelling Wideband Propagation in an Urban Parallel Street Microcellular Environment – 305

Broad Band Patch Antennas Using a Wedge-shaped Air Dielectric Substrate – 124

Broadband, Robust, Low-profile Monopole Incorporating Top Loading, Dielectric Loading, and a Distributed Capacitive Feed Mechanism – 104

Design of a TEM Waveguide for Ultra-wideband Applications – 154

Design of Large Broadband Patch Arrays – 123

Designs of Broadband Microstrip Antennas with Embedded Slots – 126

Investigation of Characteristics of High-Power Wide-Band Plasma-Filled Traveling Wave Tubes (TWT) – 295

Matrix Pade Via Lanczos for FEM Problems – 142

Novel Designs of Broadband Equilateral-triangular Microstrip Antennas – 68

Significant RX Antenna Diversity Gain in 30 GHz Broadband Radio Channels Subject to Fading – 85

Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna – 79

Small Antenna Efficiency by the Reflection and the Q Measurement Methods – 145

Tapered Leaky-wave Ultra Wide-band Microstrip Antenna – 112

The Sleeve-cage Monopole and Sleeve Helix for Wideband Operation – 80

Wide Band Modeling and Electromagnetic Pulse Propagation through HF Channel – 68

Wideband L-strip Fed Microstrip Antenna – 68

Wideband Radar Echoes from Cylindrical Rods – 74

Wideband Single Layer Microstrip Array at 28 GHz – 98

BROADCASTING

Characteristics of Digital Terrestrial Broadcasting Antennas – 105

Computer Aided Design of Holographic Antennas – 242

Low Cost Broadband Microstrip Antenna for Satellite-TV Reception – 67

BUBBLES

Implementation of Gas Bubble Loading in 2DCAV – 61

The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

BURNERS

Achieving New Source Performance Standards (NSPS) Emission Standards Through Integration of Low-No(x) Burners with an Optimization Plan for Boiler Combustion. Quarterly Technical Progress Report for January 2003 - March 2003 – 183

Computational Fluid Dynamics Based Investigation of Sensitivity of Furnace Operational Conditions to Burner Flow Controls – 159

BURNING RATE

Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

BUTT JOINTS

Inspection of Fusion Joints in Plastic Pipe – 52

BY-PRODUCTS

Envirocare of Utah: Expanding Waste Acceptance Criteria to Provide Low-Level and Mixed Waste Disposal Options – 187

CALIBRATING

A Fast and Accurate Scheme for Calibration of Active Phased-array Antennas – 117

A New Calibration Method of Adaptive Array for TDD Systems – 74

A Remote Calibration for DBF Transmitting Array Antennas by Using Synchronous Orthogonal Codes – 69

Analysis of a Charge Probe and its Response near Metallic and Dielectric Interface – 151

Density- and Structure-independent Calibration Method for Microwave Moisture Determination in Granular Materials – 157

Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps – 169

Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

Normalization of NEXRAD Antenna Gain for Overlapping Radars – 127

On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

Radio Star Flux Density Expressions for Accurate Antenna Gain Measurements – 128

Representation of Absolute Electric Fieldstrength by Superposition of Radiated and Guided Waves – 111

X-Ray Calibration Facility/Advanced Video Guidance Sensor Test – 32

CANCELLATION

Interference Cancellation Systems for Electromagnetically Dense Platforms – 148

CANCER

A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer – 223

An Evaluation of Stereoscopic Digital Mammography for Earlier Detection of Breast Cancer and Reduced Rate of Recall – 208

An Oncotropic Adenovirus Vector System for Breast Cancer Treatment – 218

Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast – 208

Anti-Angiogenesis Therapeutic Indicators in Breast Cancer – 211

Applying Statistical Models to Mammographic Screening Data to Understand Growth and Progression of Ductal Carcinoma in Situ – 217

Center for Behavioral Research: Individual Interventions for Breast Cancer Patients – 211

Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection – 215

Development of Artificial Antigen Presenting Cells for Prostate Cancer Immunotherapy – 207

Do the Effects of Exercise on Breast Cancer Prevention Vary With Environment – 213

Functional Interactions of the TACC2 Breast Tumor Suppressor Gene and Its Relevance to Breast Tumor Progression – 210

Gangliosides During Tumor Progression in Patients With Prostate Cancer – 209

HOXB7: An Oncogenic Gene in Breast Cancer Cells – 217

Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206

Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220

Interdisciplinary Breast Cancer Training Program – 225

Metastatic Progression of Breast Cancer by Allelic Loss on Chromosome 18q21 – 223

Modification of Epigenetic Changes in Cancer by the Stromal Environment – 228

Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer – 217

MTA1-Regulated Gene Expression: New Markers of Breast Cancer Metastasis – 228

Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk – 214

Outcome Based Screening for Prognostic Phospho-RTK (Receptor Tyrosine Kinase) Antibodies Using Tissue Microarrays) – 227

Promotion of Epithelial to Mesenchymal Transformation by Hyaluronan – 211

Regulation of TRAIL-Mediated Apoptosis in Prostate Cancer by Overexpression in XIAP – 223

Role of Brca1 in Nonhomologous DNA End Joining – 212

Severe Caloric Restriction in Adolescence and Incidence of Breast Cancer – 210

Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

The Influence of Stromal Transforming Growth Factor-Beta Receptor Signaling on Mouse Mammary Neoplasia – 207

The Mechanism of Retinoblastoma Protein-Mediated Terminal Cell Cycle Arrest – 218

The Role of Calgranulin Overexpression in Breast Cancer Progression – 220

The Role of the Prohibition Gene in Apoptosis of Breast Cancer Cells – 215

Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Nonpalpable Breast Tumors – 158

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

Use of a Transgenic Mouse Model With a Regulatable Estrogen Receptor Alpha (ER) to Study the Role of ER in Mammary Gland Development and Cancer – 206

Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

CAPACITANCE

Design of Two-Axis Capacitive Accelerater Using MEMS – 262

Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

CARBON DIOXIDE

Global Climate Change and the Transportation Sector: An Update on Issues and Mitigation Options – 185

Reaction Mechanisms of Magnesium Silicates with Carbon Dioxide in Microwave Fields – 41

CARBON FIBERS

Distributed Sensing of Composite Overwrapped Pressure Vessel Using Fiber-Bragg Gratings at Ambient and Cryogenic Temperatures – 39

CARBON MONOXIDE

Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion – 45

CARBON

Deposition Diagnostics for Next-Step Devices – 296

Economic Evaluation of CO2 Storage and Sink Enhancement Options – 191

Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter – 43

Multiple Strategy Bio-Detection Sensor Platforms Made from Carbon and Polymer Materials – 166

Protective Clothing Based on Permselective Membrane and Carbon Adsorption – 230

Systematic Studies of Carbon Doping in High Quality GaN Grown by Molecular Beam Epitaxy – 136

CARCINOGENS

HOXB7: An Oncogenic Gene in Breast Cancer Cells – 217

Neoplastic Consequences of a Mutator Phenotype in Human Breast Epithelial Cells: A Prospective Analysis – 226

CARDIOVASCULAR SYSTEM

Center for Innovative Minimally Invasive Therapy (CIMIT) – 205

Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206

CARDS

2.4GHz ISM Band Antenna for PC Cards – 241

CARRIER FREQUENCIES

Channel Simulation of Leo Satellites – 92

CASTING

Feasibility Assessment for Pressure Casting of Ceramic-Aluminum Composites for NASA's Propulsion Applications – 39

CASUALTIES

Patient Warming Device for Casualty Care – 222

CATALYSTS

Demonstration of Potential for Selective Catalytic Reduction and Diesel Particulate Filters – 184

Dynamometer Evaluation of Plasma-Catalyst for Diesel NOX Reduction – 171

Energy Efficient Thermal Management for Natural Gas Engine Aftertreatment via Active Flow Control – 174

Investigation of On-Vehicle Fuel Catalyst System – 44

Oxidation of Mercury Across SCR Catalysts in Coal-Fired Power Plants Burning Low Rank Fuels. Quarterly Progress Report April 1, 2004-June 30, 2004 – 185

SCR Systems for Heavy Duty Trucks: Process Towards Meeting EURO 4 Emission Standards in 2005 – 172

CAULKING

Tests Narrowed – 26

CAVITIES

Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas – 112

CELL DIVISION

Role of E-Cadherin Homophilic Contacts in the Inhibition of Cell Growth of Primary Breast Cells – 218

CELLULOSE NITRATE

A Method of Monitoring Explosive Under Cyclic Mechanical Stress – 54

CENSORED DATA (MATHEMATICS)

A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data – 270

CERAMIC MATRIX COMPOSITES

FDTD Modeling of Ceramic Multi-layer Capacitors Using Lumped Equivalent Models – 253

Feasibility Assessment for Pressure Casting of Ceramic-Aluminum Composites for NASA's Propulsion Applications – 39

CERAMICS

Advanced Second Generation Ceramic Candle Filters – 181

Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

CERTIFICATION

Advancement of Methodology for RF Dosimetry – 126

CHANNELS (DATA TRANSMISSION)
Design of a Smart Antenna for Reducing Co-Channel Interference in Cellular Mobile Communications – 144

CHAOS
Chaotic Wave Scattering and Synchronization – 75

CHARACTERIZATION
Characterization of Complex Dielectric Properties of Materials Using a Hybrid Iterative Method – 147

Characterization Strategies and Requirements for Lunar Regolith Simulant Materials – 322

Initial On-Orbit Spatial Resolution Characterization of OrbView-3 Panchromatic Images – 307

Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane – 52

CHARGED PARTICLES
A Detection of the Same Hot Plasma in the Corona: During a CME and Later at Ulysses – 192

CHARM (PARTICLE PHYSICS)
Lost Tribes of Charmonium – 276

Search for D(sub (sJ))(2632) at BaBar – 287

CHEMICAL ANALYSIS
Analyses of Elemental Partitioning in Advanced Nickel-Base Superalloy Single Crystals – 14

Explosive Chemical Signature-Based Detection of IEDs – 46

CHEMICAL COMPOSITION
Chemical Compositions and Anomalies in Stellar Coronae ADP99 – 315

Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

CHEMICAL EVOLUTION
Modeling the Transport and Chemical Evolution on Onshore and Offshore Emissions and Their Impact on Local and Regional Air Quality Using a Variable-Grid-Resolution Air Quality Model – 188

CHEMICAL LASERS
The Measurement of Gain in a Supersonic, Combustion-Driven Generator for NCl(a1Delta) – 171

CHEMICAL OXYGEN-IODINE LASERS
The Measurement of Gain in a Supersonic, Combustion-Driven Generator for NCl(a1Delta) – 171

CHEMICAL PROPULSION
Solar Electric and Chemical Propulsion for a Titan Mission – 32

CHEMICAL REACTIONS
Sulfur Oxidation and Contrail Precursor Chemistry – 47

CHEMICAL REACTORS
How to Prevent Runaway Reactions. Case Study: Phenol-Formaldehyde Reaction Hazards – 190

CHEMOTHERAPY
Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast – 208

CHINA
China's Development of Asymmetric Warfare and the Security of Taiwan, Republic of China – 301

Estimation of Geoacoustic Properties in the South China Sea Shelf Using a Towed Source and Vertical Line Hydrophone Array – 288

CHINESE SPACECRAFT
From Mercury to CEV: Space Capsules Reemerge – 31

CHIPS
Integrated Dipole Antennas on Silicon Substrates for Intra-chip Communication – 102

CHIRALITY
On the Incompatibility of Chirality Parameter Alpha and Chirality Admittance xi of Chiral Media – 155

CHROMIUM
Energetics of Oxygen Interstitials in Cr and V – 50

CHROMOSOMES
Metastatic Progression of Breast Cancer by Allelic Loss on Chromosome 18q21 – 223

CIRCADIAN RHYTHMS
Circadian Rhythms, Fatigue, and Manpower Scheduling – 229

CIRCUIT DIAGRAMS
Content Repurposing of Electrical Diagrams for Presentation in Handheld Devices – 241

CIRCUITS
Circuital Analysis of a Two-port Angular Sector – 143

Development, Exploitation, and Transition of Computer Aided Engineering (CAE) Tools – 135

Efficient Electromagnetic Modeling of Microstrip Structures in Multilayer Media – 113

Hierarchical CAD Tools for Radiation Hardened Mixed Signal Electronic Circuits – 135

Interconnect and Packaging Electrical Circuits Network – 124

CIRCULAR CYLINDERS
Analysis of Reflection from Multilayer Cylinder by Using a Black-hole Approach – 315

Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface – 66

Modeling Surface Currents on Electrically Large Impedance Cylinders - 2D, TM Case – 120

CIRCULAR PLATES
A Design Procedure for Classical Offset Dragonian Antennas with Circular Apertures – 77

CIRCULAR POLARIZATION
A Low Loss, Dual Polarized Switch for Polarization State Selection – 124

CITIES
A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78

CIVIL AVIATION
Analyses of Elemental Partitioning in Advanced Nickel-Base Superalloy Single Crystals – 14

Applications of Endothermic Reaction Technology to HSCT and AST – 16

Assessment of the NASA AvSTAR Project Plan – 1

Aviation Security: Measures for Testing the Impact of Using Commercial Data for the Secure Flight Program – 8

High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

High Speed Research Program Structural Acoustics Multi-Year Summary Report – 290

Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Low Noise Exhaust Nozzle Technology Development – 2

Nozzle Aerodynamic Stability During a Throat Shift – 1

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

CLASSIFICATIONS
Aerial Applicators Spray Nozzle Handbook – 9

Composite Combat Identification (CCID) Common Reasoning Algorithm Development Program – 262

CLEAN FUELS
Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control – 188

CLEANING
Disposal of True Waste from the Plutonium Finishing Plant in Pipe Overpack Containers to WIPP Including New Security Requirements – 187

CLIMATE CHANGE
A Mechanism For Solar Forcing of Climate: Did the Maunder Minimum Cause the Little Ice Age? – 203

Global Climate Change and the Transportation Sector: An Update on Issues and Mitigation Options – 185

CLIMATE

Climate-Driven Deformation of the Solid Earth from GRACE and GPS – 196

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 4: Cooling Degree Days. Climatography of the USA No. 85 – 202

Regional Deformation Studies with GRACE and GPS – 253

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Cooling Degree Days Weighted by Population (2000 Census) 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 5-2 – 200

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Heating Degree Days Weighted by Population (2000 Census) 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 5-1 – 198

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Temperature Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-1 – 199

CLIMATOLOGY

Contributions of TRMM to Our Understanding of Precipitation Processes and Climate Variability – 204

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 3: Heating Degree Days. Climatography of the USA No. 85 – 202

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 6: Divisional Maps, 1931-2000. Climatography of the USA No. 85 – 201

State Monthly Temperature, Precipitation, and Degree Days 1971-2000 (and Previous Normals Periods). Section 1: State Maps, 1971-2000. Historical Climatography Series No. 4 and 5 – 198

State Monthly Temperature, Precipitation, and Degree Days 1971-2000 (and Previous Normals Periods). Section 2: State Maps, 1931-2000. Historical Climatography Series No. 4 and 5 – 198

USA Climate Normals, 1971-2000. Annual Degree Days to Selected Bases, 1971-2000. Climatography of the USA No. 81. Supplement No. 2 – 202

USA Climate Normals, 1971-2000. Monthly Precipitation Probabilities and Quintiles, 1971-2000. Climatography of the USA No. 81. Supplement No. 1 – 203

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Precipitation Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-2 – 199

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Temperature and Precipitation Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-3 – 199

CLINICAL MEDICINE

Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer – 217

Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk – 214

The Reliability and Validity of the Outcome Rating Scale: A Replication Study of a Brief Clinical Measure – 214

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

CLUTTER

Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform – 103

Knowledge-Based Generalized Likelihood Ratio Test (KB-GLRT): Exploiting Knowledge of the Clutter Ridge in Airborne Radar – 167

COAL

Development of On-Line Temperature Measurement Instrumentation for Gasification Process Control – 36

On-Line Integrated Control System for Reducing Coal Costs and Coal-Related Emissions: Coal Blend Automation System (CBAS) – 187

Oxidation of Mercury Across SCR Catalysts in Coal-Fired Power Plants Burning Low Rank Fuels. Quarterly Progress Report April 1, 2004-June 30, 2004 – 185

COASTS

Compilation of Data Sources Used to Construct Bottom-Sediment Province Maps for the USA East Coast Continental Shelf from Cape Kennedy to Cape Hatteras and for Various Indonesian Waters – 176

COATINGS

Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings – 55

Higher-order Impedance Boundary Conditions for Complex Layered Planar Coatings – 130

Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors – 139

COAXIAL CABLES

The Co-conical Field Generation System - A 40 GHz Antenna Calibration Cell – 120

COCHANNEL INTERFERENCE

A Low Loss, Dual Polarized Switch for Polarization State Selection – 124

CODE DIVISION MULTIPLE ACCESS

Applications of Smart Antennas in Cellular Networks – 75

Computer Simulated and Analytical Results of MSE in Adaptive Integrated Reduced-complexity Receiver for Multipath DS/CDMA Systems – 73

Low Complexity Space-frequency Rake Receivers for WCDMA – 131

CODE DIVISION MULTIPLEXING

Code-Division Multiplexing and Frequency-Division Multiplexing for Nonlinear Inverse Scattering – 267

CODING

APTU Nozzle Code Manual, Version 3.0 – 244

Development of the CRIPTE Code for Electromagnetic Coupling – 246

Helmet-Mounted Display Targeting Symbology Color Coding: An Air-to-Air Scenario Evaluation – 231

COEFFICIENTS

FDTD Computed Numerical Diffraction Coefficients of 3-D Infinite Material Wedges – 265

Measurement of Transmission Coefficients of Radiowaves through Building Materials in the 5.8 GHz Frequency Band – 142

Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

COERCIVITY

Iraq and Failures in U.S. Compellence Policy 1990-2003 – 279

COHERENT RADAR

Coherent Seeker Guided Antiship Missile Performance Analysis – 167

ISAR Turntable Experiments Using a Coherent Ultrawideband Random Noise Radar – 84

COLLAGENS

Elastic Response of Crimped Collagen Fibrils – 228

COLOR

Helmet-Mounted Display Targeting Symbology Color Coding: An Air-to-Air Scenario Evaluation – 231

COMBAT

Analyzing and Sharing Data for Surface Combat Weapons Systems – 246

Composite Combat Identification (CCID) Common Reasoning Algorithm Development Program – 262

Survivability Enhancement in a Combat Environment – 9

COMBINATORIAL ANALYSIS
Fundamentals of Combinatorial Optimization and Algorithms Design: December Report – 263

COMBUSTION CHAMBERS
Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Porous Media Combustors for Clean Gas Turbine Engines – 42

COMBUSTION CHEMISTRY
Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

COMBUSTION CONTROL
Guide to Low-Emission Boiler and Combustion Equipment Selection – 186

Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

COMBUSTION PHYSICS
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control – 188

Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43

COMBUSTION
Achieving New Source Performance Standards (NSPS) Emission Standards Through Integration of Low-No(x) Burners with an Optimization Plan for Boiler Combustion. Quarterly Technical Progress Report for January 2003 - March 2003 – 183

Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion – 45

Diesel Engine Alternatives – 172

Investigation of On-Vehicle Fuel Catalyst System – 44

Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

COMETS
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

COMMAND AND CONTROL
Information Sharing Among Military Headquarters. The Effects on Decision-making – 300

SJFHQ Simulation – 81

Thoughts Regarding Evaluation of the Human Perspectives in the 'Demonstrators' Work in the Armed Forces Transformation Program and Command and Control Development – 62

COMMERCE
America's Freight Transportation Gateways. Connecting Our Nation to Places and Markets Abroad – 5

COMMERCIAL AIRCRAFT
Homeland Security: Protecting Airliners from Terrorist Missiles – 12

Quiet Plan for Tomorrow's Jet Engines – 17

Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

COMMERCIAL OFF-THE-SHELF PRODUCTS
Analyzing and Sharing Data for Surface Combat Weapons Systems – 246

Digital Phased Array Architectures for Radar and Communications Based on Off-the-Shelf Wireless Technologies – 134

COMMERCIAL SPACECRAFT
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

Trial by Fire – 25

COMMUNICATION EQUIPMENT
A Low-Cost, Man-Portable, Free-Space Optics Communications Device for Ethernet Applications – 170

Antennas Feasibility Study for a LMDS Communication System – 91

Array Configurations and Wideband Radiators Suitable for Shared Apertures – 83

COMMUNICATION NETWORKS
Connecting the Globe: A Regulator's Guide to Building a Global Information Community – 63

Design and Evaluation of an Efficient Reliable Manycast Protocol for Ad-hoc Networks – 83

Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60

Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments – 62

Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna – 205

From Crash Tolerance to Authenticated Byzantine Tolerance: A Structured Approach, the Cost and Benefits – 82

Numerical Computation on Radiation Characteristics of Square Loop Antennas at the Wrist Position of a Human Body in Personal Wireless Communications – 116

Performance Analysis of Mobile Ad Hoc Networking Routing Protocols – 261

COMMUNICATION SATELLITES
ACTS Battery and Solar Array Assembly On-Orbit Measured Performance – 27

Martian Infotech – 26

COMPLEX SYSTEMS
Computational Algorithms for High-Fidelity Multidisciplinary Design of Complex Aerospace Systems – 3

Dependable Pervasive Systems – 236

Extending the Horizons of DSE (GC6) – 234

Science-Based Prediction for Complex Systems – 275

COMPLEXITY
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

COMPOSITE MATERIALS
In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

COMPOSITE STRUCTURES
Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

COMPRESSIBLE FLOW
Research Instrumentation for Measurements of High-Speed Separated Flows – 170

COMPTON EFFECT
Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content – 313

COMPUTATIONAL FLUID DYNAMICS
Automated Extraction of Secondary Flow Features – 159

Computational Fluid Dynamics Based Investigation of Sensitivity of Furnace Operational Conditions to Burner Flow Controls – 159

High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

Introduction to CFD++, its Transient and Moving Body Capabilities – 246

Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

COMPUTATIONAL GRIDS
Numerical Solution of Plasma Fluid Equations Using Locally Refined Grids – 294

Using Web Services to Build Grid Applications-The No Risk WSGAF Profile – 235

COMPUTATION
Calculating The Mutual Coupling Between Apertures on Convex Cylinders Using a Hybrid UTD-MoM Method – 66
Challenges and Opportunities in Grid Performability – 235
Computation of Radar Cross Section of Waveguide Arrays – 99
Coupling to a Probe in a Metal Can by an Electric Dipole – 240
Fast Computation of Scattering from (Near-)Resonant Structures – 233

COMPUTER AIDED DESIGN
A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256
Circuital Analysis of a Two-port Angular Sector – 143
Computer Aided Design of Holographic Antennas – 242
Development, Exploitation, and Transition of Computer Aided Engineering (CAE) Tools – 135
Hierarchical CAD Tools for Radiation Hardened Mixed Signal Electronic Circuits – 135

COMPUTER COMPONENTS
2.4GHz ISM Band Antenna for PC Cards – 241

COMPUTER INFORMATION SECURITY
Aviation Security: Measures for Testing the Impact of Using Commercial Data for the Secure Flight Program – 8
Mobile Ubiquitous Security Environment (MUSE) – 250

COMPUTER NETWORKS
Dependable Pervasive Systems – 236
Geographically Locating an Internet Node Using Network Latency Measurement – 242
Integrated Network Application Management (INAM) – 249
Internet Access in US Public Schools and Classrooms: 1994-2003 – 83

COMPUTER PROGRAMMING
A General Purpose Analysis System Based on a Programmable Fluid Processor – 247
Code Review and Personality: Is Performance Linked to MBTI Type – 236
Component Composition for Embedded Systems Using Semantic Aspect-Oriented Programming – 245
Dependable Pervasive Systems – 236
Use of OpenSSH Support for Remote Login to a Multilevel Secure System – 244
Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology – 243

COMPUTER PROGRAMS
A General Purpose Analysis System Based on a Programmable Fluid Processor – 247
An Evaluation of Stereoscopic Digital Mammography for Earlier Detection of Breast Cancer and Reduced Rate of Recall – 208
APTU Nozzle Code Manual, Version 3.0 – 244
Comparison of Fiber Optic Strain Demodulation Implementations – 168
Component Middleware to Support Nonrepudiable Service Interactions – 82
Composite Combat Identification (CCID) Common Reasoning Algorithm Development Program – 262
Development of the CRIPTE Code for Electromagnetic Coupling – 246
Estimating Supplies Program: Evaluation Report – 245
Introduction to CFD++, its Transient and Moving Body Capabilities – 246
Moving-Map Composers System Version 3.4P Acceptance Test Procedures Developed for the Finnish Air Force Modification for FIAF MMC System Without DMUI/DMU – 177
On-Line Integrated Control System for Reducing Coal Costs and Coal-Related Emissions: Coal Blend Automation System (CBAS) – 187
Parallel Domain Decomposition Formulation and Software for Large-Scale Sparse Symmetrical/Unsymmetrical Aeroacoustic Applications – 239
Simulations of Diversity Techniques for Urban UAV Data Links – 11
Symplectic Treatment of a Finite Crossing Angle in the Beam-Beam Collision – 282
Utilizing IXP1200 Hardware and Software for Packet Filtering – 243
Wrapping the Future – 234

COMPUTER STORAGE DEVICES
High Frequency Performance of Self-Assembled Monolayer (SAM) Organic FETs – 137
Implicit Memory, Perception and the Rapid Deployment of Visual Attention and Action – 241

COMPUTER SYSTEMS PERFORMANCE
Evolving Computational Capability for Ship Hydrodynamics – 264

COMPUTER SYSTEMS PROGRAMS
Dual Purpose Simulation: New Data Link Test and Comparison With VDL-2 – 2
Dynamic Allocation of Servers in a Grid Hosting Environment – 237

COMPUTER TECHNIQUES
Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer – 217
Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology – 243

COMPUTER VIRUSES
Mobile Ubiquitous Security Environment (MUSE) – 250

COMPUTERIZED SIMULATION
3D Super Resolution Algorithm for Analysis of Multi-path Propagation Structure – 148
A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic – 6
Aerial Applicators Spray Nozzle Handbook – 9
Beam-beam Simulation Studies for PEP-II and KEKB – 284
Demonstration of Adaptive Radio Node – 63
Dual Purpose Simulation: New Data Link Test and Comparison With VDL-2 – 2
Sequential Multiple Comparison Testing for Budget-Limited Applications – 263
Three Dimensional Optical Fiber Simulation – 117

COMPUTERS
Utilizing IXP1200 Hardware and Software for Packet Filtering – 243

CONCRETE STRUCTURES
Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21
Reflection and Transmission Properties of Reinforced Concrete Walls – 93

CONCRETES
Decontamination Technologies for Facility Reuse – 191
Evaluation of HPC Pavement in Nelsonville, Ohio – 38

CONDITIONING (LEARNING)
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 229

CONDUCTIVITY
Development of a Conductive-polymer, Composite, Direction-finding Antenna – 106
Electrical Conductivity of HgTe at High Temperatures – 133

CONDUCTORS
FDTD Computed Numerical Diffraction Coefficients of 3-D Infinite Material Wedges – 265
Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129
Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors – 139
Pulsed Power Fusion – 149

CONFERENCES
IEEE Sensors 2004 Conference – 138
International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004 – 54
ISOP To Focus on Shuttle Transition – 26
Military Aerospace Fluids and Lubricants Workshop Proceedings – 53
Proceedings of the Workshop on Power Sources for Distributed Autonomous Systems – 137
Understanding the Insider Threat. Proceedings of a March 2004 Workshop – 301

CONFINEMENT
Compact Flares and CMEs – 309
Efficient Electromagnetic Modeling of Microstrip Structures in Multilayer Media – 113

CONICAL BODIES
A Confocal Reflector System – 77

CONJUGATE GRADIENT METHOD
A Conjugate Gradient FFT Method for Transient Scattering by Dielectric Cylinders – 259
Application of Conjugate Gradient Algorithm to Adaptive Beamforming – 255
Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

CONJUGATION
Tunable Optical Polymer Systems – 53

CONNECTIVE TISSUE
Elastic Response of Crimped Collagen Fibrils – 228

CONSISTENCY
A Topological Viewpoint on Consistency Aspects of Electromagnetic Theory on a Lattice – 131

CONSTRUCTION MATERIALS
Boiler Materials for Ultrasupercritical Coal Power Plants. Third Quarterly Report April 1 to June 30, 2004 – 48
In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19

CONSUMERS
Telemarketing: Implementation of the National Do-Not-Call Registry – 232

CONTACT LENSES
Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators – 166

CONTAINERS
Estimation of Radiolytic Gas Generation Rate for Cylindrical Radioactive Waste Packages - Application to Spent Ion Exchange Resin Containers – 41

CONTAMINATION
Bond Testing for Effects of Silicone Contamination – 173
Diamond Wire Cutting of the Tokamak Fusion Test Reactor – 295
Interim Report of the Defense Science Board Task Force on SARS Quarantine – 226
Microbiological Air Contamination from Machining Fluids – 181

CONTINENTAL SHELVES
Compilation of Data Sources Used to Construct Bottom-Sediment Province Maps for the USA East Coast Continental Shelf from Cape Kennedy to Cape Hatteras and for Various Indonesian Waters – 176

CONTRACT MANAGEMENT
Contract Management: The Air Force Should Improve How It Purchases AWACS Spare Parts – 15

CONTRAILS
Sulfur Oxidation and Contrail Precursor Chemistry – 47

CONTROL EQUIPMENT
Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast – 208

CONTROL MOMENT GYROSCOPES
Development Of A Control Moment Gyroscope Controlled, Three Axis Satellite Simulator, With Active Balancing For The Bifocal Relay Mirror Initiative – 24

CONTROL SYSTEMS DESIGN
Design of Robust Controllers for Telecom Power Supplies – 140
Robust Control Design for Systems With Probabilistic Uncertainty – 18

CONTROL THEORY
Null Control for Linear Arrays by Phase-only or Amplitude-only Modification of the Excitations – 85

CONTROLLABILITY
Wind Tunnel Investigation of the Static Stability and Control Effectiveness of a Rotary Tail in a Portable UAV – 4

CONTROLLERS
Autonomous Assembly of Modular Structures in Space and on Extraterrestrial Locations – 251
Robust Control Design for Systems With Probabilistic Uncertainty – 18

CONVECTION
Modeling Ocean Deep Convection – 197

CONVENTIONS
IERS Conventions (2003) – 310

CONVERGENCE
A New Method to Compute the Fundamental Mode Resonant Frequencies of Microstrip Annular Rings – 121
The Adaptive Control of Optical Beam Jitter – 170

CONVERGENT-DIVERGENT NOZZLES
APTU Nozzle Code Manual, Version 3.0 – 244

COOLING
An Experimental Study of Steady State High Heat Flux Removal Using Spray Cooling – 160
Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 2: Precipitation. Climatography of the USA No. 85 – 201
Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 4: Cooling Degree Days. Climatography of the USA No. 85 – 202
Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 5: Divisional Maps, 1971-2000. Climatography of the USA No. 85 – 201
USA Climate Normals, 1971-2000. Annual Degree Days to Selected Bases, 1971-2000. Climatography of the USA No. 81. Supplement No. 2 – 202

COORDINATES
Spherical-multipole Analysis of the Field within a Canonical GTEM-cell – 257

COPOLYMERS
Morphology and Properties of Model Block and Graft Copolymers – 54

COPPER ALLOYS
GRCop-84: A High-Temperature Copper Alloy for High-Heat-Flux Applications – 50

CORONAL LOOPS
Compact Flares and CMEs – 309

CORONAL MASS EJECTION
Current Sheet Evolution in the Aftermath of a CME Event – 324

CORONAS
A Detection of the Same Hot Plasma in the Corona: During a CME and Later at Ulysses – 192

CORRECTION
Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology – 243

CORRELATION
Constraints of Melting, Sea-Level and the Paleoclimate from GRACE – 196

CORROSION PREVENTION
Six Sigma Evaluation of the High Level Waste Tank Farm Corrosion Control Program at the Savannah River Site – 41

CORRUGATED WAVEGUIDES
Dual-band Compact Square Waveguide Corrugated Polarizer – 112

COSMIC DUST
Experiments on Dust Grain Charging – 315

COSMIC MICROWAVE BACKGROUND RADIATION
Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content – 313

COST EFFECTIVENESS
Design and Evaluation of an Efficient Reliable Manycast Protocol for Ad-hoc Networks – 83

COST REDUCTION
Lightweight Nonmetallic Thermal Protection Materials Technology – 51

On-Line Integrated Control System for Reducing Coal Costs and Coal-Related Emissions: Coal Blend Automation System (CBAS) – 187

COUNTERMEASURES
Low Frequency Sonar Countermeasure – 139

COUPLED MODES
Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface – 66

Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159

Slow and Fast Light in Coupled Microresonators – 294

COUPLING
Minimization of Mutual Coupling Effects in Eigenstructure Algorithms Based on Modal Analysis – 94

CP VIOLATION
Constraints on r(sub B) and gamma in B(sup (+-)) rightarrow D(sup 0)K(sup (+-)) decays by a Dalitz analysis of D(sup 0) Greater Than K(sub S) pi(sup -) pi(sup +) – 282

D+ --\g K-K+pi+ Meson Decays: A Search for CP Violation and a Measurement of the Branching Ratio – 285

Measurement of CP Violating Asymmetries in B(sup 0) --\g f(sup 0)(980)Ks Decays – 285

Measurement of CP-violating parameters in fully reconstructed B--\gD(*)pi and B--\gDrho decays – 282

Measurements of Branching Fraction, Polarization, and Direct CP-Violating Asymmetry in B(sup +) --\g K*(sup 0)(rho)(sup +) Decays – 283

New Ways to Soft Leptogenesis – 277

CREW WORKSTATIONS
Human Factors Assessment of the UH-60M Crew Station During the Early User Demonstration Number 2 (EUD2) – 12

CROSS FLOW
A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow – 16

CROSS POLARIZATION
A Simple Theoretical Model for Polarization Diversity Reception in Wireless Mobile Environments – 68

A Uniplanar Quasi-yagi Antenna with Wide Bandwidth and Low Mutual Coupling Characteristics – 71

Dual Band Dual Linear Polarization Elliptical Microstrip Ring Antenna – 145

Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar – 151

Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna – 79

CROSS SECTIONS
Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section – 118

Hard Photodisintegration of a Proton Pair in 3He – 286

Measured Back Scattering Cross Section of Thin Wires – 156

CROSSINGS
Beam-beam Simulation Studies for PEP-II and KEKB – 284

CROSSLINKING
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

CROSSTALK
Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk – 214

CRUSTS
Constraints of Melting, Sea-Level and the Paleoclimate from GRACE – 196

CRYOGENIC ROCKET PROPELLANTS
Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative – 34

CRYOGENICS
Cryo Power and Heat Transfer – 171

Technology Challenges for Deep-Throttle Cryogenic Engines for Space Exploration – 33

U.S. Chemical Safety and Hazard Investigation Board Case Study. Explosion at Biochemical Facility: Liquid Nitric Oxide Release: ISOTEC, Miami Township, Ohio, September 21, 2003 – 190

CRYPTOGRAPHY
Secure Distribution of Open Source Information – 302

CRYSTAL GROWTH
Macromolecular Crystallization in Microgravity – 57

Reproducible Crystal Growth Experiments in Microgravity Science Glovebox at the International Space Station (SUBSA Investigation) – 57

CRYSTALLOGRAPHY
Fluorescent Approaches to High Throughput Crystallography – 296

CRYSTALS
Bio-Derived Photonic Assemblies – 45

Experimental Characterization of Photonic Band Crystals for Tera Hertz Devices – 134

Liquid Between Macromolecules in Protein Crystals: Static Versus Dynamics – 192

Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures – 297

Two-Dimensional Photonic Crystals for Near IR and Visible Optoelectronics Applications – 294

CUBIC LATTICES
Static Permittivity of a Multiphase System of Spheres – 274

CURRENT DENSITY
A New Method to Compute the Fundamental Mode Resonant Frequencies of Microstrip Annular Rings – 121

High Frequency Performance of Self-Assembled Monolayer (SAM) Organic FETs – 137

Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

CURRENT DISTRIBUTION
Analysis of a Charge Probe and its Response near Metallic and Dielectric Interface – 151

Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms – 85

Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

CURRENT SHEETS
Current Sheet Evolution in the Aftermath of a CME Event – 324

CURVATURE
FDTD Analysis of Mutual Coupling between Microstrip Patch Antennas on Curved Surfaces – 71

CUTTING
Diamond Wire Cutting of the Tokamak Fusion Test Reactor – 295

CYCLES
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

CYLINDRICAL ANTENNAS
A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions – 72

A Conformal Spiral Array Antenna Radiating an Omnidirectional Circularly-Polarized Wave – 70

On the Accuracy of the Transmission Line Theory for the Insulated Linear Antenna – 113

The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

Variety of Cylindrical Fresnel Zone Plate Antennas – 120

CYLINDRICAL BODIES

2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

A Conjugate Gradient FFT Method for Transient Scattering by Dielectric Cylinders – 259

A Viable Model for Power Focussing in a Lossy Cylinder – 142

Cylindrical 3D PML-PLRC-FDTD Schemes for Frequency-dispersive and Inhomogeneous Media – 118

Design of Cylindrical Reflector Antennas with Caustic-located Array Feeding – 60

On the Accuracy of the Transmission Line Theory for the Insulated Linear Antenna – 113

Quasi-static Analysis of Asymmetric Cylindrical Coplanar Waveguide – 151

Radiation Properties of Two Cylindrical Conformal Arrays Isolated by a Space Filter – 59

Shape Reconstruction of a Perfectly Conducting Cylinder Using Real-coded Genetic Algorithm – 266

Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

Wideband Radar Echoes from Cylindrical Rods – 74

CYLINDRICAL COORDINATES

A 2.5-D PSTD Algorithm in Cylindrical Coordinates – 259

PML-FDTD Method for Elastic Waves in Cylindrical and Spherical Coordinates – 257

CYLINDRICAL SHELLS

Coupling to a Probe in a Metal Can by an Electric Dipole – 240

CYLINDRICAL WAVES

Inhomogeneous Cylindrical Waves: An Approach to Complex Beams – 255

DAMAGE ASSESSMENT

Battle Damage Assessment Using Inverse Synthetic Aperture Radar (ISAR) – 164

DAMAGE

Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

DATA ACQUISITION

RACT/BACT/LAER Clearinghouse (RBLC) Clean Air Technology Center Annual Report for 2003 – 186

Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms – 85

The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

DATA BASES

Advanced Technology Lifecycle Analysis System (ATLAS) Technology Tool Box (TTB) – 300

Differences and Similarities in Andra's Assessment of Activities Carried Out by Radioactive Waste Generators and Affecting the Quality of IL-LL Short-Lived Waste Packages and HL-IL Long-Lived Waste Packages – 187

Integrity Through Mediated Interfaces – 248

DATA FLOW ANALYSIS

Regression Equations for Estimating Flood Flows for the 2-, 10-, 25-, 50-, 100-, and 500-Year Recurrence Intervals in Connecticut – 237

DATA INTEGRATION

Global Positioning System Data Integration and Development of a Three-Dimensional Spatial Model of the Kansas Highway Network – 59

Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion – 167

DATA LINKS

Dual Purpose Simulation: New Data Link Test and Comparison With VDL-2 – 2

Simulations of Diversity Techniques for Urban UAV Data Links – 11

DATA MANAGEMENT

Analyzing and Sharing Data for Surface Combat Weapons Systems – 246

Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion – 167

DATA MINING

Self-Organizing Maps in Sequence Processing – 238

DATA PROCESSING

Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

Probe Pulse Shape Estimation in Synthetic Aperture Method – 88

DATA REDUCTION

Analyzing and Sharing Data for Surface Combat Weapons Systems – 246

DATA SIMULATION

Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268

DATA SYSTEMS

Analyzing and Sharing Data for Surface Combat Weapons Systems – 246

DATA TRANSMISSION

Device Profiling Analysis in Device-Aware Network – 249

Three Dimensional Optical Fiber Simulation – 117

DEACTIVATION

Remote System Technologies for Deactivating Hanford Hot Cells – 141

DEATH

Protein Kinase Pathways That Regulate Neuronal Survival and Death – 208

DECAY

Search for the Decay B(sup 0) Yields K*(sup +)(rho)(sup -) – 287

DECEPTION

Telemarketing: Implementation of the National Do-Not-Call Registry – 232

DECISION MAKING

A Model-Based Approach to Battle Execution Monitoring – 302

Composite Combat Identification (CCID) Common Reasoning Algorithm Development Program – 262

Information Sharing Among Military Headquarters. The Effects on Decision-making – 300

The Impact of Computer Decision Support on Military Decision Making – 246

Two Trees: Migrating Fault Trees to Decision Trees for Real Time Fault Detection on International Space Station – 306

Uncertainties in the Analytic Hierarchy Process – 272

DECISION SUPPORT SYSTEMS

A Model-Based Approach to Battle Execution Monitoring – 302

Advanced Technology Lifecycle Analysis System (ATLAS) Technology Tool Box (TTB) – 300

Civil Works Operations & Maintenance Management Tools Research Program: Program Summary FY 2000 - FY 2002 – 272

The Impact of Computer Decision Support on Military Decision Making – 246

DECISION THEORY

Uncertainties in the Analytic Hierarchy Process – 272

DECOMMISSIONING

Demonstration and Evaluation of Potential High Level Waste Melter Decontamination Technologies for Savannah River Site – 185

Diamond Wire Cutting of the Tokamak Fusion Test Reactor – 295

DECOMPOSITION

A Fast Multilevel Domain Decomposition Algorithm for Radar Imaging – 103

A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

Domain Decomposition Method: A Direct Solution of Maxwell Equations – 258

Parallel Domain Decomposition Formulation and Software for Large-Scale Sparse Symmetrical/Unsymmetrical Aeroacoustic Applications – 239

Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

Radar Polarimetry – 165

DECONTAMINATION

Decontamination Technologies for Facility Reuse – 191

Demonstration and Evaluation of Potential High Level Waste Melter Decontamination Technologies for Savannah River Site – 185

Remote System Technologies for Deactivating Hanford Hot Cells – 141

DEFECTS

Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles – 30

Demonstration and Validation of the Excited Dielectric Test (Trade Name) Method to Detect and Locate Defects in Aircraft Wiring Systems – 141

DEFENSE PROGRAM

DOD Systems Modernization: Management of Integrated Military Human Capital Program Needs Additional Improvements – 239

Information Operations as a Core Competency (Joint Force Quarterly) – 303

Interim Report of the Defense Science Board Task Force on SARS Quarantine – 226

Technology Development: New DOD Space Science and Technology Strategy Provides Basis for Optimizing Investments, but Future Versions Need to Be More Robust – 20

DEFORMATION

Constraints of Melting, Sea-Level and the Paleoclimate from GRACE – 196

Improving Overlay in Nanolithography with a Deformable Mask Holder – 135

Liquid Between Macromolecules in Protein Crystals: Static Versus Dynamics – 192

Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

DEGRADATION

Fuel From Self-Degrading Bioengineering Packaging – 225

Nanoparticle-Mediated Rescue of p53 Through Targeted Degradation of MDM2 – 215

The Co-conical Field Generation System - A 40 GHz Antenna Calibration Cell – 120

DELTA 4 LAUNCH VEHICLE

Trial by Fire – 25

DEMODULATION

Comparison of Fiber Optic Strain Demodulation Implementations – 168

DENSITY DISTRIBUTION

Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

DENSITY (MASS/VOLUME)

Density- and Structure-independent Calibration Method for Microwave Moisture Determination in Granular Materials – 157

DEOXYRIBONUCLEIC ACID

Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

Role of Brca1 in Nonhomologous DNA End Joining – 212

DEPLOYMENT

Deployment and Evaluation of the Helicopter In-Flight Tracking System (HITS) – 8

Implicit Memory, Perception and the Rapid Deployment of Visual Attention and Action – 241

ISS ECLSS Technology Evolution for Exploration – 230

Large Deployable Antennas: Concepts and Realization – 104

Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 229

DEPOSITION

Computational Analysis and Simulation of Toxic Particle Deposition in the Human Respiratory System – 56

Deposition Diagnostics for Next-Step Devices – 296

Novel Optical Diagnostic Techniques for Studying Particle Contact and Deposition Upon a Large Cylinder in a Sheared Suspension – 163

DESIGN ANALYSIS

2.4GHz ISM Band Antenna for PC Cards – 241

A Design Procedure for Classical Offset Dragonian Antennas with Circular Apertures – 77

A Fractal Based FSS with Dual Band Characteristics – 87

A New Broad-band, Dual-frequency Coplanar Waveguide Fed Slot-Antenna – 66

A Review of Man-Rating in Past and Current Manned Space Flight Programs – 21

An Analysis and Design Tool for Evaluation of Integrated Antenna Diversity Systems in Portable Wireless Devices – 90

Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

Design of a Focal Plane Dielectric Rod Array for Feeding a Multiple Beams Reflector Antenna – 76

Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60

Design of Two-layer Printed Reflect Arrays for Bandwidth Enhancement – 78

Multi-Disciplinary Computational Tools for Naval Design – 264

DESIGN OPTIMIZATION

Design of Low Sidelobe Circular Ring Arrays by Element Radius Optimization – 109

Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems – 90

Preliminary Design of a Manned Nuclear Electric Propulsion Vehicle Using Genetic Algorithms – 34

DESIGN TO COST

Superconducting RF Systems and Cryogenics. Subgroup Summary Report – 275

DESIGN

Design Studies for Flux and Polarization Measurements of Photons and Positrons for SLAC Proposal E166: An Experiment to Test Polarized Positron Production in the FFTB – 286

DESULFURIZING

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000 – 180

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, June 2000 – 180

DETECTION

Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles – 30

Defense Information Warfare Technology Applications (DIWTA) Automated Intrusion Detection Environment (AIDE) Advanced Concept Technology Demonstration (ACTD) – 249

Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection – 215

Integrated Bioenvironmental Hazards Research Program – 168

Multiple Strategy Bio-Detection Sensor Platforms Made from Carbon and Polymer Materials – 166

Nanosensors to Monitor Space Radiation Exposure – 326

Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

Shape Sensing a Morphed Wing with an Optical Fiber Bragg Grating – 16

Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

DETONATION WAVES

Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

DETONATION

Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

DEUTERIUM

Charged Pion Photoproduction from Hydrogen and Deuterium at Jefferson Lab – 277

DEUTERONS

Hard Photodisintegration of a Proton Pair in 3He – 286

DIAGNOSIS

Deposition Diagnostics for Next-Step Devices – 296

Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer – 217

Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43

DIAMONDS

Diamond Wire Cutting of the Tokamak Fusion Test Reactor – 295

DIELECTRIC PROPERTIES

Characterization of Complex Dielectric Properties of Materials Using a Hybrid Iterative Method – 147

Microstrip Antennas for Dielectric Property Measurement – 157

Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

Precise Dielectric Properties Determination of Laminar-shaped Materials in a Partially-filled Waveguide – 146

DIELECTRIC WAVEGUIDES

A Resonant Type Leaky-Wave Antenna Using an Image NRD Guide – 122

Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159

DIELECTRICS

2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

3-D Spectral Domain Green's Function for Arbitrarily Multilayered Dielectric Structure – 118

A Conjugate Gradient FFT Method for Transient Scattering by Dielectric Cylinders – 259

A New Approach for Accurate Analysis of Antennas Above Real Ground – 152

A New FDTD Formulation with Reduced Dispersion for the Simulation of Wave Propagation Through Inhomogeneous Media – 254

A New Time Domain Analysis of Vertical Dipole in the Vicinity of a Planar Dielectric Interface – 114

Accurate and Efficient Computation of the Periodic Green's Function in Multilayered Media via a Hybrid Spectral/Spatial Summation with Optimized Complex Images – 146

An Inhomogeneous Waveguide Transformer with Hard Walls for the Excitation of Quasi-optical Amplifiers – 115

Analysis of a Charge Probe and its Response near Metallic and Dielectric Interface – 151

Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

Asymptotic Boundary Conditions for Strip-loaded Surfaces of Cylindrical Structures with Arbitrarily Shaped Cross-section – 123

Bandwidth Enhancement of Microstrip Antenna with Leaky-wave Excitation – 79

Broad Band Patch Antennas Using a Wedge-shaped Air Dielectric Substrate – 124

Demonstration and Validation of the Excited Dielectric Test (Trade Name) Method to Detect and Locate Defects in Aircraft Wiring Systems – 141

Dual Band Dual Linear Polarization Elliptical Microstrip Ring Antenna – 145

Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar – 151

Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials – 146

Extensions of the Single-integral-equation Method – 258

FDTD Modeling of an Artificially-synthesized Absorbing Medium – 155

Higher-order Impedance Boundary Conditions for Complex Layered Planar Coatings – 130

Metallic Zone Plates for Sectoral Horns – 119

Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

Moment Method Based Analysis of Dielectric-resonator Antennas – 122

Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas – 122

PBG-Assisted Gain Enhancement of Patch Antennas on High-dielectric Constant Substrate – 109

Propagation of Electromagnetic Waves Near the Surface of a Half-space Dielectric with Rough Interface – 257

Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Review on the Layered Fresnel Zone Lens Antenna – 119

Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components – 153

Scattering from Dielectric Bodies – 69

Some Developments in Fresnel Zone Plate Lens Antennas – 111

The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

Theoretical and Experimental Investigations on Focusing Properties of the Fresnel Zone Lens and Plate – 294

Time-Domain Modelling of Propagation in Nonlinear Dielectrics Using TLM – 258

Vectorial Waveguide Reflectometer for Dielectric Characterization of Materials Under Power Microwaves – 147

DIELS-ALDER REACTIONS

Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

DIENES

Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

DIESEL ENGINES

Adaptation of Advanced Diesel Engines for Military Requirements Under Severe Environmental Conditions – 61

Demonstration of Potential for Selective Catalytic Reduction and Diesel Particulate Filters – 184

Diesel Engine Alternatives – 172

Dynamometer Evaluation of Plasma-Catalyst for Diesel NOX Reduction – 171

Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

SCR Systems for Heavy Duty Trucks: Process Towards Meeting EURO 4 Emission Standards in 2005 – 172

State-of-the-Art and Emerging Truck Engine Technologies for Optimized Performance, Emissions and Life Cycle Costs – 172

DIESEL FUELS

Comparative Study on Exhaust Emissions from Diesel- and CNG-Powered Urban Buses – 189

Comparison of Clean Diesel Buses to CNG Buses – 188

Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Investigation of On-Vehicle Fuel Catalyst System – 44

DIFFERENTIAL GEOMETRY

Application of Differential Geometry to Acoustics: Development of a Generalized Paraxial Ray-Trace Procedure from Geodesic Deviation – 273

DIFFRACTION PATTERNS

Modeling of Gaussian Beam Diffraction from a Thick Single-slit Perfectly Conducting Screen: Finite-Difference Time-Domain Method Versus Rigorous Theory – 269

DIFFRACTION

A 2.5-D Diffraction Tomography Inversion Scheme for Ground Penetrating Radar – 97

A Design Method of Offset Fresnel Zone Plate Reflector as Receiving Antenna – 119

A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves – 269

Circuital Analysis of a Two-port Angular Sector – 143

Complexity Issues in Inverse Scattering Problems – 149

FDTD Computed Numerical Diffraction Coefficients of 3-D Infinite Material Wedges – 265

New Class Microwave Antennas Based on the Elements of the Diffraction Quasioptics: Advantages and Applications – 65

Review on the Layered Fresnel Zone Lens Antenna – 119

The Hybrid(sup 2)-Method: Combination of the FE/BE Hybrid Method with the UTD – 267

DIFFUSION

Numerical Solution of Plasma Fluid Equations Using Locally Refined Grids – 294

DIGITAL DATA

An Assessment of Alternative SAR Display Formats: Orientation and Situational Awareness – 302

DIGITAL SYSTEMS

An Evaluation of Stereoscopic Digital Mammography for Earlier Detection of Breast Cancer and Reduced Rate of Recall – 208

Applications of Smart Antennas in Cellular Networks – 75

Simplified Version of the Chaum Voting Scheme – 235

DIGITAL TECHNIQUES

Development and Evaluation Test of DBF Equipment for Transmitting – 72

DIPLEXERS

A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256

DIPOLE ANTENNAS

A Millimeter-wave Cavity-backed Suspended Substrate Stripline Antenna – 99

An Annular-Ring Reduced Surface Wave Microstrip Antenna – 114

Beamspace STAP for Circular Arrays – 120

Development of a Conductive-polymer, Composite, Direction-finding Antenna – 106

Electromagnetic Analysis of an Antenna Buried in a Composite Environment – 73

Electromagnetic Energy around Hertzian Dipoles – 81

Integrated Dipole Antennas on Silicon Substrates for Intra-chip Communication – 102

DIRECT CURRENT

Siemens Programmable Variable Speed DC Drives Applied to Wet and Dry Expansion Engines – 277

DIRECTION FINDING

Development of a Conductive-polymer, Composite, Direction-finding Antenna – 106

DIRECTIONAL SOLIDIFICATION (CRYSTALS)

Morphological Evolution of Directional Solidification Interfaces in Microgravity: An Analysis of Model Experiments Performed on the International Space Station – 204

Observation of an Aligned Gas - Solid 'Eutectic' during Controlled Directional Solidification Aboard the International Space Station - Comparison with Ground-based Studies – 58

The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

DISCONTINUITY

A New Hybrid Mode-matching Method for the Analysis of Inductive Obstacles and Discontinuities – 257

Interconnect and Packaging Electrical Circuits Network – 124

DISEASES

Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206

Neoplastic Consequences of a Mutator Phenotype in Human Breast Epithelial Cells: A Prospective Analysis – 226

Severe Caloric Restriction in Adolescence and Incidence of Breast Cancer – 210

Vaccines and Animal Models for Arboviral Encephalitides – 222

DISPERSING

Design of a TEM Waveguide for Ultra-wideband Applications – 154

DISPLAY DEVICES

An Evaluation of Stereoscopic Digital Mammography for Earlier Detection of Breast Cancer and Reduced Rate of Recall – 208

An Integrated Procedure for Measuring the Spatial and Temporal Resolution of Visual Displays – 138

Device Profiling Analysis in Device-Aware Network – 249

Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

Tunable Optical Polymer Systems – 53

DISTANCE MEASURING EQUIPMENT

An Inexpensive Distance Measuring System for Location of Robotic Vehicles – 93

Polarimetric Radar Measurements for Vehicle Control and Warning Applications – 305

DISTRIBUTED PROCESSING

Mobile Ubiquitous Security Environment (MUSE) – 250

DISTRIBUTION FUNCTIONS

Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

DIVING (UNDERWATER)

Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264

DOCUMENT MARKUP LANGUAGES

Applying Petri Nets to Systems Biology using XML Technologies – 237

Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology – 243

DOMAINS

A Fast Multilevel Domain Decomposition Algorithm for Radar Imaging – 103

Fast Spectral Domain Algorithm for Hybrid Finite Element/Boundary Integral Modeling of Infinite Periodic Arrays – 260

DOMINANCE

OR Modeling of a Conceptual System of Systems for Maritime Littoral Dominance in 2020 – 272

DOPPLER RADAR

Normalization of NEXRAD Antenna Gain for Overlapping Radars – 127

DOSAGE

Effects of Nuclear Interactions in Space Radiation Transport – 229

DOSIMETERS

Advancement of Methodology for RF Dosimetry – 126

Extension and Validation of the Equivalent Sources Helical Antenna Modeling with the FDTD Code – 130

DOWNLINKING

Channel Simulation of Leo Satellites – 92

Downlink Propagation Measurements in the GSM 900 and 1800 MHz Bands – 93

DRAINAGE

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 3: Heating Degree Days. Climatography of the USA No. 85 – 202

DRONE VEHICLES

MAV State-of-the-Art and Technology Drivers – 11

Simulations of Diversity Techniques for Urban UAV Data Links – 11

Wind Tunnel Investigation of the Static Stability and Control Effectiveness of a Rotary Tail in a Portable UAV – 4

DROPS (LIQUIDS)

Aerial Applicators Spray Nozzle Handbook – 9

DRUGS

Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast – 208

DUCTILITY

Fracture Toughness Improvement of Composites Reinforced with Optimally Shaped Short Ductile Fibers – 40

DURABILITY

Evaluation of HPC Pavement in Nelsonville, Ohio – 38

DUST

Improved Smokescreen For MM Wave And IR – 116

DYADICS

Electromagnetic Radiation of Antennas in the Presence of an Arbitrarily Shaped Dielectric Object: Green Dyadics and Their Applications – 132

Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

DYNAMIC MODELS

An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

DYNAMIC PRESSURE

Twist Model Development and Results From the Active Aeroelastic Wing F/A-18 Aircraft – 15

DYNAMIC RESPONSE

Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

DYNAMIC STRUCTURAL ANALYSIS

Multi-Disciplinary Computational Tools for Naval Design – 264

EARLY WARNING SYSTEMS

Defense Information Warfare Technology Applications (DIWTA) Automated Intrusion Detection Environment (AIDE) Advanced Concept Technology Demonstration (ACTD) – 249

EARTH OBSERVATIONS (FROM SPACE)

The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

EARTH OBSERVING SYSTEM (EOS)

EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

EARTH ORBITAL ENVIRONMENTS

Time-Domain Analysis of the Electromagnetic Coupling in Satellite Environments – 31

EARTH ORBITS

IERS Conventions (2003) – 310

EARTH (PLANET)

GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

EARTH SCIENCES

NASA GES DISC DAAC Satellite Data for GIS – 308

ECONOMIC ANALYSIS

Economic Impact Analysis (EIA) for the Proposed Stationary Combustion Turbines NSPS – 184

ECONOMIC IMPACT

Economic Impact Analysis (EIA) for the Proposed Stationary Combustion Turbines NSPS – 184

Economic Impact Analysis of Final Iron and Steel Foundries NESHAP – 183

ECONOMICS

Economic Contribution of the California Air Pollution Control Industry – 190

ECOSYSTEMS

Integrated Bioenvironmental Hazards Research Program – 168

EDUCATION

Cooperative Agreement in Space Sciences (CPSS) NCC5-637 – 305

Core Program in the Joint Institute for Advancement of Flight Sciences – 299

Harnessing Technology for Evidence-Based Education and Training in Minimally Invasive Surgery – 219

Interdisciplinary Breast Cancer Training Program – 225

Internet Access in US Public Schools and Classrooms: 1994-2003 – 83

Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Student Hands-On Training (SHOT) Workshop Summer 2003 and 2004 – 24

EFFECTIVENESS

An Efficient Technique for Modelling Wideband Propagation in an Urban Parallel Street Microcellular Environment – 305

EFFICIENCY

Array Pattern Synthesis with High Radiation Efficiency for Transmission Antenna Arrays – 89

EIGENVECTORS

Low Complexity Space-frequency Rake Receivers for WCDMA – 131

EJECTORS

Low Noise Exhaust Nozzle Technology Development – 2

Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

ELASTIC PROPERTIES

Elastic Response of Crimped Collagen Fibrils – 228

ELASTIC WAVES

Identification Versus Imaging – 149

PML-FDTD Method for Elastic Waves in Cylindrical and Spherical Coordinates – 257

ELECTRIC BATTERIES

Design of Robust Controllers for Telecom Power Supplies – 140

ELECTRIC CHARGE

Analysis of a Charge Probe and its Response near Metallic and Dielectric Interface – 151

ELECTRIC CONDUCTORS

Physical Realization of Magnetic Walls Using Finite-thickness 3D Printed Arrays – 108

ELECTRIC CURRENT

Asymptotic Boundary Conditions for Strip-loaded Surfaces of Cylindrical Structures with Arbitrarily Shaped Cross-section – 123

Closed Form Expression For Mutual Partial Inductance Between Two Skewed Linear Current Segments – 113

Modeling Surface Currents on Electrically Large Impedance Cylinders - 2D, TM Case – 120

ELECTRIC DIPOLES

A New Time Domain Analysis of Vertical Dipole in the Vicinity of a Planar Dielectric Interface – 114

Coupling to a Probe in a Metal Can by an Electric Dipole – 240

ELECTRIC FIELDS

A Viable Model for Power Focussing in a Lossy Cylinder – 142

Analysis of a Charge Probe and its Response near Metallic and Dielectric Interface – 151

Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193

Higher-Order MoM Implementation to Solve Integral Equations – 268

Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements – 156

Moment Method Based Analysis of Dielectric-resonator Antennas – 122

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

Pulsed Power Fusion – 149

Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

Representation of Absolute Electric Fieldstrength by Superposition of Radiated and Guided Waves – 111

The Field Transmitted into a PBG Crystal due to an Electric Line Source – 108

ELECTRIC GENERATORS

Solar Electric and Chemical Propulsion for a Titan Mission – 32

ELECTRIC NETWORKS

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

ELECTRIC POTENTIAL

3-D Numerical Mode-Matching (NMM) Method for Inhomogeneous Media – 254

A Viable Model for Power Focussing in a Lossy Cylinder – 142

Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

Time-domain Techniques for Reconstructing Lossy Layered Media from One-sided Scattering – 129

ELECTRIC POWER

A Viable Model for Power Focussing in a Lossy Cylinder – 142

ELECTRICAL ENGINEERING

Development, Exploitation, and Transition of Computer Aided Engineering (CAE) Tools – 135

ELECTRICAL IMPEDANCE

A New Approach for Microstrip Active Antennas Using Modal FFT-algorithm – 98

Complexity Issues in Inverse Scattering Problems – 149

On the Incompatibility of Chirality Parameter Alpha and Chirality Admittance xi of Chiral Media – 155

ELECTRICAL PROPERTIES

Computer Aided Design of Holographic Antennas – 242

Dual-band Compact Square Waveguide Corrugated Polarizer – 112

On the Accuracy of the Transmission Line Theory for the Insulated Linear Antenna – 113

ELECTRICAL RESISTANCE

High Frequency Performance of Self-Assembled Monolayer (SAM) Organic FETs – 137

ELECTRICAL RESISTIVITY

A Bipolar Electrode for Use in a Semi Fuel Cell – 139

Electrical Conductivity of HgTe at High Temperatures – 133

Nonlinear Inversion in Three-dimensional Cross-well Induction Logging using Full-Vectorial Multi-Frequency Data – 148

ELECTROCHEMISTRY

International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004 – 54

Scholarly Research Program. Delivery Order 0007: Characterization of Ionic Liquids as Fuel Cell Electrolytes – 37

ELECTRODES

A Bipolar Electrode for Use in a Semi Fuel Cell – 139

ELECTROFORMING

Nickel Sandwich Technology for High Precision Reflector Antennas – 97

ELECTROLYTES

International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004 – 54

ELECTROLYTIC CELLS

Scholarly Research Program. Delivery Order 0007: Characterization of Ionic Liquids as Fuel Cell Electrolytes – 37

ELECTROMAGNETIC ABSORPTION

Fundamental Limit on the Performance of Radar Absorbing Materials – 109

ELECTROMAGNETIC COMPATIBILITY

A Fast Time Domain Integral Equation Technique for Analyzing EMC/EMI Problems – 258

ELECTROMAGNETIC COUPLING

Development of the CRIPTE Code for Electromagnetic Coupling – 246

Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Time-Domain Analysis of the Electromagnetic Coupling in Satellite Environments – 31

ELECTROMAGNETIC FIELDS

A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves – 269

Design of a TEM Waveguide for Ultra-wideband Applications – 154

Electromagnetic Analysis of an Antenna Buried in a Composite Environment – 73

Elemental Probes for Planar Near-field Antenna Measurements – 103

Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

Numerical Calculation of the Volterra Integral Equation for a Time-varying Medium – 109

Reduced-Order Models for the Field Analysis of Hybrid Systems – 152

Representation of Absolute Electric Fieldstrength by Superposition of Radiated and Guided Waves – 111

ELECTROMAGNETIC INTERACTIONS

An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz – 76

Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

ELECTROMAGNETIC INTERFERENCE

Applications of Smart Antennas in Cellular Networks – 75

Design of a Smart Antenna for Reducing Co-Channel Interference in Cellular Mobile Communications – 144

Electromagnetic Interference from Wind Turbines – 147

Interference Cancellation Systems for Electromagnetically Dense Platforms – 148

ELECTROMAGNETIC MEASUREMENT

Elemental Probes for Planar Near-field Antenna Measurements – 103

ELECTROMAGNETIC PROPERTIES

A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions – 72

Circuital Analysis of a Two-port Angular Sector – 143

Efficient MoM Analysis of Polarization Selective Surfaces Using Trefoil Knot Arrays – 293

Pigments With Potential for Adaptable Optical Properties – 51

ELECTROMAGNETIC PULSES

Complex Natural Resonances Extracted from Radar Signatures Measured in Time Domain with UWB Laboratory System – 65

Wide Band Modeling and Electromagnetic Pulse Propagation through HF Channel – 68

ELECTROMAGNETIC RADIATION

An Anisotropic Perfectly Matched Layer (APML) Absorber for Mesh Truncation in the Context of a Multiresolution Time Domain Scheme – 89

Aperture Theory And The Equivalence Theorem – 233

Electromagnetic Radiation of Antennas in the Presence of an Arbitrarily Shaped Dielectric Object: Green Dyadics and Their Applications – 132

Experiment Research On MM Wavelength Radar Absorbing Materials – 155

Extensions of the Single-integral-equation Method – 258

Identification Versus Imaging – 149

Propagation of Electromagnetic Waves Near the Surface of a Half-space Dielectric with Rough Interface – 257

ELECTROMAGNETIC SCATTERING

2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

A 2.5-D PSTD Algorithm in Cylindrical Coordinates – 259

A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108

Acceleration of Two-dimensional Time Domain Integral Equation Solvers Using a Hilbert Transform – 261

Aperture Theory And The Equivalence Theorem – 233

Chaotic Wave Scattering and Synchronization – 75

Fast Generalized Forward-backward Method by Using a Spectral Acceleration – 255

Fast Steepest Descent Path Algorithm for Electromagnetic Scattering Problems in Layered Medium – 278

Scattering of Plane Waves by Two-Dimensional Periodic Impedance Surface – 85

Shape Reconstruction of a Perfectly Conducting Cylinder Using Real-coded Genetic Algorithm – 266

Time-domain Techniques for Reconstructing Lossy Layered Media from One-sided Scattering – 129

ELECTROMAGNETIC SPECTRA

Rational Krylov Reduced Order Modeling of Frequency Selective Surfaces Through the Blazing Onset Using Woodbury Singularity Extraction – 265

ELECTROMAGNETIC WAVE TRANSMISSION

A 2.5-D PSTD Algorithm in Cylindrical Coordinates – 259

Array Pattern Synthesis with High Radiation Efficiency for Transmission Antenna Arrays – 89

Cylindrical 3D PML-PLRC-FDTD Schemes for Frequency-dispersive and Inhomogeneous Media – 118

Improvement of an Acoustic Sounder Device Used to Measure Atmospheric Turbulence – 194

Matrix Pade Via Lanczos for FEM Problems – 142

Modeling of Gaussian Beam Diffraction from a Thick Single-slit Perfectly Conducting Screen: Finite-Difference Time-Domain Method Versus Rigorous Theory – 269

Numerical Calculation of the Volterra Integral Equation for a Time-varying Medium – 109

Time-Domain Modelling of Propagation in Nonlinear Dielectrics Using TLM – 258

ELECTROMAGNETISM

A Topological Viewpoint on Consistency Aspects of Electromagnetic Theory on a Lattice – 131

Efficient Electromagnetic Modeling of Microstrip Structures in Multilayer Media – 113

Electromagnetic Parallel Processing Using the Personal Computers of a Local Area Network – 242

Parameters of Microstrip Patch Antenna under the Consideration Using the Piecewise Basis Functions – 121

Physical Realization of Magnetic Walls Using Finite-thickness 3D Printed Arrays – 108

Symmetry Synthesis of the Multiport Scattering Matrix as a First Step in the Design of Electromagnetic Devices and Components with Bianisotropic Media – 132

ELECTRON ACCELERATION

Study of e(sup +)e(sup -) --\g (pi)(sup +)(pi)(sup -)(pi)(sup 0) Process Using Initial State Radiation with BaBar – 283

ELECTRON BEAMS

Energy Deposition Using EGS4 – 286

Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

The 1-MW Radiatively Driven Hypersonic Wind Tunnel Experiments – 60

Two-Dimensional Photonic Crystals for Near IR and Visible Optoelectronics Applications – 294

ELECTRON IRRADIATION

Study of e(sup +)e(sup -) --\g (pi)(sup +)(pi)(sup -)(pi)(sup 0) Process Using Initial State Radiation with BaBar – 283

ELECTRON MOBILITY

Infrared Characterization of SiN Films on Si for High Speed Electronics Applications – 43

ELECTRON TRANSFER

Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures – 297

ELECTRONIC STRUCTURE

Electronic Structure and Mechanical Properties of Metals and Intermetallics – 42

ELECTRONIC WARFARE

Designing a Forcenet Information Topology – 248

ELECTRO-OPTICS

Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

Polymer Waveguides for Quantum Information – 55

Two-Dimensional Photonic Crystals for Near IR and Visible Optoelectronics Applications – 294

ELECTROSTATICS

Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193

ELEVATION

Coupled Gravity and Elevation Measurement of Ice Sheet Mass Change – 195

ELLIPTIC DIFFERENTIAL EQUATIONS

Parabolic Equation-Based Propagation Fields Near Surface Irregularities Including Backscatter – 266

EMERGENCIES

Lessons Learned: The 'Pale Horse' Bioterrorism Response Exercise – 214

EMISSION SPECTRA

Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

EMISSION

Guide to Low-Emission Boiler and Combustion Equipment Selection – 186

EMOTIONAL FACTORS
A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer – 223

EMOTIONS
A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer – 223

ENCAPSULATING
Simulation Modeling and Analysis of Device-Aware Network Architectures – 240

ENCEPHALITIS
Vaccines and Animal Models for Arboviral Encephalitides – 222

Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

ENDOSCOPES
Center for Innovative Minimally Invasive Therapy (CIMIT) – 205

ENDOTHERMIC REACTIONS
Applications of Endothermic Reaction Technology to HSCT and AST – 16

END-TO-END DATA SYSTEMS
Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES) – 289

ENERGY CONVERSION
Demonstration of Silicon Carbide Power Devices in Practical Power Conversion Systems – 46

Fuel From Self-Degrading Bioengineering Packaging – 225

ENERGY GAPS (SOLID STATE)
Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials – 132

Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials – 146

Mixed Metallic Photonic Band-gap Material and Bragg Mirror – 298

ENERGY STORAGE
International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004 – 54

Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors – 139

Novel Techniques for the Production of Gamma Rays – 293

ENERGY TRANSFER
Pulsed Power Fusion – 149

ENGINE DESIGN
Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Quiet Plan for Tomorrow's Jet Engines – 17

Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport – 15

ENGINE FAILURE
Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

ENGINE MONITORING INSTRUMENTS
A Concept for the Inclusion of Analytical and Computational Capability in Existing Systems for Measurement of Neutron Flux – 164

ENGINE PARTS
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 174

ENGINE TESTS
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

ENGINEERS
Automated Extraction of Secondary Flow Features – 159

ENVIRONMENT EFFECTS
Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

Simulated Space Environment Effects on Tether Materials with Protective Coatings – 37

ENVIRONMENT MODELS
Modeling the Transport and Chemical Evolution on Onshore and Offshore Emissions and Their Impact on Local and Regional Air Quality Using a Variable-Grid-Resolution Air Quality Model – 188

ENVIRONMENT PROTECTION
Economic Impact Analysis of Final Iron and Steel Foundries NESHAP – 183

ENVIRONMENTAL CONTROL
ISS ECLSS Technology Evolution for Exploration – 230

ENVIRONMENTAL MONITORING
Envirocare of Utah: Expanding Waste Acceptance Criteria to Provide Low-Level and Mixed Waste Disposal Options – 187

Urban Air Toxics Monitoring Program (UATMP), 2003 – 182

ENZYMES
Fuel From Self-Degrading Bioengineering Packaging – 225

EPIDEMIOLOGY
An Epidemiological Study of Leptospira-Induced Abortion in Mares in Central Kentucky (1990-2004) – 224

EPITAXY
Relationship of Magnetocrystalline Anisotropy and Stoichiometry in Epitaxial L1(sup 0) CoPt(001) and FePT (001) Thin Films – 297

EPITHELIUM
Modification of Epigenetic Changes in Cancer by the Stromal Environment – 228

Role of E-Cadherin Homophilic Contacts in the Inhibition of Cell Growth of Primary Breast Cells – 218

EPOXY RESINS
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

EQUALIZERS (CIRCUITS)
Computer Simulated and Analytical Results of MSE in Adaptive Integrated Reduced-complexity Receiver for Multipath DS/CDMA Systems – 73

EQUIVALENCE
Aperture Theory And The Equivalence Theorem – 233

Causality and Restrictions on the Initial-Boundary Conditions for Signal Propagation in Attenuating Medium – 147

EROSION
Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane – 52

ERROR ANALYSIS
Error Control in the Reduced Expansion and Field Testing (REFT) Method for MoM Matrix Thinning – 233

Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology – 243

ERROR CORRECTING CODES
Experimental Implementation of Efficient Linear Optics Quantum Computation – 138

ERRORS
A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data – 270

Error Control in the Reduced Expansion and Field Testing (REFT) Method for MoM Matrix Thinning – 233

On the Planarity Errors of the Hologram of the CATR – 92

ESCHERICHIA
Production and Purification of Refolded Recombinant Human IL-7 From Inclusion Bodies – 227

ESTERS
Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

ESTIMATES
Estimating Supplies Program: Evaluation Report – 245

Estimation of Geoacoustic Properties in the South China Sea Shelf Using a Towed Source and Vertical Line Hydrophone Array – 288

Lightning Contribution to Improvement of Passive Microwave Vertical Structure and Rainfall Estimation – 196

Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

Review of Marine Corps Expeditionary Force Preventive Medicine Materiel Requirements – 219

The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

ESTIMATING

3D Super Resolution Algorithm for Analysis of Multi-path Propagation Structure – 148

Estimating Supplies Program: Evaluation Report – 245

The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

Tracking and Sensor Fusion Issues in the Tactical Land Environment – 304

ESTROGENS

Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220

Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk – 214

The Role of Calgranulin Overexpression in Breast Cancer Progression – 220

Use of a Transgenic Mouse Model With a Regulatable Estrogen Receptor Alpha (ER) to Study the Role of ER in Mammary Gland Development and Cancer – 206

ETCHING

Improving Overlay in Nanolithography with a Deformable Mask Holder – 135

ETHERNET

A Low-Cost, Man-Portable, Free-Space Optics Communications Device for Ethernet Applications – 170

ETHYL ALCOHOL

Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative – 34

EUTECTICS

Observation of an Aligned Gas - Solid 'Eutectic' during Controlled Directional Solidification Aboard the International Space Station - Comparison with Ground-based Studies – 58

EVACUATING (TRANSPORTATION)

Patient Warming Device for Casualty Care – 222

EVALUATION

An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

California's K-12 Public Schools. How Are They Doing? – 301

Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

Flight and Aerospace Research: Airborne Simulation and Research Investigations, 1999 - 2004 – 11

Situation Assessment and Information Fusion: An Experimental Framework for Performance Evaluation – 302

EVANESCENCE

Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports – 130

EVOLUTION (DEVELOPMENT)

Current Sheet Evolution in the Aftermath of a CME Event – 324

Morphological Evolution of Directional Solidification Interfaces in Microgravity: An Analysis of Model Experiments Performed on the International Space Station – 204

EXCITATION

Bandwidth Enhancement of Microstrip Antenna with Leaky-wave Excitation – 79

Filtering Characteristics of Thin, Planar 3D Printed Element Arrays – 153

Infinite Phased Array Analysis Using FDTD Periodic Boundary Conditions: Pulse Scanning in Oblique Directions – 265

Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques – 253

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas – 150

Synthesis of Shaped-Beam Pattern for Mobile Antenna – 143

EXHAUST EMISSION

Achieving New Source Performance Standards (NSPS) Emission Standards Through Integration of Low-No(x) Burners with an Optimization Plan for Boiler Combustion. Quarterly Technical Progress Report for January 2003 - March 2003 – 183

Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB-1493 Rulemarking – 186

Comparative Study on Exhaust Emissions from Diesel- and CNG-Powered Urban Buses – 189

Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 174

Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control – 188

Global Climate Change and the Transportation Sector: An Update on Issues and Mitigation Options – 185

Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

Internal Combustion Engine (ICE) Air Toxic Emissions – 173

Modeling the Transport and Chemical Evolution on Onshore and Offshore Emissions and Their Impact on Local and Regional Air Quality Using a Variable-Grid-Resolution Air Quality Model – 188

SCR Systems for Heavy Duty Trucks: Process Towards Meeting EURO 4 Emission Standards in 2005 – 172

State-of-the-Art and Emerging Truck Engine Technologies for Optimized Performance, Emissions and Life Cycle Costs – 172

Thermoelectrical Energy Recovery from the Exhaust of a Light Truck – 173

Verification of Ship Emission Estimates with Monitoring Measurements to Improve Inventory and Modeling – 178

EXHAUST GASES

Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 179

Gasoline Vehicle Exhaust Particle Sampling Study – 179

Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

EXHAUST NOZZLES

Low Noise Exhaust Nozzle Technology Development – 2

Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

EXPANDABLE STRUCTURES

In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

EXPERIMENT DESIGN

Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings – 55

Spent Fuel Transportation Package Performance Study Experimental Design Challenges – 56

EXPERIMENTATION

Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms – 85

EXPLOITATION
Development, Exploitation, and Transition of Computer Aided Engineering (CAE) Tools – 135

EXPLOSIONS
U.S. Chemical Safety and Hazard Investigation Board Case Study. Explosion at Biochemical Facility: Liquid Nitric Oxide Release: ISOTEC, Miami Township, Ohio, September 21, 2003 – 190

EXPLOSIVES DETECTION
Explosive Chemical Signature-Based Detection of IEDs – 46

EXPLOSIVES
Modeling Thermal Ignition of Energetic Materials – 299

EXTERNAL TANKS
Nondestructive Evaluation of Space Shuttle External Tank Foam – 28

EXTRACTION
A Parametric Approach to Radar Processing of Reentry Vehicle Signatures – 95

A Viable Scheme for Elemental Extraction and Purification Using In-Situ Planetary Resources – 318

Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform – 103

Efficient Electromagnetic Modeling of Microstrip Structures in Multilayer Media – 113

Identification Versus Imaging – 149

Rational Krylov Reduced Order Modeling of Frequency Selective Surfaces Through the Blazing Onset Using Woodbury Singularity Extraction – 265

EXTRAPOLATION
Ultrawide-band Noise Synthetic Aperture Radar: Theory and Experiment – 87

EXTRATERRESTRIAL RADIATION
Nanosensors to Monitor Space Radiation Exposure – 326

The Human Exploration Initative: Space Radiation Measurement Needs – 306

EXTRAVEHICULAR ACTIVITY
Autonomous Assembly of Modular Structures in Space and on Extraterrestrial Locations – 251

EXTREME ULTRAVIOLET RADIATION
IMAGE-POLAR Concurrent Plasmapause Observations – 195

EXTREMELY HIGH FREQUENCIES
Integrated Microphotonic Receiver for Ka-Band – 140

EYE (ANATOMY)
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

EYE MOVEMENTS
Implicit Memory, Perception and the Rapid Deployment of Visual Attention and Action – 241

FABRICATION
A Broadband Microstrip Antenna for SAR Applications – 75

A Novel InAs Quantum Wire System – 139

A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies – 78

Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section – 118

Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface – 66

Development of a Conductive-polymer, Composite, Direction-finding Antenna – 106

Development of Eight Meters Inverse Cosecant Square Reflector Antenna – 67

Fibrous Monolith Wear Resistant Components for the Mining Industry. Semi-Annual Report No. 4 – 51

Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 30

Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159

Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

Tapered Leaky-wave Ultra Wide-band Microstrip Antenna – 112

The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

Transient Approximation of SAFE-100 Heat Pipe Operation – 32

UV Baked/Cured Photoresist Used as a Sacrificial Layer in MEMS Fabrication – 280

Wideband L-strip Fed Microstrip Antenna – 68

FABRICS
Fundamental Issues Regarding the High Temperature Failure Properties of Graphite/Polyimide Fabric Composites – 40

Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps – 169

FAILURE MODES
Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

FAILURE
Fundamental Issues Regarding the High Temperature Failure Properties of Graphite/Polyimide Fabric Composites – 40

Iraq and Failures in U.S. Compellence Policy 1990-2003 – 279

FAN BLADES
Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport – 15

FAR FIELDS
Far Field Analysis of Radiation Sources – 110

Far-field Antenna Patterns Determined from Infrared Holograms – 89

Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

FARM CROPS
Aerial Applicators Spray Nozzle Handbook – 9

FAST FOURIER TRANSFORMATIONS
A Conjugate Gradient FFT Method for Transient Scattering by Dielectric Cylinders – 259

A Fast and Accurate Scheme for Calibration of Active Phased-array Antennas – 117

FAULT DETECTION
Two Trees: Migrating Fault Trees to Decision Trees for Real Time Fault Detection on International Space Station – 306

FAULT TOLERANCE
From Crash Tolerance to Authenticated Byzantine Tolerance: A Structured Approach, the Cost and Benefits – 82

Wrapping the Future – 234

FAULT TREES
Two Trees: Migrating Fault Trees to Decision Trees for Real Time Fault Detection on International Space Station – 306

FEASIBILITY ANALYSIS
Feasibility Assessment for Pressure Casting of Ceramic-Aluminum Composites for NASA's Propulsion Applications – 39

Report on Measurement at Ohio University to Estimate Backgrounds for Neutron Radiography in the 10-14 MeV Region – 275

FEASIBILITY
Antennas Feasibility Study for a LMDS Communication System – 91

FEMALES
A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer – 223
Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220
Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

FERMI SURFACES
A Novel InAs Quantum Wire System – 139

FERMIONS
Beyond the Standard Model with a B and K Physics – 285

FERRITES
FDTD Modeling of Magnetized Ferrites Using Z Transforms – 254
Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115
Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

FERROMAGNETIC MATERIALS
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193

FERTILIZATION
Computational Nanomechanics of Materials – 281

FETUSES
An Epidemiological Study of Leptospira-Induced Abortion in Mares in Central Kentucky (1990-2004) – 224

FEVER
Molecular Mechanisms of Filovirus Cellular Trafficking – 222
Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224
Vaccines and Animal Models for Arboviral Encephalitides – 222

FIBER COMPOSITES
Distributed Sensing of Composite Overwrapped Pressure Vessel Using Fiber-Bragg Gratings at Ambient and Cryogenic Temperatures – 39
Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40
Fracture Toughness Improvement of Composites Reinforced with Optimally Shaped Short Ductile Fibers – 40

FIBER OPTICS
A Low-Cost, Man-Portable, Free-Space Optics Communications Device for Ethernet Applications – 170
Comparison of Fiber Optic Strain Demodulation Implementations – 168
Three Dimensional Optical Fiber Simulation – 117

FIBERS
Elastic Response of Crimped Collagen Fibrils – 228

FIELD EFFECT TRANSISTORS
Cryo Power and Heat Transfer – 171
High Frequency Performance of Self-Assembled Monolayer (SAM) Organic FETs – 137

FIELD TESTS
Elemental Probes for Planar Near-field Antenna Measurements – 103
GSM/TDMA Adaptive Antenna Field-Trial Results – 75

FILTRATION
Advanced Second Generation Ceramic Candle Filters – 181
Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter – 43
Utilizing IXP1200 Hardware and Software for Packet Filtering – 243

FINANCE
Insider Threat Study: Illicit Cyber Activity in the Banking and Finance Sector – 232

FINANCIAL MANAGEMENT
Core Financial System Requirements: Checklist for Reviewing Systems under the Federal Financial Management Improvement Act – 300

FINITE DIFFERENCE THEORY
A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78
A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves – 269
Cylindrical 3D PML-PLRC-FDTD Schemes for Frequency-dispersive and Inhomogeneous Media – 118
Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports – 130
Extension and Validation of the Equivalent Sources Helical Antenna Modeling with the FDTD Code – 130
FDTD Modeling of Ceramic Multi-layer Capacitors Using Lumped Equivalent Models – 253
Measurement of Radiation Efficiency of Antennas in the Vicinity of Human Head Model Proposed By COST 244 – 131
Modelling Wave Propagation in Diagonal Microstrip Lines Using Enhanced FDTD Equations – 128
Study of Micromachined Microstrip Lines Using FDTD – 117

FINITE DIFFERENCE TIME DOMAIN METHOD
A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves – 269
A New FDTD Formulation with Reduced Dispersion for the Simulation of Wave Propagation Through Inhomogeneous Media – 254
An Anisotropic Perfectly Matched Layer (APML) Absorber for Mesh Truncation in the Context of a Multiresolution Time Domain Scheme – 89
An Enhanced Higher-Order FDTD Technique for the Construction of Efficient Reflectionless PMLs in 3-D Generalized Curvilinear Coordinate Systems – 274
Cylindrical 3D PML-PLRC-FDTD Schemes for Frequency-dispersive and Inhomogeneous Media – 118
Design and Simulation of Active Spiral Inductors for RF Integrated Circuits – 145
Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60
Domain Decomposition Method: A Direct Solution of Maxwell Equations – 258
Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports – 130
Employing PML Absorbers in the Design and Simulation of Ground Penetrating Radars – 266
FDTD Computed Numerical Diffraction Coefficients of 3-D Infinite Material Wedges – 265
FDTD Modeling of an Artificially-synthesized Absorbing Medium – 155
FDTD Modeling of Ceramic Multi-layer Capacitors Using Lumped Equivalent Models – 253
FDTD Modeling of Magnetized Ferrites Using Z Transforms – 254
Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129
Full-wave Analysis of HF Antennas on Helicopters Using the FDTD, FEM and NEC – 128
Infinite Phased Array Analysis Using FDTD Periodic Boundary Conditions: Pulse Scanning in Oblique Directions – 265
Measurement of Radiation Efficiency of Antennas in the Vicinity of Human Head Model Proposed By COST 244 – 131
Modeling of Gaussian Beam Diffraction from a Thick Single-slit Perfectly Conducting Screen: Finite-Difference Time-Domain Method Versus Rigorous Theory – 269
Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques – 253
Modelling Wave Propagation in Diagonal Microstrip Lines Using Enhanced FDTD Equations – 128

Numerical Amplification of the Excitation Source in Waveguide Structure – 266

PML-FDTD Method for Elastic Waves in Cylindrical and Spherical Coordinates – 257

Reflection and Transmission Properties of Reinforced Concrete Walls – 93

Study of Micromachined Microstrip Lines Using FDTD – 117

Three Dimensional Optical Fiber Simulation – 117

Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Nonpalpable Breast Tumors – 158

Transient Plane Wave Scattering from Objects Near Lossy Ground with FDTD – 150

Validation of a High-Order Prefactored Compact Code on Nonlinear Flows with Complex Geometries – 4

FINITE ELEMENT METHOD

Design of Two-Axis Capacitive Accelerater Using MEMS – 262

Fast Spectral Domain Algorithm for Hybrid Finite Element/Boundary Integral Modeling of Infinite Periodic Arrays – 260

Full-wave Analysis of HF Antennas on Helicopters Using the FDTD, FEM and NEC – 128

Higher-Order MoM Implementation to Solve Integral Equations – 268

Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

Matrix Pade Via Lanczos for FEM Problems – 142

Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques – 253

Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

Parallel Domain Decomposition Formulation and Software for Large-Scale Sparse Symmetrical/Unsymmetrical Aeroacoustic Applications – 239

Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

Surface Wave Scattering by Finite Periodic Structure of Arbitrary Profile in a Ground Plane: TE case – 84

The Hybrid(sup 2)-Method: Combination of the FE/BE Hybrid Method with the UTD – 267

Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

FIRE EXTINGUISHERS

An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

FIRES

An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

FISSION

Hardware Progress Made in the Early Flight Fission Test Facilities (EFF-TF) To Support Near-Term Space Fission Systems – 29

Transient Approximation of SAFE-100 Heat Pipe Operation – 32

FLAME PROPAGATION

Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

FLAMES

Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43

FLEXIBILITY

Twist Model Development and Results From the Active Aeroelastic Wing F/A-18 Aircraft – 15

FLIGHT CHARACTERISTICS

Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators – 166

FLIGHT CONTROL

MAV State-of-the-Art and Technology Drivers – 11

FLIGHT CREWS

Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

FLIGHT HAZARDS

Turbulence Hazard Metric Based on Peak Accelerations for Jetliner Passengers – 8

FLIGHT MECHANICS

Core Program in the Joint Institute for Advancement of Flight Sciences – 299

FLIGHT PATHS

Survivability Enhancement in a Combat Environment – 9

FLIGHT SAFETY

FLIGHTFAX: Army Aviation Risk-Management Information. Volume 32, Number 12 – 7

FLIGHT SIMULATION

Flight and Aerospace Research: Airborne Simulation and Research Investigations, 1999 - 2004 – 11

Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

Twist Model Development and Results From the Active Aeroelastic Wing F/A-18 Aircraft – 15

FLIGHT SIMULATORS

Flight and Aerospace Research: Airborne Simulation and Research Investigations, 1999 - 2004 – 11

FLOODS

Regression Equations for Estimating Flood Flows for the 2-, 10-, 25-, 50-, 100-, and 500-Year Recurrence Intervals in Connecticut – 237

FLOQUET THEOREM

Asymptotic Boundary Conditions for Strip-loaded Surfaces of Cylindrical Structures with Arbitrarily Shaped Cross-section – 123

Time Domain Green's Function for a Phased Semi-infinite Periodic Line Array of Dipoles – 261

FLOW CHARACTERISTICS

Modelling Opacity using Petri Nets – 236

FLOW DISTRIBUTION

Evolving Computational Capability for Ship Hydrodynamics – 264

Introduction to CFD++, its Transient and Moving Body Capabilities – 246

Performance of Propeller 4381 in Crashback – 160

FLOW REGULATORS

Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

FLOW VELOCITY

An Experimental Study of Steady State High Heat Flux Removal Using Spray Cooling – 160

FLUE GASES

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, June 2000 – 180

FLUID DYNAMICS

Novel Optical Diagnostic Techniques for Studying Particle Contact and Deposition Upon a Large Cylinder in a Sheared Suspension – 163

FLUID FILTERS

Demonstration of Potential for Selective Catalytic Reduction and Diesel Particulate Filters – 184

FLUID FLOW

Application of Differential Geometry to Acoustics: Development of a Generalized Paraxial Ray-Trace Procedure from Geodesic Deviation – 273

Comments on the paper by Zinoviev and Bies 'On Acoustic Radiation by a Rigid Object in a Fluid Flow' – 162

Performance of Propeller 4381 in Crashback – 160

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

FLUID MANAGEMENT

Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative – 34

FLUORESCENCE

Fluorescent Approaches to High Throughput Crystallography – 296

FLUX DENSITY

Radio Star Flux Density Expressions for Accurate Antenna Gain Measurements – 128

FOAMS

An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

Nondestructive Evaluation of Space Shuttle External Tank Foam – 28

The Origin and Significance of Mammary Intraductal Foam Cells – 216

FOCAL PLANE DEVICES

Design of a Focal Plane Dielectric Rod Array for Feeding a Multiple Beams Reflector Antenna – 76

FOLDING

Elastic Response of Crimped Collagen Fibrils – 228

FORECASTING

Possible Role of the Oceans in the Variations of Length of Day at High Frequencies – 310

The Defense Science Board 2001 Summer Study on Defense Science and Technology – 61

The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

FOREIGN POLICY

Iraq and Failures in U.S. Compellence Policy 1990-2003 – 279

FORESTS

Effect of Canopy-Air Interface Roughness on HF-VHF Wave Propagation in Forest – 86

FOURIER TRANSFORMATION

Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129

FRACTURE STRENGTH

Fracture Toughness Improvement of Composites Reinforced with Optimally Shaped Short Ductile Fibers – 40

FRAMING CAMERAS

An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

FREE-SPACE OPTICAL COMMUNICATION

Retrocommunication – 63

FREQUENCIES

A Comparison of Frequency Offset Estimation Methods in Orthogonal Frequency Division Multiplexing (OFDM) Systems – 273

A Fractal Based FSS with Dual Band Characteristics – 87

A New Genetic-Algorithm-based Frequency Selective Surface Design for Dual Frequency Applications – 145

A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies – 78

Frequency Agile Materials for Electronics (FAME) – 136

Low Complexity Space-frequency Rake Receivers for WCDMA – 131

Polarimetric Backscatter Characterization of Road Surface Faults at Millimeter-wave Frequencies – 80

Rational Krylov Reduced Order Modeling of Frequency Selective Surfaces Through the Blazing Onset Using Woodbury Singularity Extraction – 265

Scattering by Resistively Loaded, Multilayer Frequency Selective Surfaces over Two-octave Bandwidth – 98

Synthesis of Shaped-Beam Pattern for Mobile Antenna – 143

FREQUENCY DISTRIBUTION

Generalized Coincident Arrays for the Direct Measurement of the Principal Solution in Radio Astronomy – 127

FREQUENCY DIVISION MULTIPLE ACCESS

Applications of Smart Antennas in Cellular Networks – 75

FREQUENCY DIVISION MULTIPLEXING

A Comparison of Frequency Offset Estimation Methods in Orthogonal Frequency Division Multiplexing (OFDM) Systems – 273

Code-Division Multiplexing and Frequency-Division Multiplexing for Nonlinear Inverse Scattering – 267

Simulation Performance of Multiple-Input Multiple-Output Systems Employing Single-Carrier Modulation and Orthogonal Frequency Division Multiplexing – 279

FREQUENCY HOPPING

Frequency Agile Materials for Electronics (FAME) – 136

Reduced-Order Models for the Field Analysis of Hybrid Systems – 152

FREQUENCY RANGES

Reflection and Transmission Properties of Reinforced Concrete Walls – 93

FREQUENCY RESPONSE

Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

FRESNEL LENSES

A Design Method of Offset Fresnel Zone Plate Reflector as Receiving Antenna – 119

Review on the Layered Fresnel Zone Lens Antenna – 119

Some Developments in Fresnel Zone Plate Lens Antennas – 111

Theoretical and Experimental Investigations on Focusing Properties of the Fresnel Zone Lens and Plate – 294

FRESNEL REGION

Variety of Cylindrical Fresnel Zone Plate Antennas – 120

FRICTION STIR WELDING

Unraveling the Material Processing Conditions for Optimizing FSW Process – 175

FUEL CELLS

A Bipolar Electrode for Use in a Semi Fuel Cell – 139

Clean Gas Reformer - A Compact Fuel Reformer for Undersea Vehicle Fuel Cells – 178

Scholarly Research Program. Delivery Order 0007: Characterization of Ionic Liquids as Fuel Cell Electrolytes – 37

Solid Acid Based Fuel Cells – 178

FUEL COMBUSTION

Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion – 45

FUEL CONSUMPTION

Diesel Engine Alternatives – 172

FUEL INJECTION

Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control – 188

FUEL SYSTEMS

Investigation of On-Vehicle Fuel Catalyst System – 44

FUELS

Clean Gas Reformer - A Compact Fuel Reformer for Undersea Vehicle Fuel Cells – 178

Fuel From Self-Degrading Bioengineering Packaging – 225

FULL SCALE TESTS

Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

FULLERENES

Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures – 297

FUNCTIONAL ANALYSIS

Multi-Disciplinary Computational Tools for Naval Design – 264

FUNCTIONAL DESIGN SPECIFICATIONS

Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Non-palpable Breast Tumors – 158

FURNACES
Computational Fluid Dynamics Based Investigation of Sensitivity of Furnace Operational Conditions to Burner Flow Controls – 159

FUSION
Inspection of Fusion Joints in Plastic Pipe – 52

GALACTIC WINDS
Galactic Winds and Intragroup Medium Energetics – 317

GALAXIES
X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years – 316

GALERKIN METHOD
Higher-Order MoM Implementation to Solve Integral Equations – 268

GALLIUM NITRIDES
Systematic Studies of Carbon Doping in High Quality GaN Grown by Molecular Beam Epitaxy – 136

GAME THEORY
New Fictitious Play Procedure For Solving Blotto Games – 271

GAMES
New Fictitious Play Procedure For Solving Blotto Games – 271

GAMMA RAY ASTRONOMY
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Long-Lag, Wide-pulse Gamma-Ray Bursts – 312

Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

GAMMA RAY BURSTS
Long-Lag, Wide-pulse Gamma-Ray Bursts – 312

Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Space-Borne Observations of Intense Gamma-Ray Flashes Above Thunderstorms – 326

GAMMA RAY SPECTROMETERS
Gamma-Ray Identification of Nuclear Weapon Materials – 46

GAMMA RAYS
Novel Techniques for the Production of Gamma Rays – 293

Practical Gamma Spectroscopy Assay Techniques for Large Volume Low-Level Waste Boxes – 231

Space-Borne Observations of Intense Gamma-Ray Flashes Above Thunderstorms – 326

GANGLIA
Gangliosides During Tumor Progression in Patients With Prostate Cancer – 209

GAS ANALYSIS
Gas System Upgrade for the BaBar IFR Detector at SLAC – 283

Three-Dimensional Simulation of Gas Conductance Measurement Experiments on Alcator C-Mod – 284

GAS FLOW
Energy Efficient Thermal Management for Natural Gas Engine Aftertreatment via Active Flow Control – 174

Gas System Upgrade for the BaBar IFR Detector at SLAC – 283

Three-Dimensional Simulation of Gas Conductance Measurement Experiments on Alcator C-Mod – 284

GAS PRESSURE
Implementation of Gas Bubble Loading in 2DCAV – 61

GAS TURBINE ENGINES
Porous Media Combustors for Clean Gas Turbine Engines – 42

Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport – 15

GAS TURBINES
A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow – 16

Porous Media Combustors for Clean Gas Turbine Engines – 42

GASIFICATION
Development of On-Line Temperature Measurement Instrumentation for Gasification Process Control – 36

GASOLINE
Gasoline Vehicle Exhaust Particle Sampling Study – 179

GENERAL OVERVIEWS
Present Status of Lunar Regolith Simulants, Workshop Overview and Objectives – 322

Shuttle-Derived Launch Vehicles' Capablities: An Overview – 22

GENERATORS
Thermoelectrical Energy Recovery from the Exhaust of a Light Truck – 173

GENES
Functional Interactions of the TACC2 Breast Tumor Suppressor Gene and Its Relevance to Breast Tumor Progression – 210

HOXB7: An Oncogenic Gene in Breast Cancer Cells – 217

Role of Brca1 in Nonhomologous DNA End Joining – 212

GENETIC ALGORITHMS
A New Genetic-Algorithm-based Frequency Selective Surface Design for Dual Frequency Applications – 145

Adaptive Nulling with Spherical Arrays Using a Genetic Algorithm – 107

Shape Reconstruction of a Perfectly Conducting Cylinder Using Real-coded Genetic Algorithm – 266

GENETICS
Neoplastic Consequences of a Mutator Phenotype in Human Breast Epithelial Cells: A Prospective Analysis – 226

GEODESY
IERS Conventions (2003) – 310

GEODETIC SURVEYS
Climate-Driven Deformation of the Solid Earth from GRACE and GPS – 196

GEOGRAPHIC INFORMATION SYSTEMS
NASA GES DISC DAAC Satellite Data for GIS – 308

GEOMAGNETISM
Thermal N+ in the Inner Magnetosphere – 295

GEOMETRICAL OPTICS
An Analysis of a Dual Gridded Reflector Antenna – 67

GEOPHYSICS
Linear Inverse Problems in Wave Motion: Non-self-adjoint Integral Equations of the First Kind – 273

GEOSYNCHRONOUS ORBITS
The AstroMesh Deployable Reflector – 154

GLASS
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193

Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

GLIDERS
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

GLOBAL POSITIONING SYSTEM
Constraints of Melting, Sea-Level and the Paleoclimate from GRACE – 196

Coupled Gravity and Elevation Measurement of Ice Sheet Mass Change – 195

Global Positioning System Data Integration and Development of a Three-Dimensional Spatial Model of the Kansas Highway Network – 59

Regional Deformation Studies with GRACE and GPS – 253

GRADIENTS
Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP) – 49

GRAFTING
Cell Sheet Engineering with Intelligent Polymer-Grafted Surfaces – 54

Morphology and Properties of Model Block and Graft Copolymers – 54

GRANULAR MATERIALS
Density- and Structure-independent Calibration Method for Microwave Moisture Determination in Granular Materials – 157

GRAPH THEORY
New Canonical Representative Marking Algorithms for Place/Transition-Nets – 238

GRAPHITE
Fundamental Issues Regarding the High Temperature Failure Properties of Graphite/Polyimide Fabric Composites – 40

GRATINGS (SPECTRA)
Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

GRATINGS
Revisited Generalized Wood Anomalies – 239

GRAVIMETERS
Coupled Gravity and Elevation Measurement of Ice Sheet Mass Change – 195

GRAVITATION
Coupled Gravity and Elevation Measurement of Ice Sheet Mass Change – 195

Regional Deformation Studies with GRACE and GPS – 253

GRAZING INCIDENCE
Nickel Sandwich Technology for High Precision Reflector Antennas – 97

GREENHOUSE EFFECT
Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB-1493 Rulemarking – 186

GREEN'S FUNCTIONS
3-D Spectral Domain Green's Function for Arbitrarily Multilayered Dielectric Structure – 118

A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions – 72

Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

Time Domain Green's Function for a Phased Semi-infinite Periodic Line Array of Dipoles – 261

GRENADES
Environmental Life Cycle Techniques for New Weapons Acquisition Systems – 45

GRID COMPUTING (COMPUTER NETWORKS)
Challenges and Opportunities in Grid Performability – 235

GROUND PENETRATING RADAR
A 2.5-D Diffraction Tomography Inversion Scheme for Ground Penetrating Radar – 97

Complex Natural Resonances Extracted from Radar Signatures Measured in Time Domain with UWB Laboratory System – 65

GROUND STATIONS
Design and Development of Co-Polarized Ku-band Ground Terminal System for Very Small Aperture Terminal (VSAT) Application – 94

GROUND TESTS
Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps – 169

Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

GROWTH
Ebola and Marburg Viruses Replicate in Monocyle- Derived Dendritic Cells without Inducing the Production of Cytokines and Full Maturation – 221

GUIDANCE SENSORS
X-Ray Calibration Facility/Advanced Video Guidance Sensor Test – 32

GUINEA PIGS
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

GULFS
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 229

GYPSUM
Innovative Integrated Approach to Minimizing Gypsum and Pyrite Wastes by Conversion to Marketable Products – 42

GYROSCOPES
Development Of A Control Moment Gyroscope Controlled, Three Axis Satellite Simulator, With Active Balancing For The Bifocal Relay Mirror Initiative – 24

GYROTROPISM
Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

HABITABILITY
Smart Structures for Vibration Control on Long-Term Space Exploration and Habitation Missions – 323

HABITATS
In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

Lunar and Martian Sub-surface Habitat Structure Technology Development and Application – 320

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 30

Reuse International Space Station (ISS) Modules as Lunar Habitat – 318

Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

HADRONS
Jefferson Lab Phenomenology: An Overview – 277

HALF SPACES
An Improved Renormalization Technique for Profile Inversion – 267

HALL THRUSTERS
SMART Use for Electric Propulsion – 35

HANDBOOKS
Aerial Applicators Spray Nozzle Handbook – 9

HARBORS
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

HARDWARE
Hardware Progress Made in the Early Flight Fission Test Facilities (EFF-TF) To Support Near-Term Space Fission Systems – 29

HARMONIC MOTION
An Efficient High-frequency Boundary Integral Equation – 260

HAZARDOUS MATERIALS
Pre/Post-Strike Atmospheric Assessment System (PAAS) – 182

Spent Fuel Transportation Package Performance Study Experimental Design Challenges – 56

HAZARDS
How to Prevent Runaway Reactions. Case Study: Phenol-Formaldehyde Reaction Hazards – 190

Integrated Bioenvironmental Hazards Research Program – 168

U.S. Chemical Safety and Hazard Investigation Board Case Study. Explosion at Biochemical Facility: Liquid Nitric Oxide Release: ISOTEC, Miami Township, Ohio, September 21, 2003 – 190

HEAD (ANATOMY)
Appropriate Treatment of Head Injuries by Surgeons During the Civil War – 213

Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna – 205

HEALTH
Center for Behavioral Research: Individual Interventions for Breast Cancer Patients – 211

Do the Effects of Exercise on Breast Cancer Prevention Vary With Environment – 213

EPA Chemical Accident Investigation Report: Shell Chemical Company, Deer Park, Texas – 190

Review of Marine Corps Expeditionary Force Preventive Medicine Materiel Requirements – 219

Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

Uniformed Services University of the Health Sciences Journal 2003 Edition – 226

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

HEART DISEASES

Center for Innovative Minimally Invasive Therapy (CIMIT) – 205

HEAT FLUX

An Experimental Study of Steady State High Heat Flux Removal Using Spray Cooling – 160

Cryo Power and Heat Transfer – 171

HEAT MEASUREMENT

Severe Caloric Restriction in Adolescence and Incidence of Breast Cancer – 210

HEAT PIPES

Miniature Heat Transport System for Spacecraft Thermal Control – 162

Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module – 33

Transient Approximation of SAFE-100 Heat Pipe Operation – 32

HEAT RESISTANT ALLOYS

Analyses of Elemental Partitioning in Advanced Nickel-Base Superalloy Single Crystals – 14

GRCop-84: A High-Temperature Copper Alloy for High-Heat-Flux Applications – 50

HEAT TRANSFER

Cryo Power and Heat Transfer – 171

HEATING EQUIPMENT

Patient Warming Device for Casualty Care – 222

HEATING

Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 2: Precipitation. Climatography of the USA No. 85 – 201

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 3: Heating Degree Days. Climatography of the USA No. 85 – 202

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 4: Cooling Degree Days. Climatography of the USA No. 85 – 202

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 5: Divisional Maps, 1971-2000. Climatography of the USA No. 85 – 201

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 6: Divisional Maps, 1931-2000. Climatography of the USA No. 85 – 201

USA Climate Normals, 1971-2000. Annual Degree Days to Selected Bases, 1971-2000. Climatography of the USA No. 81. Supplement No. 2 – 202

HEAVY IONS

Experimental Evaluation of a Negative Ion Source for a Heavy Ion Fusion Negative Ion Driver – 281

HEAVY WATER

Dismantling of the Upper RPV Components of the Karlsruhe Multi-Purpose Research Reactor (MZFR), Germany – 291

HELICAL ANTENNAS

Extension and Validation of the Equivalent Sources Helical Antenna Modeling with the FDTD Code – 130

The Sleeve-cage Monopole and Sleeve Helix for Wideband Operation – 80

HELICOPTERS

Deployment and Evaluation of the Helicopter In-Flight Tracking System (HITS) – 8

Human Factors Assessment of the UH-60M Crew Station During the Early User Demonstration Number 2 (EUD2) – 12

HELIOSEISMOLOGY

Seismic Study of the Solar Interior: Inferences from SOI/MDI Observations During Solar Activity – 325

HELIUM

A Survey of Helium Accreting White Dwarfs – 317

HELMET MOUNTED DISPLAYS

Helmet-Mounted Display Targeting Symbology Color Coding: An Air-to-Air Scenario Evaluation – 231

HEMORRHAGES

Molecular Mechanisms of Filovirus Cellular Trafficking – 222

Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

Vaccines and Animal Models for Arboviral Encephalitides – 222

HETEROGENEITY

Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

HIERARCHIES

Uncertainties in the Analytic Hierarchy Process – 272

HIGH ENERGY INTERACTIONS

Superconducting RF Systems and Cryogenics. Subgroup Summary Report – 275

HIGH FREQUENCIES

An Efficient High-frequency Boundary Integral Equation – 260

Compact Reconfigurable HF-UHF Antennas – 136

Dual Purpose Simulation: New Data Link Test and Comparison With VDL-2 – 2

Effect of Canopy-Air Interface Roughness on HF-VHF Wave Propagation in Forest – 86

High Frequency Performance of Self-Assembled Monolayer (SAM) Organic FETs – 137

Possible Role of the Oceans in the Variations of Length of Day at High Frequencies – 310

Representation of Absolute Electric Fieldstrength by Superposition of Radiated and Guided Waves – 111

Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

Wide Band Modeling and Electromagnetic Pulse Propagation through HF Channel – 68

HIGH GAIN

A Reflector Antenna with High Gain and Wide Angle Beam Steering Capabilities – 76

Moment Method Based Analysis of Dielectric-resonator Antennas – 122

HIGH RESOLUTION

3D Super Resolution Algorithm for Analysis of Multi-path Propagation Structure – 148

Aerosol Optical Depth Model Assessment With High Resolution Multiple Angle Sensors – 23

Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion – 167

HIGH SPEED

3D Super Resolution Algorithm for Analysis of Multi-path Propagation Structure – 148

Applications of Endothermic Reaction Technology to HSCT and AST – 16

Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

Infrared Characterization of SiN Films on Si for High Speed Electronics Applications – 43

Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

Research Instrumentation for Measurements of High-Speed Separated Flows – 170

HIGH TEMPERATURE GASES
Advanced Second Generation Ceramic Candle Filters – 181

HIGH TEMPERATURE PLASMAS
A Detection of the Same Hot Plasma in the Corona: During a CME and Later at Ulysses – 192

HIGH TEMPERATURE SUPERCONDUCTORS
Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors – 139

HIGH TEMPERATURE
Fundamental Issues Regarding the High Temperature Failure Properties of Graphite/Polyimide Fabric Composites – 40

GRCop-84: A High-Temperature Copper Alloy for High-Heat-Flux Applications – 50

Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors – 139

HIGHWAYS
Global Positioning System Data Integration and Development of a Three-Dimensional Spatial Model of the Kansas Highway Network – 59

HILBERT TRANSFORMATION
Acceleration of Two-dimensional Time Domain Integral Equation Solvers Using a Hilbert Transform – 261

Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles – 30

HOLDERS
Improving Overlay in Nanolithography with a Deformable Mask Holder – 135

HOLOGRAPHY
Far-field Antenna Patterns Determined from Infrared Holograms – 89

On the Planarity Errors of the Hologram of the CATR – 92

HOMING DEVICES
Coherent Seeker Guided Antiship Missile Performance Analysis – 167

HORMONES
Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk – 214

Regulation of TRAIL-Mediated Apoptosis in Prostate Cancer by Overexpression in XIAP – 223

HORN ANTENNAS
Analysis of Radiation from Two Separate Axisymmetric Horns Using the Method of Moments – 114

Design of a TEM Waveguide for Ultra-wideband Applications – 154

HORSES
An Epidemiological Study of Leptospira-Induced Abortion in Mares in Central Kentucky (1990-2004) – 224

HUBBLE SPACE TELESCOPE
Eta Carinae: What We have learned recently with HST/STIS, VLT/UVES and VLTI: What We Might Learn with VLT/VLTI across the 2008/9 Minimum – 312

HUMAN BEINGS
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

Severe Caloric Restriction in Adolescence and Incidence of Breast Cancer – 210

HUMAN BODY
Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna – 205

HUMAN FACTORS ENGINEERING
Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs) – 231

Human Factors Assessment of the UH-60M Crew Station During the Early User Demonstration Number 2 (EUD2) – 12

Thoughts Regarding Evaluation of the Human Perspectives in the 'Demonstrators' Work in the Armed Forces Transformation Program and Command and Control Development – 62

HUMAN-COMPUTER INTERFACE
Human Interfaces for Space Situational Awareness – 25

HYBRID COMPOSITES
Influence of Stress Relaxation in Hybrid Composite/Metal Bolted Connections – 175

HYBRID STRUCTURES
Reduced-Order Models for the Field Analysis of Hybrid Systems – 152

HYDRAULIC EQUIPMENT
Research and Development (R&D) on Advanced Nonstructural Materials. Delivery Order 0001: Study of Hydraulic System Component Storage With Operational and Rust-Inhibited Hydraulic Fluids – 53

HYDRAULIC FLUIDS
Military Aerospace Fluids and Lubricants Workshop Proceedings – 53

Research and Development (R&D) on Advanced Nonstructural Materials. Delivery Order 0001: Study of Hydraulic System Component Storage With Operational and Rust-Inhibited Hydraulic Fluids – 53

HYDROCARBON FUELS
Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion – 45

HYDROCLIMATOLOGY
Climate-Driven Deformation of the Solid Earth from GRACE and GPS – 196

HYDRODYNAMICS
Evolving Computational Capability for Ship Hydrodynamics – 264

The U.S. Navy Submarine Hydrodynamics/ Hydroacoustic Community: A Case Study in Strategic Planning for a Decentralized, Multi-Organizational, Military Community – 288

HYDROGEN PRODUCTION
Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor – 49

HYDROGEN
Charged Pion Photoproduction from Hydrogen and Deuterium at Jefferson Lab – 277

Deposition Diagnostics for Next-Step Devices – 296

Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion – 45

HYDROLOGY
Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 3: Heating Degree Days. Climatography of the USA No. 85 – 202

HYDROPHONES
Estimation of Geoacoustic Properties in the South China Sea Shelf Using a Towed Source and Vertical Line Hydrophone Array – 288

HYPERSONIC SPEED
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers – 162

HYPERSONIC WIND TUNNELS
The 1-MW Radiatively Driven Hypersonic Wind Tunnel Experiments – 60

HYPERTHERMIA
Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

HYPERVELOCITY IMPACT
Hypervelocity Impact Analysis of International Space Station Whipple and Enhanced Stuffed Whipple Shields – 23

HYPOTHERMIA
Patient Warming Device for Casualty Care – 222

HYPOXIA
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

ICE
Coupled Gravity and Elevation Measurement of Ice Sheet Mass Change – 195

IDENTIFYING
Tracking and Sensor Fusion Issues in the Tactical Land Environment – 304

IGNITION
Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298
Modeling Thermal Ignition of Energetic Materials – 299

IMAGE ANALYSIS
Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62

IMAGE PROCESSING
Advance Path Measurement for Automotive Radar – 102
Characterization of 3 to 5 Micron Thermal Imagers and Analysis of Narrow Band Images – 252
Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform – 103
Initial On-Orbit Spatial Resolution Characterization of OrbView-3 Panchromatic Images – 307
Neural Network for Image-to-Image Control of Optical Tweezers – 169
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264
Principal Components Based Techniques for Hyperspectral Image Data – 244

IMAGERY
Martian Infotech – 26
Principal Components Based Techniques for Hyperspectral Image Data – 244

IMAGING TECHNIQUES
A Fast Multilevel Domain Decomposition Algorithm for Radar Imaging – 103
An Optimal Algorithm for Radar Imaging – 84
Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection – 215
Eta Carinae: What We have learned recently with HST/STIS, VLT/UVES and VLTI: What We Might Learn with VLT/VLTI across the 2008/9 Minimum – 312
Far Field Analysis of Radiation Sources – 110
Identification Versus Imaging – 149
Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206
Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62
Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43
The Utility of Auroral Image-based Activities Metrics – 193

IMMUNOLOGY
Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

IMPACT RESISTANCE
Ultrafast Spectroscopy of Energetic Materials: Toward a Molecular Understanding of Impact Sensitivity – 292

IMPEDANCE MATCHING
A T-Strip Loaded Rectangular Microstrip Patch Antenna for Dual-Frequency Operation – 112
Designs of Broadband Microstrip Antennas with Embedded Slots – 126

IMPEDANCE
A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113
An Annular-Ring Reduced Surface Wave Microstrip Antenna – 114
Broad Band Patch Antennas Using a Wedge-shaped Air Dielectric Substrate – 124
Design of Large Broadband Patch Arrays – 123
Higher-order Impedance Boundary Conditions for Complex Layered Planar Coatings – 130
Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268
Planar Trapezoidal and Pentagonal Monopoles with Impedance Bandwidths in Excess of 10:1 – 88
Scattering of Plane Waves by Two-Dimensional Periodic Impedance Surface – 85
Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

IMPINGEMENT
Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

IMPULSES
Matrix Pade Via Lanczos for FEM Problems – 142
Probe Pulse Shape Estimation in Synthetic Aperture Method – 88

IMPURITIES
Alternate Configurations for Blocked Impurity Band Detectors – 262

IN SITU MEASUREMENT
Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

IN SITU RESOURCE UTILIZATION
Are we There Yet? ... Developing In-Situ Fabrication and Repair (ISFR) Technologies to Explore and Live on the Moon and Mars – 18
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 323
Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58
In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323
In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19
Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21
Manufacture of Solar Cells on the Moon – 57

INCOMPATIBILITY
On the Incompatibility of Chirality Parameter Alpha and Chirality Admittance xi of Chiral Media – 155

INDIUM ANTIMONIDES
Residual Gas Effects on Detached Solidification in Microgravity – 297

INDIUM ARSENIDES
A Novel InAs Quantum Wire System – 139

INDUCTANCE
Closed Form Expression For Mutual Partial Inductance Between Two Skewed Linear Current Segments – 113

INDUCTORS
Design and Simulation of Active Spiral Inductors for RF Integrated Circuits – 145

INDUSTRIES
Economic Contribution of the California Air Pollution Control Industry – 190

INERTIAL CONFINEMENT FUSION
Pulsed Power Fusion – 149

INFECTIOUS DISEASES
Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224
Vaccines and Animal Models for Arboviral Encephalitides – 222

INFLATABLE STRUCTURES
Inflatable Microstrip Reflectarray Antennas at X and Ka-band Frequencies – 97
Materials Challenges in Space Exploration – 36
On Inflatable Antenna State of the Art Precision – 100
Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

INFORMATION FLOW
Modelling Opacity using Petri Nets – 236

INFORMATION MANAGEMENT
Development of Risk Assessment Matrix for NASA Engineering and Safety Center – 304
FLIGHTFAX: Army Aviation Risk-Management Information. Volume 32, Number 12 – 7
Japanese Beetle Program Manual – 5

INFORMATION RETRIEVAL
Extracting Dynamic Evidence Networks – 251

INFORMATION SYSTEMS
A Model-Based Approach to Battle Execution Monitoring – 302
Core Financial System Requirements: Checklist for Reviewing Systems under the Federal Financial Management Improvement Act – 300
Defense Information Warfare Technology Applications (DIWTA) Automated Intrusion Detection Environment (AIDE) Advanced Concept Technology Demonstration (ACTD) – 249
Distributed Enactment of Composite Web Services – 82
DOD Systems Modernization: Management of Integrated Military Human Capital Program Needs Additional Improvements – 239
Engineering Lessons Learned and Systems Engineering Applications – 59
Information Operations as a Core Competency (Joint Force Quarterly) – 303
Martian Infotech – 26
Tracking and Sensor Fusion Issues in the Tactical Land Environment – 304

INFORMATION TRANSFER
Wireless Network Security: Design Considerations for an Enterprise Network – 81

INFRARED DETECTORS
The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

INFRARED FILTERS
Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

INFRARED IMAGERY
The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

INFRARED INSTRUMENTS
Improved Smokescreen For MM Wave And IR – 116

INFRARED RADIATION
High Responsivity Tunable Step Quantum Well Infrared Photodetector – 165
Infrared Characterization of SiN Films on Si for High Speed Electronics Applications – 43
Pigments With Potential for Adaptable Optical Properties – 51
The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24
Two-Dimensional Photonic Crystals for Near IR and Visible Optoelectronics Applications – 294

INFRARED SIGNATURES
Semi-Empirical IR Signature Model for Tilted Surfaces – 197

INFRARED SPECTRA
Infrared Characterization of SiN Films on Si for High Speed Electronics Applications – 43

INFRARED SPECTROSCOPY
Infrared Characterization of SiN Films on Si for High Speed Electronics Applications – 43

INHOMOGENEITY
Inhomogeneous Cylindrical Waves: An Approach to Complex Beams – 255

INJURIES
Appropriate Treatment of Head Injuries by Surgeons During the Civil War – 213
EPA Chemical Accident Investigation Report: Shell Chemical Company, Deer Park, Texas – 190
EPA Chemical Accident Investigation Report: Surpass Chemical Co., Inc., Albany, NY – 189

INSULATION
On the Accuracy of the Transmission Line Theory for the Insulated Linear Antenna – 113

INTEGRAL EQUATIONS
A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256
A Fast Time Domain Integral Equation Technique for Analyzing EMC/EMI Problems – 258
Accurate and Efficient Computation of the Periodic Green's Function in Multilayered Media via a Hybrid Spectral/Spatial Summation with Optimized Complex Images – 146
An Efficient High-frequency Boundary Integral Equation – 260
Analysis of Shielded CPW Spatial Power Combiners – 151
Extensions of the Single-integral-equation Method – 258
Fast Spectral Domain Algorithm for Hybrid Finite Element/Boundary Integral Modeling of Infinite Periodic Arrays – 260
Higher-Order MoM Implementation to Solve Integral Equations – 268
Linear Inverse Problems in Wave Motion: Non-self-adjoint Integral Equations of the First Kind – 273
Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques – 253
Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157
Parameters of Microstrip Patch Antenna under the Consideration Using the Piecewise Basis Functions – 121
Surface Integral Equations for Three Dimensional Surfaces Containing Circuit Analog Sheets – 143

INTEGRATED CIRCUITS
Design and Simulation of Active Spiral Inductors for RF Integrated Circuits – 145
Dual Band Dual Linear Polarization Elliptical Microstrip Ring Antenna – 145
Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar – 151
Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129
Integrated Dipole Antennas on Silicon Substrates for Intra-chip Communication – 102

INTELLIGENCE
Understanding the Insider Threat. Proceedings of a March 2004 Workshop – 301

INTERFACIAL TENSION
Residual Gas Effects on Detached Solidification in Microgravity – 297

INTERFERENCE
A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

INTERFEROMETRY
Large 2-D Thinned Array for the Microwave Imaging Radiometer with Synthetic Aperture (MIRAS) – 100

INTERGALACTIC MEDIA
The Warm-Hot Intergalactic Medium – 314

INTERMETALLICS
Electronic Structure and Mechanical Properties of Metals and Intermetallics – 42

INTERMODULATION
A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108

INTERNAL COMBUSTION ENGINES
Internal Combustion Engine (ICE) Air Toxic Emissions – 173

INTERNAL WAVES
DRI internal Wave Simulations – 289
Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES) – 289

INTERNATIONAL SPACE STATION
Hypervelocity Impact Analysis of International Space Station Whipple and Enhanced Stuffed Whipple Shields – 23
ISS ECLSS Technology Evolution for Exploration – 230

Reproducible Crystal Growth Experiments in Microgravity Science Glovebox at the International Space Station (SUBSA Investigation) – 57

Reuse International Space Station (ISS) Modules as Lunar Habitat – 318

Skeleton Crew for the Space Station – 31

The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

Two Trees: Migrating Fault Trees to Decision Trees for Real Time Fault Detection on International Space Station – 306

INTERNETS

Component Middleware to Support Nonrepudiable Service Interactions – 82

Distributed Enactment of Composite Web Services – 82

Geographically Locating an Internet Node Using Network Latency Measurement – 242

Martian Infotech – 26

Monitoring of Contractual Service Level Agreement – 232

Notations for the Specification and Verification of Composite Web Services – 304

INTEROPERABILITY

Assessing the Risk and Valie of Adopting Emerging and Unstable Web Services Specifications – 234

Using Web Services to Build Grid Applications-The No Risk WSGAF Profile – 235

INTERPLANETARY SPACE

Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

INTERPOLATION

Developing Spatially Interpolated Surfaces and Estimating Uncertainty – 182

INTERSTELLAR TRAVEL

A Strategic Roadmap to Centauri – 19

INTERSTITIALS

Energetics of Oxygen Interstitials in Cr and V – 50

INVARIANCE

A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78

A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

INVENTORIES

Estimating Supplies Program: Evaluation Report – 245

The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

INVENTORY CONTROLS

The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

INVERSE SCATTERING

2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

Code-Division Multiplexing and Frequency-Division Multiplexing for Nonlinear Inverse Scattering – 267

Complexity Issues in Inverse Scattering Problems – 149

Identification Versus Imaging – 149

Time-domain Techniques for Reconstructing Lossy Layered Media from One-sided Scattering – 129

INVERSIONS

Linear Inverse Problems in Wave Motion: Non-self-adjoint Integral Equations of the First Kind – 273

ION BEAMS

Experimental Evaluation of a Negative Ion Source for a Heavy Ion Fusion Negative Ion Driver – 281

ION EXCHANGE RESINS

Estimation of Radiolytic Gas Generation Rate for Cylindrical Radioactive Waste Packages - Application to Spent Ion Exchange Resin Containers – 41

ION PROPULSION

Solar Electric and Chemical Propulsion for a Titan Mission – 32

ION SOURCES

Experimental Evaluation of a Negative Ion Source for a Heavy Ion Fusion Negative Ion Driver – 281

ION STORAGE

RF Stabilization for Storage of Antiprotons – 292

ION TRAPS (INSTRUMENTATION)

RF Stabilization for Storage of Antiprotons – 292

IONIZING RADIATION

Advancement of Methodology for RF Dosimetry – 126

IONOSPHERES

Thermal N+ in the Inner Magnetosphere – 295

IONOSPHERIC PROPAGATION

Wide Band Modeling and Electromagnetic Pulse Propagation through HF Channel – 68

IONS

International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004 – 54

Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

IRAQ

Iraq and Failures in U.S. Compellence Policy 1990-2003 – 279

Using Agent-Based Modeling to Assess the Impact of Martial Law on a Representative Iraqi Town – 244

ISOLATION

Radiation Properties of Two Cylindrical Conformal Arrays Isolated by a Space Filter – 59

ISOTROPIC MEDIA

On the Incompatibility of Chirality Parameter Alpha and Chirality Admittance xi of Chiral Media – 155

ITERATION

Characterization of Complex Dielectric Properties of Materials Using a Hybrid Iterative Method – 147

Domain Decomposition Method: A Direct Solution of Maxwell Equations – 258

Error Control in the Reduced Expansion and Field Testing (REFT) Method for MoM Matrix Thinning – 233

Fast Computation of Scattering from (Near-)Resonant Structures – 233

Null Control for Linear Arrays by Phase-only or Amplitude-only Modification of the Excitations – 85

ITERATIVE SOLUTION

A Comparison of Solution Accuracy Resulting from Factoring and Inverting Ill-conditioned Matrices – 233

Complexity Issues in Inverse Scattering Problems – 149

Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

JAPAN

Vaccines and Animal Models for Arboviral Encephalitides – 222

JAVA (PROGRAMMING LANGUAGE)

Component Composition for Embedded Systems Using Semantic Aspect-Oriented Programming – 245

Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology – 243

JET AIRCRAFT NOISE

Model-Scale Aerodynamic Performance Testing of Proposed Modifications to the NASA Langley Low Speed Aeroacoustic Wind Tunnel – 287

JET ENGINE FUELS

Computational Analysis and Simulation of Toxic Particle Deposition in the Human Respiratory System – 56

JET ENGINES

Quiet Plan for Tomorrow's Jet Engines – 17

JET FLOW

Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup – 161

JET MIXING FLOW
A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow – 16

JUNCTION TRANSISTORS
Demonstration of Silicon Carbide Power Devices in Practical Power Conversion Systems – 46

JUPITER (PLANET)
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

KANSAS
Global Positioning System Data Integration and Development of a Three-Dimensional Spatial Model of the Kansas Highway Network – 59

KAPTON (TRADEMARK)
Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

KERNEL FUNCTIONS
Accurate and Efficient Computation of the Periodic Green's Function in Multilayered Media via a Hybrid Spectral/Spatial Summation with Optimized Complex Images – 146

KNOWLEDGE BASED SYSTEMS
Collaborative Assistant for Rapid Knowledge Formation and Reasoning – 303

Knowledge-Based Generalized Likelihood Ratio Test (KB-GLRT): Exploiting Knowledge of the Clutter Ridge in Airborne Radar – 167

KNOWLEDGE REPRESENTATION
Collaborative Assistant for Rapid Knowledge Formation and Reasoning – 303

LAMINAR FLOW
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

LAMINATES
Distributed Sensing of Composite Overwrapped Pressure Vessel Using Fiber-Bragg Gratings at Ambient and Cryogenic Temperatures – 39

Precise Dielectric Properties Determination of Laminar-shaped Materials in a Partially-filled Waveguide – 146

LAND MOBILE SATELLITE SERVICE
Multi-state Markov Model for Satellite Propagation Channels – 92

LANDING MODULES
The Status of Lunar Simulants: Conclusions and Recommendations from the 2005 Lunar Regolith Simulant Materials Workshop – 322

LARGE SPACE STRUCTURES
Autonomous Assembly of Modular Structures in Space and on Extraterrestrial Locations – 251

Large Deployable Antennas: Concepts and Realization – 104

Materials Challenges in Space Exploration – 36

The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII – 104

The AstroMesh Deployable Reflector – 154

LASER BEAMS
The Adaptive Control of Optical Beam Jitter – 170

LASER OUTPUTS
Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

LASER RANGE FINDERS
Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion – 167

LASERS
Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43

LATERAL STABILITY
Bistatic Scattering Characterization of a Complex Object – 87

LATTICES (MATHEMATICS)
A Topological Viewpoint on Consistency Aspects of Electromagnetic Theory on a Lattice – 131

Lattices. Subgroup Summary Report – 275

LAUNCH VEHICLES
A Review of Man-Rating in Past and Current Manned Space Flight Programs – 21

Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative – 34

Multiple Satellite Trajectory Optimization – 25

Shuttle-Derived Launch Vehicles' Capablities: An Overview – 22

LAUNCHERS
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

LAUNCHING SITES
Survivability Enhancement in a Combat Environment – 9

LAUNCHING
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

Martian Infotech – 26

LAW (JURISPRUDENCE)
Insider Threat Study: Illicit Cyber Activity in the Banking and Finance Sector – 232

LAYOUTS
Lattices. Subgroup Summary Report – 275

LEADING EDGES
Tests Narrowed – 26

LEAKAGE
Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section – 118

LENS ANTENNAS
A Design Method of Offset Fresnel Zone Plate Reflector as Receiving Antenna – 119

Review on the Layered Fresnel Zone Lens Antenna – 119

Some Developments in Fresnel Zone Plate Lens Antennas – 111

LENSES
Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP) – 49

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

LEPTONS
New Ways to Soft Leptogenesis – 277

LETHALITY
Molecular Mechanisms of Filovirus Cellular Trafficking – 222

LIBRARIES
Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

LIFE CYCLE COSTS
Advanced Technology Lifecycle Analysis System (ATLAS) Technology Tool Box (TTB) – 300

Economic Evaluation of CO2 Storage and Sink Enhancement Options – 191

LIFE (DURABILITY)
Environmental Life Cycle Techniques for New Weapons Acquisition Systems – 45

LIFE SUPPORT SYSTEMS
ISS ECLSS Technology Evolution for Exploration – 230

LIGANDS
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

LIGHT BEAMS
Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

The Adaptive Control of Optical Beam Jitter – 170

LIGHT EMITTING DIODES
Evaluation of Light Emitting Diode Linear Source Devices – 5

LIGHT MODULATORS
Neural Network for Image-to-Image Control of Optical Tweezers – 169

LIGHT SCATTERING
Liquid Between Macromolecules in Protein Crystals: Static Versus Dynamics – 192

LIGHT TRANSMISSION
Slow and Fast Light in Coupled Microresonators – 294

LIGHT (VISIBLE RADIATION)
History and Evolution of Fresnel Zone Plate Antennas For Microwaves and Millimeter Waves – 119

LIGHTNING
An Orbital 'Virtual Radar' from TRMM Passive Microwave and Lightning Observations – 203

Lightning Contribution to Improvement of Passive Microwave Vertical Structure and Rainfall Estimation – 196

Space-Borne Observations of Intense Gamma-Ray Flashes Above Thunderstorms – 326

LIKELIHOOD RATIO
Knowledge-Based Generalized Likelihood Ratio Test (KB-GLRT): Exploiting Knowledge of the Clutter Ridge in Airborne Radar – 167

LINE OF SIGHT
X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years – 316

LINEAR ACCELERATORS
First Results from the CEBAF CLAS Spectrometer – 274

Jefferson Lab Phenomenology: An Overview – 277

Low Field Accelertor Structure Couplers and Design Techniques – 284

LINEAR ARRAYS
Generalized Coincident Arrays for the Direct Measurement of the Principal Solution in Radio Astronomy – 127

Null Control for Linear Arrays by Phase-only or Amplitude-only Modification of the Excitations – 85

Optimization of Linear Array Antenna Performance – 104

Optimum Amplitude and Phase Control for an Adaptive Linear Array Using a Genetic Algorithm – 65

Performance Improvement of Estimation Direction-of-arrival via Array Geometry Arrangement – 86

Recalculating Linear Array Antennas to Compensate for Failed Elements While Maintaining Fixed Nulls – 102

Synthesis of Shaped-Beam Pattern for Mobile Antenna – 143

LINEAR CIRCUITS
Matrix Pade Via Lanczos for FEM Problems – 142

Reduced-Order Models for the Field Analysis of Hybrid Systems – 152

LINEAR EQUATIONS
Linear Inverse Problems in Wave Motion: Non-self-adjoint Integral Equations of the First Kind – 273

Regression Equations for Estimating Flood Flows for the 2-, 10-, 25-, 50-, 100-, and 500-Year Recurrence Intervals in Connecticut – 237

LINEAR POLARIZATION
A Low Loss, Dual Polarized Switch for Polarization State Selection – 124

Dual Band Dual Linear Polarization Elliptical Microstrip Ring Antenna – 145

LINEARITY
Closed Form Expression For Mutual Partial Inductance Between Two Skewed Linear Current Segments – 113

LIQUID ATOMIZATION
Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup – 158

LIQUID COOLING
Dismantling of the Upper RPV Components of the Karlsruhe Multi-Purpose Research Reactor (MZFR), Germany – 291

LIQUID FUELS
Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion – 45

LIQUID OXYGEN
Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative – 34

LIQUID-SOLID INTERFACES
Observation of an Aligned Gas - Solid 'Eutectic' during Controlled Directional Solidification Aboard the International Space Station - Comparison with Ground-based Studies – 58

LIQUIDS
Scholarly Research Program. Delivery Order 0007: Characterization of Ionic Liquids as Fuel Cell Electrolytes – 37

LITHOGRAPHY
Improving Overlay in Nanolithography with a Deformable Mask Holder – 135

Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

LOADING
Implementation of Gas Bubble Loading in 2DCAV – 61

LOADS (FORCES)
Design of Robust Controllers for Telecom Power Supplies – 140

Turbulence Hazard Metric Based on Peak Accelerations for Jetliner Passengers – 8

LOCAL AREA NETWORKS
Electromagnetic Parallel Processing Using the Personal Computers of a Local Area Network – 242

Use of OpenSSH Support for Remote Login to a Multilevel Secure System – 244

LOG PERIODIC ANTENNAS
An Inexpensive Distance Measuring System for Location of Robotic Vehicles – 93

LOGIC CIRCUITS
Experimental Implementation of Efficient Linear Optics Quantum Computation – 138

LOGISTICS MANAGEMENT
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

LOGISTICS
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

LONG DURATION SPACE FLIGHT
Smart Structures for Vibration Control on Long-Term Space Exploration and Habitation Missions – 323

LOOP ANTENNAS
Numerical Computation on Radiation Characteristics of Square Loop Antennas at the Wrist Position of a Human Body in Personal Wireless Communications – 116

LOSSES
Metastatic Progression of Breast Cancer by Allelic Loss on Chromosome 18q21 – 223

LOSSY MEDIA
PML and PSTD Algorithm for Arbitrary Lossy Bianisotropic Media – 259

LOW COST
A Low-Cost, Man-Portable, Free-Space Optics Communications Device for Ethernet Applications – 170

An Inexpensive Distance Measuring System for Location of Robotic Vehicles – 93

Low Cost Broadband Microstrip Antenna for Satellite-TV Reception – 67

The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

LOW EARTH ORBITS
Channel Simulation of Leo Satellites – 92

LOW FREQUENCIES
Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles – 30

Generalized Coincident Arrays for the Direct Measurement of the Principal Solution in Radio Astronomy – 127

Low Complexity Space-frequency Rake Receivers for WCDMA – 131

Low Frequency Sonar Countermeasure – 139

LOW NOISE
Low Noise Exhaust Nozzle Technology Development – 2

LOW SPEED WIND TUNNELS
Model-Scale Aerodynamic Performance Testing of Proposed Modifications to the NASA Langley Low Speed Aeroacoustic Wind Tunnel – 287

LUBRICANTS
Military Aerospace Fluids and Lubricants Workshop Proceedings – 53

LUNAR BASES
In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Manufacture of Solar Cells on the Moon – 57

LUNAR ENVIRONMENT
In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

Lunar and Martian Sub-surface Habitat Structure Technology Development and Application – 320

LUNAR GEOLOGY
Characterization Strategies and Requirements for Lunar Regolith Simulant Materials – 322

LUNAR PROBES
SMART Use for Electric Propulsion – 35

LUNAR PROGRAMS
The Status of Lunar Simulants: Conclusions and Recommendations from the 2005 Lunar Regolith Simulant Materials Workshop – 322

LUNAR RESOURCES
Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

LUNAR ROCKS
Characterization Strategies and Requirements for Lunar Regolith Simulant Materials – 322

Present Status of Lunar Regolith Simulants, Workshop Overview and Objectives – 322

LUNAR SOIL
Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Present Status of Lunar Regolith Simulants, Workshop Overview and Objectives – 322

The Status of Lunar Simulants: Conclusions and Recommendations from the 2005 Lunar Regolith Simulant Materials Workshop – 322

LUNAR SURFACE
Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

LUNAR TOPOGRAPHY
Lunar and Martian Sub-surface Habitat Structure Technology Development and Application – 320

LYMPHATIC SYSTEM
MTA1-Regulated Gene Expression: New Markers of Breast Cancer Metastasis – 228

LYMPHOCYTES
Ebola and Marburg Viruses Replicate in Monocyle- Derived Dendritic Cells without Inducing the Production of Cytokines and Full Maturation – 221

LYSOZYME
Liquid Between Macromolecules in Protein Crystals: Static Versus Dynamics – 192

MACH NUMBER
Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport – 15

MACHINE LEARNING
Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer – 217

MACROMOLECULES
Liquid Between Macromolecules in Protein Crystals: Static Versus Dynamics – 192

Macromolecular Crystallization in Microgravity – 57

MAGNETARS
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Emission From Rotation-Powered Pulsars and Magnetars – 312

Observations of Soft Gamma Repeaters – 314

MAGNETIC DIPOLES
Nonlinear Inversion in Three-dimensional Cross-well Induction Logging using Full-Vectorial Multi-Frequency Data – 148

MAGNETIC FIELD CONFIGURATIONS
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

MAGNETIC FIELDS
Compact Flares and CMEs – 309

Electrical Conductivity of HgTe at High Temperatures – 133

FDTD Modeling of Magnetized Ferrites Using Z Transforms – 254

Higher-Order MoM Implementation to Solve Integral Equations – 268

Low Field Accelertor Structure Couplers and Design Techniques – 284

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

Pulsed Power Fusion – 149

MAGNETIC MATERIALS
FDTD Modeling of an Artificially-synthesized Absorbing Medium – 155

MAGNETIC PROPERTIES
Causality and Restrictions on the Initial-Boundary Conditions for Signal Propagation in Attenuating Medium – 147

Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193

Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures – 297

MAGNETIC SIGNATURES
Compact Flares and CMEs – 309

MAGNETIZATION
Hybrid Molecular and Spin-Semiconductor Based Research – 168

MAGNETOSTATIC FIELDS
Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

MAGNETOSTATICS
Beamforming by Magnetostatic Wave Microstrip Antennas – 98

MAGNETS
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193

MAGNIFICATION
A Confocal Reflector System – 77

MAINTENANCE
Civil Works Operations & Maintenance Management Tools Research Program: Program Summary FY 2000 - FY 2002 – 272

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 30

MALES
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

MALFUNCTIONS
The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

MAMMARY GLANDS
A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer – 223

An Evaluation of Stereoscopic Digital Mammography for Earlier Detection of Breast Cancer and Reduced Rate of Recall – 208

An Oncotropic Adenovirus Vector System for Breast Cancer Treatment – 218

Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast – 208

Anti-Angiogenesis Therapeutic Indicators in Breast Cancer – 211

Applying Statistical Models to Mammographic Screening Data to Understand Growth and Progression of Ductal Carcinoma in Situ – 217

Center for Behavioral Research: Individual Interventions for Breast Cancer Patients – 211

Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection – 215

Do the Effects of Exercise on Breast Cancer Prevention Vary With Environment – 213

Functional Interactions of the TACC2 Breast Tumor Suppressor Gene and Its Relevance to Breast Tumor Progression – 210

HOXB7: An Oncogenic Gene in Breast Cancer Cells – 217

Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206

Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220

Interdisciplinary Breast Cancer Training Program – 225

Metastatic Progression of Breast Cancer by Allelic Loss on Chromosome 18q21 – 223

Modification of Epigenetic Changes in Cancer by the Stromal Environment – 228

Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer – 217

MTA1-Regulated Gene Expression: New Markers of Breast Cancer Metastasis – 228

Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk – 214

Outcome Based Screening for Prognostic Phospho-RTK (Receptor Tyrosine Kinase) Antibodies Using Tissue Microarrays) – 227

Promotion of Epithelial to Mesenchymal Transformation by Hyaluronan – 211

Role of Brca1 in Nonhomologous DNA End Joining – 212

Severe Caloric Restriction in Adolescence and Incidence of Breast Cancer – 210

Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

The Influence of Stromal Transforming Growth Factor-Beta Receptor Signaling on Mouse Mammary Neoplasia – 207

The Origin and Significance of Mammary Intraductal Foam Cells – 216

The Role of Calgranulin Overexpression in Breast Cancer Progression – 220

The Role of the Prohibition Gene in Apoptosis of Breast Cancer Cells – 215

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

Use of a Transgenic Mouse Model With a Regulatable Estrogen Receptor Alpha (ER) to Study the Role of ER in Mammary Gland Development and Cancer – 206

Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

MANAGEMENT INFORMATION SYSTEMS

FLIGHTFAX: Army Aviation Risk-Management Information. Volume 32, Number 12 – 7

MANAGEMENT METHODS

Lessons Learned: The 'Pale Horse' Bioterrorism Response Exercise – 214

MANAGEMENT PLANNING

ISOP To Focus on Shuttle Transition – 26

The U.S. Navy Submarine Hydrodynamics/ Hydroacoustic Community: A Case Study in Strategic Planning for a Decentralized, Multi-Organizational, Military Community – 288

MANAGEMENT SYSTEMS

Core Financial System Requirements: Checklist for Reviewing Systems under the Federal Financial Management Improvement Act – 300

Differences and Similarities in Andra's Assessment of Activities Carried Out by Radioactive Waste Generators and Affecting the Quality of IL-LL Short-Lived Waste Packages and HL-IL Long-Lived Waste Packages – 187

MANNED MARS MISSIONS

Nuclear Power Systems for Manned Mission to Mars – 20

MANNED SPACE FLIGHT

A Review of Man-Rating in Past and Current Manned Space Flight Programs – 21

Materials Requirements for Advanced Propulsion Systems – 35

Preliminary Design of a Manned Nuclear Electric Propulsion Vehicle Using Genetic Algorithms – 34

Skeleton Crew for the Space Station – 31

Space Resource Utilization and Extending Human Presence Across the Solar System – 319

The Human Exploration Initative: Space Radiation Measurement Needs – 306

Trial by Fire – 25

MANNED SPACECRAFT

From Mercury to CEV: Space Capsules Reemerge – 31

MANPOWER

Circadian Rhythms, Fatigue, and Manpower Scheduling – 229

MANUALS

APTU Nozzle Code Manual, Version 3.0 – 244

Japanese Beetle Program Manual – 5

MAPPING

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 6: Divisional Maps, 1931-2000. Climatography of the USA No. 85 – 201

MAPS

An Assessment of Alternative SAR Display Formats: Orientation and Situational Awareness – 302

MARINE PROPULSION

Performance of Propeller 4381 in Crashback – 160

MARINE TECHNOLOGY

Multi-Disciplinary Computational Tools for Naval Design – 264

MARINE TRANSPORTATION

America's Freight Transportation Gateways. Connecting Our Nation to Places and Markets Abroad – 5

MARKERS

MTA1-Regulated Gene Expression: New Markers of Breast Cancer Metastasis – 228

MARKETING

Kosovo Media Assessment – 64

MARS ATMOSPHERE

GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

Solar Cycle/Seasonal Variations of H, D, H2 and He Distributions and Escape on Mars as Determined by the Mars Thermosphere Global Circulation Model (MTGCM) – 324

MARS BASES

In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19

MARS ENVIRONMENT

Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments – 62

Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

Lunar and Martian Sub-surface Habitat Structure Technology Development and Application – 320

MARS MISSIONS

Materials Requirements for Advanced Propulsion Systems – 35

Nuclear Power Systems for Manned Mission to Mars – 20

MARS (PLANET)

Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 323

In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

Martian Infotech – 26

MARS SURFACE

Lunar and Martian Sub-surface Habitat Structure Technology Development and Application – 320

MARTENSITIC TRANSFORMATION

Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

MASKS

Improving Overlay in Nanolithography with a Deformable Mask Holder – 135

MASS SPECTROSCOPY

A Method of Monitoring Explosive Under Cyclic Mechanical Stress – 54

MASS TRANSFER

Concepts to Automate Fluid Transfer Capability of Low Impact Docking System (LIDS) – 27

MATERIALS SCIENCE

Research Opportunities Supporting the Vision for Space Exploration from the Transformation of the Former Microgravity Materials Science Program – 36

MATHEMATICAL MODELS

A Comparison of Solution Accuracy Resulting from Factoring and Inverting Ill-conditioned Matrices – 233

A Simple Theoretical Model for Polarization Diversity Reception in Wireless Mobile Environments – 68

A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow – 16

An Efficient Technique for Modelling Wideband Propagation in an Urban Parallel Street Microcellular Environment – 305

Applying Statistical Models to Mammographic Screening Data to Understand Growth and Progression of Ductal Carcinoma in Situ – 217

Beyond the Standard Model with a B and K Physics – 285

Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

FDTD Modeling of an Artificially-synthesized Absorbing Medium – 155

Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment – 69

Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup – 161

Multi-state Markov Model for Satellite Propagation Channels – 92

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

Polarimetric Backscatter Characterization of Road Surface Faults at Millimeter-wave Frequencies – 80

Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Self-Organizing Maps in Sequence Processing – 238

Shape Sensing a Morphed Wing with an Optical Fiber Bragg Grating – 16

Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62

Single-Spin Polarization Effects and the Determination of Timelike Proton Form Factors – 286

Spherical-multipole Analysis of the Field within a Canonical GTEM-cell – 257

The Effect of the USA Naval Academy Foundation Preparatory Program on the Performance of Naval Academy Midshipmen – 263

Vectorial Waveguide Reflectometer for Dielectric Characterization of Materials Under Power Microwaves – 147

MATHEMATICAL PROGRAMMING

Fundamentals of Combinatorial Optimization and Algorithms Design: December Report – 263

MATRICES (MATHEMATICS)

A Comparison of Solution Accuracy Resulting from Factoring and Inverting Ill-conditioned Matrices – 233

A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

A New Hybrid Mode-matching Method for the Analysis of Inductive Obstacles and Discontinuities – 257

Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics – 291

Electromagnetic Radiation of Antennas in the Presence of an Arbitrarily Shaped Dielectric Object: Green Dyadics and Their Applications – 132

Error Control in the Reduced Expansion and Field Testing (REFT) Method for MoM Matrix Thinning – 233

Fast Computation of Scattering from (Near-)Resonant Structures – 233

Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268

Measurement of the CKM Angles (alpha) and (gamma) at the BaBar Experiment – 283

MATRIX MATERIALS

Fracture Toughness Improvement of Composites Reinforced with Optimally Shaped Short Ductile Fibers – 40

MATRIX METHODS

A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

MAXWELL EQUATION

Causality and Restrictions on the Initial-Boundary Conditions for Signal Propagation in Attenuating Medium – 147

Domain Decomposition Method: A Direct Solution of Maxwell Equations – 258

Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129

Parameters of Microstrip Patch Antenna under the Consideration Using the Piecewise Basis Functions – 121

Reflection and Transmission Properties of Reinforced Concrete Walls – 93

Three Dimensional Optical Fiber Simulation – 117

MEASURE AND INTEGRATION

Numerical Solution of Plasma Fluid Equations Using Locally Refined Grids – 294

MEASURING INSTRUMENTS

Constraints of Melting, Sea-Level and the Paleoclimate from GRACE – 196

MECHANICAL DRIVES

Siemens Programmable Variable Speed DC Drives Applied to Wet and Dry Expansion Engines – 277

MECHANICAL ENGINEERING

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport – 15

MECHANICAL PROPERTIES

Electronic Structure and Mechanical Properties of Metals and Intermetallics – 42

Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

GRCop-84: A High-Temperature Copper Alloy for High-Heat-Flux Applications – 50

Unraveling the Material Processing Conditions for Optimizing FSW Process – 175

UV Baked/Cured Photoresist Used as a Sacrificial Layer in MEMS Fabrication – 280

MEDICAL EQUIPMENT

Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

Review of Marine Corps Expeditionary Force Preventive Medicine Materiel Requirements – 219

MEDICAL SCIENCE

Center for Behavioral Research: Individual Interventions for Breast Cancer Patients – 211

Interdisciplinary Breast Cancer Training Program – 225

MEDICAL SERVICES

Center for Innovative Minimally Invasive Therapy (CIMIT) – 205

Patient Warming Device for Casualty Care – 222

The Reliability and Validity of the Outcome Rating Scale: A Replication Study of a Brief Clinical Measure – 214

Uniformed Services University of the Health Sciences Journal 2003 Edition – 226

MELTING

Constraints of Melting, Sea-Level and the Paleoclimate from GRACE – 196

MEMBRANE STRUCTURES

A Prototype Actuator Concept for Membrane Boundary Vibration Control – 176

MENTAL HEALTH

Discourse Analysis of Navy Leaders' Attitudes About Mental Health Problems – 207

MERCURY AMALGAMS

High Tensile Strength Amalgams for In-Space Repair and Fabrication – 48

MERCURY (METAL)

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000 – 180

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, June 2000 – 180

Oxidation of Mercury Across SCR Catalysts in Coal-Fired Power Plants Burning Low Rank Fuels. Quarterly Progress Report April 1, 2004-June 30, 2004 – 185

MERCURY TELLURIDES

Electrical Conductivity of HgTe at High Temperatures – 133

MESONS

B0 --\g K+ pi- pi0 Dalitz Plot Analysis – 287

Constraints on r(sub B) and gamma in B(sup (+-)) rightarrow D(sup 0)K(sup (+-)) decays by a Dalitz analysis of D(sup 0) Greater Than K(sub S) pi(sup -) pi(sup +) – 282

D+ --\g K-K+pi+ Meson Decays: A Search for CP Violation and a Measurement of the Branching Ratio – 285

Lost Tribes of Charmonium – 276

Measurement of CP Violating Asymmetries in B(sup 0) --\g f(sup 0)(980)Ks Decays – 285

Measurement of CP-Asymmetries for the Decays B(sup (+-)) --\g D(sub CP)(sup 0) K*(sup (+-)) with the BABAR Detector – 286

Measurement of the B0--\gK0sK0sK0s Branching Fraction – 283

Measurement of the Branching Fractions for the Decays B(sup 0)--\gD*(sup -) p(bar p)(pi)(sup +), B(sup 0)--\gD(sup -)p(bar p)(pi)(sup +), B0--\gD*(sup 0) p(bar p) and B(sup 0)--\gD(sup 0) p(bar p) – 285

Measurements of Branching Fraction, Polarization, and Direct CP-Violating Asymmetry in B(sup +) --\g K*(sup 0)(rho)(sup +) Decays – 283

Search for an X(3872) charged partner in the decay mode X- Yields J/psi pi- pi0 in the B meson decays B0 Yields X- K+ and B- Yields X- Ks – 282

Search for D(sub (sJ))(2632) at BaBar – 287

Search for the Decay B+ Yields K+ nu nubar – 282

Searches for Charmless Decays B0 --\g eta omega, B0 --\g eta K0, B+ --\g eta rho+, and B+ --\g eta' pi+ – 283

Study of (bar B)(sup 0) --\g D(*)(sup 0)(bar K)(*)(sup 0) Decays – 283

METABOLISM

Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206

METADATA

Using Web Services to Build Grid Applications-The No Risk WSGAF Profile – 235

METAL COATINGS

Development of High Resolution Hard X-Ray Telescope with Multi-Layer Coatings – 311

METAL FIBERS

Fracture Toughness Improvement of Composites Reinforced with Optimally Shaped Short Ductile Fibers – 40

METAL MATRIX COMPOSITES

Practical Gamma Spectroscopy Assay Techniques for Large Volume Low-Level Waste Boxes – 231

METAL OXIDE SEMICONDUCTORS

Infrared Characterization of SiN Films on Si for High Speed Electronics Applications – 43

METAL PLATES

Metallic Zone Plates for Sectoral Horns – 119

METAL STRIPS

Improved Smokescreen For MM Wave And IR – 116

Modelling Wave Propagation in Diagonal Microstrip Lines Using Enhanced FDTD Equations – 128

METALLICITY

Galactic Winds and Intragroup Medium Energetics – 317

METALS

Electronic Structure and Mechanical Properties of Metals and Intermetallics – 42

Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

METASTASIS

Metastatic Progression of Breast Cancer by Allelic Loss on Chromosome 18q21 – 223

MTA1-Regulated Gene Expression: New Markers of Breast Cancer Metastasis – 228

METEOROLOGICAL PARAMETERS

Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model – 197

Pre/Post-Strike Atmospheric Assessment System (PAAS) – 182

METEOROLOGICAL RADAR

An Orbital 'Virtual Radar' from TRMM Passive Microwave and Lightning Observations – 203

Normalization of NEXRAD Antenna Gain for Overlapping Radars – 127

METEOROLOGICAL SATELLITES

The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

METEOROLOGY

Evaluations of Global Wind Prediction at Fleet Numerical Meteorology and Oceanography Center: from the Perspective of a Wave Modeler – 197

METHANATION

Sabatier Methanation Reactor for Space Exploration – 321

METHOD OF MOMENTS

Accurate and Efficient Computation of the Periodic Green's Function in Multilayered Media via a Hybrid Spectral/Spatial Summation with Optimized Complex Images – 146

Analysis of Radiation from Two Separate Axisymmetric Horns Using the Method of Moments – 114

Asymptotic Boundary Conditions for Strip-loaded Surfaces of Cylindrical Structures with Arbitrarily Shaped Cross-section – 123

Efficient MoM Analysis of Polarization Selective Surfaces Using Trefoil Knot Arrays – 293

Error Control in the Reduced Expansion and Field Testing (REFT) Method for MoM Matrix Thinning – 233

Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas – 112

Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268

Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159

Moment Method Analysis of Parallel Plate Slot Antennas – 66

Moment Method Based Analysis of Dielectric-resonator Antennas – 122

Rigorous Analysis of Practical Reflector Antennas – 80

MICE

The Influence of Stromal Transforming Growth Factor-Beta Receptor Signaling on Mouse Mammary Neoplasia – 207

Use of a Transgenic Mouse Model With a Regulatable Estrogen Receptor Alpha (ER) to Study the Role of ER in Mammary Gland Development and Cancer – 206

MICROELECTROMECHANICAL SYSTEMS

A General Purpose Analysis System Based on a Programmable Fluid Processor – 247

Design of Two-Axis Capacitive Accelerater Using MEMS – 262

Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

UV Baked/Cured Photoresist Used as a Sacrificial Layer in MEMS Fabrication – 280

MICROELECTRONICS

Hybrid Molecular and Spin-Semiconductor Based Research – 168

Integrated Microphotonic Receiver for Ka-Band – 140

MAV State-of-the-Art and Technology Drivers – 11

MICROGRAVITY

Macromolecular Crystallization in Microgravity – 57

Morphological Evolution of Directional Solidification Interfaces in Microgravity: An Analysis of Model Experiments Performed on the International Space Station – 204

Novel Optical Diagnostic Techniques for Studying Particle Contact and Deposition Upon a Large Cylinder in a Sheared Suspension – 163

Reproducible Crystal Growth Experiments in Microgravity Science Glovebox at the International Space Station (SUBSA Investigation) – 57

Residual Gas Effects on Detached Solidification in Microgravity – 297

The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

MICROMACHINING

Study of Micromachined Microstrip Lines Using FDTD – 117

MICROMINIATURIZATION

MAV State-of-the-Art and Technology Drivers – 11

MICROORGANISMS

Microbiological Air Contamination from Machining Fluids – 181

Molecular Mechanisms of Filovirus Cellular Trafficking – 222

MICROSTRIP ANTENNAS

A Broadband Microstrip Antenna for SAR Applications – 75

A New Approach for Microstrip Active Antennas Using Modal FFT-algorithm – 98

A Procedure to Design Wide-Band Electromagnetically-coupled Stacked Microstrip Antennas Based on a Simple Network Model – 114

A T-Strip Loaded Rectangular Microstrip Patch Antenna for Dual-Frequency Operation – 112

A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies – 78

An Anisotropic Perfectly Matched Layer (APML) Absorber for Mesh Truncation in the Context of a Multiresolution Time Domain Scheme – 89

An Annular-Ring Reduced Surface Wave Microstrip Antenna – 114

An Aperture-coupled Small Microstrip Antenna with Enhanced Bandwidth – 67

Archimedean Spiral-mode Microstrip Antenna with Improved Axial Ratio – 79

Bandwidth Enhancement of Microstrip Antenna with Leaky-wave Excitation – 79

Beamforming by Magnetostatic Wave Microstrip Antennas – 98

Broad Band Patch Antennas Using a Wedge-shaped Air Dielectric Substrate – 124

Compact Dual-frequency Operation of Rectangular Microstrip Antennas – 96

Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface – 66

Design of Large Broadband Patch Arrays – 123

Designs of Broadband Microstrip Antennas with Embedded Slots – 126

Dual Band Dual Linear Polarization Elliptical Microstrip Ring Antenna – 145

Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar – 151

Dual-frequency Operation of Single-feed Triangular Microstrip Antennas – 96

Fast Spectral Domain Analysis of Large Finite Microstrip Patch Arrays – 101

FDTD Analysis of Mutual Coupling between Microstrip Patch Antennas on Curved Surfaces – 71

IEEE Antennas and Propagation Society International Symposium – 64

Inflatable Microstrip Reflectarray Antennas at X and Ka-band Frequencies – 97

Ka-Band Beam Steering Reflectarray Study – 86

Low Cost Broadband Microstrip Antenna for Satellite-TV Reception – 67

Microstrip Antennas for Dielectric Property Measurement – 157

Microstrip Patch Antenna for GSM 1800 Handsets – 90

Microstrip Patches for a Reflectarray – 96

Millimeter-wave Photodetection and Direct Integration with Microstrip Slot Antenna Array – 91

Multi-band Antennas – 65

Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas – 122

Novel Designs of Broadband Equilateral-triangular Microstrip Antennas – 68

Parameters of Microstrip Patch Antenna under the Consideration Using the Piecewise Basis Functions – 121

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas – 150

Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna – 79

Single-feed Dual-frequency Microstrip Antenna with Two Patches – 95

Tapered Leaky-wave Ultra Wide-band Microstrip Antenna – 112

Wideband L-strip Fed Microstrip Antenna – 68

Wideband Single Layer Microstrip Array at 28 GHz – 98

MICROSTRIP DEVICES

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

MICROSTRIP TRANSMISSION LINES

A Multi-frequency Microstrip-fed Shorted Square Ring Slot Line Antenna – 71

Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas – 112

Modelling Wave Propagation in Diagonal Microstrip Lines Using Enhanced FDTD Equations – 128

Numerical Amplification of the Excitation Source in Waveguide Structure – 266

Reactively Loaded Microstrip Antenna for Dual-frequency Operation – 95

Study of Micromachined Microstrip Lines Using FDTD – 117

MICROWAVE ANTENNAS

A Millimeter-wave Cavity-backed Suspended Substrate Stripline Antenna – 99

A Shaped Relector Antenna for Mobile Communications – 85

Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

Development of a Tri-plate Ring-Slot Antenna for mm-Wave Frequency Band – 99

New Class Microwave Antennas Based on the Elements of the Diffraction Quasioptics: Advantages and Applications – 65

The Co-conical Field Generation System - A 40 GHz Antenna Calibration Cell – 120

Variety of Cylindrical Fresnel Zone Plate Antennas – 120

MICROWAVE CIRCUITS

S-Parameter Extraction of 3-D Microwave Structures by Using 3D-FDFD Method in Conjunction with Asymptotic Waveform Evaluation Technique – 106

MICROWAVE EQUIPMENT

A Resonant Type Leaky-Wave Antenna Using an Image NRD Guide – 122

Improved Smokescreen For MM Wave And IR – 116

MICROWAVE FREQUENCIES

Design of Large Broadband Patch Arrays – 123

Reduced-Order Models for the Field Analysis of Hybrid Systems – 152

MICROWAVE IMAGERY

Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Nonpalpable Breast Tumors – 158

MICROWAVE SENSORS

On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

MICROWAVE SOUNDING

EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

MICROWAVE TRANSMISSION

Measurement of Transmission Coefficients of Radiowaves through Building Materials in the 5.8 GHz Frequency Band – 142

MICROWAVES

An Orbital 'Virtual Radar' from TRMM Passive Microwave and Lightning Observations – 203

Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

Density- and Structure-independent Calibration Method for Microwave Moisture Determination in Granular Materials – 157

Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports – 130

History and Evolution of Fresnel Zone Plate Antennas For Microwaves and Millimeter Waves – 119

Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Numerical Analysis of Thin Coaxial Antennas for Microwave Coagulation Therapy – 112

Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Review on the Layered Fresnel Zone Lens Antenna – 119

Some Developments in Fresnel Zone Plate Lens Antennas – 111

Vectorial Waveguide Reflectometer for Dielectric Characterization of Materials Under Power Microwaves – 147

MILITARY OPERATIONS

A Model-Based Approach to Battle Execution Monitoring – 302

Information Operations as a Core Competency (Joint Force Quarterly) – 303

Information Sharing Among Military Headquarters. The Effects on Decision-making – 300

Iraq and Failures in U.S. Compellence Policy 1990-2003 – 279

MORS Workshop. Operations Analysis Support to Network Centric Operations. Held in McLean, VA on 27-29 January 2004 – 271

Technology Development: New DOD Space Science and Technology Strategy Provides Basis for Optimizing Investments, but Future Versions Need to Be More Robust – 20

Uniformed Services University of the Health Sciences Journal 2003 Edition – 226

MILITARY PERSONNEL

Discourse Analysis of Navy Leaders' Attitudes About Mental Health Problems – 207

Microhematuria Associated With a Special Operations Craft Mission – 225

Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

MILITARY TECHNOLOGY

Adaptation of Advanced Diesel Engines for Military Requirements Under Severe Environmental Conditions – 61

Shedding Light on the Battlefield: Tactical Applications of Photonic Technology – 167

MILLIMETER WAVES

A Millimeter-wave Cavity-backed Suspended Substrate Stripline Antenna – 99

A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies – 78

Development of a Tri-plate Ring-Slot Antenna for mm-Wave Frequency Band – 99

Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar – 151

Experiment Research On MM Wavelength Radar Absorbing Materials – 155

History and Evolution of Fresnel Zone Plate Antennas For Microwaves and Millimeter Waves – 119

Moment Method Based Analysis of Dielectric-resonator Antennas – 122

Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Omnidirectional-dual Polarized Antenna for Wireless Indoor Applications at Millimeter Waves – 90

Polarimetric Backscatter Characterization of Road Surface Faults at Millimeter-wave Frequencies – 80

Some Developments in Fresnel Zone Plate Lens Antennas – 111

MIMO (CONTROL SYSTEMS)

Demonstration of Adaptive Radio Node – 63

Simulation Performance of Multiple-Input Multiple-Output Systems Employing Single-Carrier Modulation and Orthogonal Frequency Division Multiplexing – 279

MINERALS

The Status of Lunar Simulants: Conclusions and Recommendations from the 2005 Lunar Regolith Simulant Materials Workshop – 322

MINIATURE ELECTRONIC EQUIPMENT

Microstrip Patch Antenna for GSM 1800 Handsets – 90

MINIATURIZATION

An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz – 76

Minimization of Mutual Coupling Effects in Eigenstructure Algorithms Based on Modal Analysis – 94

MINING
Fibrous Monolith Wear Resistant Components for the Mining Industry. Semi-Annual Report No. 4 – 51

MIRRORS
Development Of A Control Moment Gyroscope Controlled, Three Axis Satellite Simulator, With Active Balancing For The Bifocal Relay Mirror Initiative – 24

Development of High Resolution Hard X-Ray Telescope with Multi-Layer Coatings – 311

MISSILES
Coherent Seeker Guided Antiship Missile Performance Analysis – 167

Homeland Security: Protecting Airliners from Terrorist Missiles – 12

Introduction to CFD++, its Transient and Moving Body Capabilities – 246

Silicon-Based Visible/Near-Infrared Affordable Missile Warning – 292

MIXERS
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

MOBILE COMMUNICATION SYSTEMS
A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78

A Shaped Relector Antenna for Mobile Communications – 85

A Simple Theoretical Model for Polarization Diversity Reception in Wireless Mobile Environments – 68

Compact Dual-frequency Operation of Rectangular Microstrip Antennas – 96

Design of a Smart Antenna for Reducing Co-Channel Interference in Cellular Mobile Communications – 144

Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements – 156

Performance Estimation of Space-Time Adaptive Processing via Subband Processing in Mobile Communications – 69

Synthesis of Shaped-Beam Pattern for Mobile Antenna – 143

MOBILITY
The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

MODAL RESPONSE
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

MODELS
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

MODEMS
Geographically Locating an Internet Node Using Network Latency Measurement – 242

MODIS (RADIOMETRY)
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

MODULATION
A Comparison of Frequency Offset Estimation Methods in Orthogonal Frequency Division Multiplexing (OFDM) Systems – 273

Simulation Performance of Multiple-Input Multiple-Output Systems Employing Single-Carrier Modulation and Orthogonal Frequency Division Multiplexing – 279

MODULATORS
Integrated Microphotonic Receiver for Ka-Band – 140

MOISTURE CONTENT
Density- and Structure-independent Calibration Method for Microwave Moisture Determination in Granular Materials – 157

MOLECULAR BEAM EPITAXY
Systematic Studies of Carbon Doping in High Quality GaN Grown by Molecular Beam Epitaxy – 136

MOLECULAR DYNAMICS
Science-Based Prediction for Complex Systems – 275

Transport Coefficients and Molecular Dynamics: Alternatives – 161

MOLECULAR ELECTRONICS
Hybrid Molecular and Spin-Semiconductor Based Research – 168

MOLECULAR STRUCTURE
Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

Femtosecond Real-Time Probing of Energetic Reactions: Complex Organics and Advanced Techniques – 291

High Frequency Performance of Self-Assembled Monolayer (SAM) Organic FETs – 137

Morphology and Properties of Model Block and Graft Copolymers – 54

MOLECULES
Integrated Bioenvironmental Hazards Research Program – 168

MONKEYS
Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

MONOPOLE ANTENNAS
A Multi-Branch Monopole Antenna for Dual-Band Cellular Applications – 105

Planar Trapezoidal and Pentagonal Monopoles with Impedance Bandwidths in Excess of 10:1 – 88

MONOPOLES
A Novel Sleeve Monopole with Broad Bandwidth – 74

The Sleeve-cage Monopole and Sleeve Helix for Wideband Operation – 80

MONTE CARLO METHOD
A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data – 270

MORPHOLOGY
Morphological Evolution of Directional Solidification Interfaces in Microgravity: An Analysis of Model Experiments Performed on the International Space Station – 204

Morphology and Properties of Model Block and Graft Copolymers – 54

Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes – 37

MORTALITY
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

MOTOR VEHICLES
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

Polarimetric Radar Measurements for Vehicle Control and Warning Applications – 305

MOUNTAINS
Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter – 43

MULTIPATH TRANSMISSION
Computer Simulated and Analytical Results of MSE in Adaptive Integrated Reduced-complexity Receiver for Multipath DS/CDMA Systems – 73

On the Performance of the VESPA Algorithm for Blind Beamforming and Signal Detection of Multi-source Multipath Signals – 73

MULTIPHASE FLOW
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

MULTIPLE ACCESS
Development and Evaluation Test of DBF Equipment for Transmitting – 72

MULTIPOLES
Fast Steepest Descent Path Algorithm for Electromagnetic Scattering Problems in Layered Medium – 278

Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268

Spherical-multipole Analysis of the Field within a Canonical GTEM-cell – 257

MULTISENSOR FUSION
An Architecture for Network Centric Operations in Unconventional Crisis: Lessons Learnt from Singapore's SARS Experience – 303

Situation Assessment and Information Fusion: An Experimental Framework for Performance Evaluation – 302

The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion – 167

Tracking and Sensor Fusion Issues in the Tactical Land Environment – 304

MULTIVARIATE STATISTICAL ANALYSIS

The Effect of the USA Naval Academy Foundation Preparatory Program on the Performance of Naval Academy Midshipmen – 263

University of South Carolina CB Support, Basic Research in Materials and Techniques for Optical Computing Standoff Sensors – 271

MUSCULOSKELETAL SYSTEM

Do Integrins Mediate the Skeletal Response to Altered Loading? – 230

MUTATIONS

Identification of Functions of Neurofibromin Distinct from the RASGAP domain – 216

Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220

NACELLES

High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

NANOFABRICATION

Improving Overlay in Nanolithography with a Deformable Mask Holder – 135

NANOPARTICLES

Nanoparticle-Mediated Rescue of p53 Through Targeted Degradation of MDM2 – 215

NANOSTRUCTURE (CHARACTERISTICS)

Computational Nanomechanics of Materials – 281

NANOSTRUCTURES (DEVICES)

Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures – 297

NANOTECHNOLOGY

A Novel InAs Quantum Wire System – 139

Improving Overlay in Nanolithography with a Deformable Mask Holder – 135

Nanoparticle-Mediated Rescue of p53 Through Targeted Degradation of MDM2 – 215

Nanosensors to Monitor Space Radiation Exposure – 326

Neural Network for Image-to-Image Control of Optical Tweezers – 169

NARROWBAND

A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256

Characterization of 3 to 5 Micron Thermal Imagers and Analysis of Narrow Band Images – 252

Small Antenna Efficiency by the Reflection and the Q Measurement Methods – 145

NASA PROGRAMS

Assessment of the NASA AvSTAR Project Plan – 1

Atmospheric/Space Environment Support Lessons Learned Regarding Aerospace Vehicle Design and Operations – 28

Engineering Lessons Learned and Systems Engineering Applications – 248

NASA Celebrates the World Year of Physics – 306

NASA SPACE PROGRAMS

Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Cooperative Agreement in Space Sciences (CPSS) NCC5-637 – 305

Learning Lessons from the X-37 Project – 29

Lunar and Martian Sub-surface Habitat Structure Technology Development and Application – 320

NASA GES DISC DAAC Satellite Data for GIS – 308

Present Status of Lunar Regolith Simulants, Workshop Overview and Objectives – 322

Shuttle-Derived Launch Vehicles' Capablities: An Overview – 22

Skeleton Crew for the Space Station – 31

Strategic Research Partnerships for Exploration – 319

The Human Exploration Initative: Space Radiation Measurement Needs – 306

Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

NATIONAL AIRSPACE SYSTEM

Transforming the NAS: The Next Generation Air Traffic Control System – 6

NATURAL GAS

Comparative Study on Exhaust Emissions from Diesel- and CNG-Powered Urban Buses – 189

Comparison of Clean Diesel Buses to CNG Buses – 188

Energy Efficient Thermal Management for Natural Gas Engine Aftertreatment via Active Flow Control – 174

NAVIER-STOKES EQUATION

Evolving Computational Capability for Ship Hydrodynamics – 264

NAVIGATION

Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

NAVY

Discourse Analysis of Navy Leaders' Attitudes About Mental Health Problems – 207

The U.S. Navy Submarine Hydrodynamics/ Hydroacoustic Community: A Case Study in Strategic Planning for a Decentralized, Multi-Organizational, Military Community – 288

NEAR EARTH OBJECTS

Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

NEAR FIELDS

Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

Uni-polar Scanning Method for Near-field Measurements of Antennas – 154

NEAR INFRARED RADIATION

Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Silicon-Based Visible/Near-Infrared Affordable Missile Warning – 292

Two-Dimensional Photonic Crystals for Near IR and Visible Optoelectronics Applications – 294

NEOPLASMS

Anti-Angiogenesis Therapeutic Indicators in Breast Cancer – 211

Neoplastic Consequences of a Mutator Phenotype in Human Breast Epithelial Cells: A Prospective Analysis – 226

The Role of the Prohibition Gene in Apoptosis of Breast Cancer Cells – 215

NEPTUNE (PLANET)

GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

NETS

New Canonical Representative Marking Algorithms for Place/Transition-Nets – 238

NETWORK ANALYSIS

MORS Workshop. Operations Analysis Support to Network Centric Operations. Held in McLean, VA on 27-29 January 2004 – 271

NEURAL NETS

Experimental Validation of a Neural Network Direction Finder – 142

Neural Network for Image-to-Image Control of Optical Tweezers – 169

NEUROLOGY

Protein Kinase Pathways That Regulate Neuronal Survival and Death – 208

NEUROPHYSIOLOGY

Implicit Memory, Perception and the Rapid Deployment of Visual Attention and Action – 241

Protein Kinase Pathways That Regulate Neuronal Survival and Death – 208

Self-Organized Criticality and Stochastic Resonance in the Human Brain – 281

NEUTRAL PARTICLES

Measurement of the B0--\gK0sK0sK0s Branching Fraction – 283

Study of (bar B)(sup 0) --\g D(*)(sup 0) (bar K)(*)(sup 0) Decays – 283

NEUTRON FLUX DENSITY

A Concept for the Inclusion of Analytical and Computational Capability in Existing Systems for Measurement of Neutron Flux – 164

NEUTRON RADIOGRAPHY

Report on Measurement at Ohio University to Estimate Backgrounds for Neutron Radiography in the 10-14 MeV Region – 275

NEUTRON STARS

Simultaneous X-Ray and UV Spectroscopy of the Symbiotic HD 154791 – 317

NEUTRONS

Precision Measurements of the Neutron Spin Structure at Jefferson Lab Hall A – 278

NEWTON METHODS

Complexity Issues in Inverse Scattering Problems – 149

NICKEL ALLOYS

Analyses of Elemental Partitioning in Advanced Nickel-Base Superalloy Single Crystals – 14

NICKEL CADMIUM BATTERIES

ACTS Battery and Solar Array Assembly On-Orbit Measured Performance – 27

NICKEL

Nickel Sandwich Technology for High Precision Reflector Antennas – 97

Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

NITRIC OXIDE

Health Impact of Nitric Oxide: Effects on Lung Function and Cellular and Biochemical Processes in Healthy Humans – 179

U.S. Chemical Safety and Hazard Investigation Board Case Study. Explosion at Biochemical Facility: Liquid Nitric Oxide Release: ISOTEC, Miami Township, Ohio, September 21, 2003 – 190

NITROGEN IONS

Thermal N+ in the Inner Magnetosphere – 295

NITROGEN OXIDES

Dynamometer Evaluation of Plasma-Catalyst for Diesel NOX Reduction – 171

Verification of Ship Emission Estimates with Monitoring Measurements to Improve Inventory and Modeling – 178

NOISE TEMPERATURE

Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92

NONDESTRUCTIVE TESTS

Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles – 30

Nondestructive Evaluation of Space Shuttle External Tank Foam – 28

NONLINEAR EQUATIONS

Validation of a High-Order Prefactored Compact Code on Nonlinear Flows with Complex Geometries – 4

NONLINEARITY

Code-Division Multiplexing and Frequency-Division Multiplexing for Nonlinear Inverse Scattering – 267

Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

Nonlinear Inversion in Three-dimensional Cross-well Induction Logging using Full-Vectorial Multi-Frequency Data – 148

NOZZLE DESIGN

High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

Low Noise Exhaust Nozzle Technology Development – 2

NOZZLE GEOMETRY

Nozzle Aerodynamic Stability During a Throat Shift – 1

NUCLEAR ELECTRIC PROPULSION

Nuclear Power Systems for Manned Mission to Mars – 20

Preliminary Design of a Manned Nuclear Electric Propulsion Vehicle Using Genetic Algorithms – 34

NUCLEAR FUELS

Site-Specific Analysis of a Spent Nuclear Fuel Transportation Accident – 184

Spent Fuel Transportation Package Performance Study Experimental Design Challenges – 56

NUCLEAR INTERACTIONS

Effects of Nuclear Interactions in Space Radiation Transport – 229

NUCLEAR MAGNETIC RESONANCE

Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

NUCLEAR MEDICINE

Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection – 215

NUCLEAR RESEARCH

Oak Ridge National Laboratory Radiation Control Program-Partners in Site Restoration – 278

NUCLEAR WEAPONS

Gamma-Ray Identification of Nuclear Weapon Materials – 46

NUMERICAL ANALYSIS

3-D Numerical Mode-Matching (NMM) Method for Inhomogeneous Media – 254

A New Approach for Accurate Analysis of Antennas Above Real Ground – 152

A New Approach for Microstrip Active Antennas Using Modal FFT-algorithm – 98

Accurate Model of Arbitrary Wire Antennas in Free Space, Above or Inside Lossy Ground – 97

An Efficient High-frequency Boundary Integral Equation – 260

Higher-order Impedance Boundary Conditions for Complex Layered Planar Coatings – 130

Measurement of Radiation Efficiency of Antennas in the Vicinity of Human Head Model Proposed By COST 244 – 131

Numerical Analysis of Thin Coaxial Antennas for Microwave Coagulation Therapy – 112

Numerical Solution of Plasma Fluid Equations Using Locally Refined Grids – 294

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

Spent Fuel Transportation Package Performance Study Experimental Design Challenges – 56

Spherical-multipole Analysis of the Field within a Canonical GTEM-cell – 257

The General NMM Solution for 2-D EMF Problems with Arbitrary Excitations under General Coordinates – 205

The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

NUMERICAL INTEGRATION

Modeling Surface Currents on Electrically Large Impedance Cylinders - 2D, TM Case – 120

OBESITY

Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk – 214

OBJECT-ORIENTED PROGRAMMING

Visual Language for Parallel, Object-Oriented Programming – 237

OBSERVATION

Observations of Compact X-Ray Binaries with Chandra – 315

OCCULTATION

Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

OCEAN BOTTOM
Using Adaptive Simulated Annealing to Estimate Ocean Bottom Acoustic Properties from Acoustic Data – 288

OCEAN MODELS
Possible Role of the Oceans in the Variations of Length of Day at High Frequencies – 310

OCEAN SURFACE
Evolving Computational Capability for Ship Hydrodynamics – 264

Fast Generalized Forward-backward Method by Using a Spectral Acceleration – 255

OCEANOGRAPHY
Evaluations of Global Wind Prediction at Fleet Numerical Meteorology and Oceanography Center: from the Perspective of a Wave Modeler – 197

OCEANS
Modeling Ocean Deep Convection – 197

On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

Possible Role of the Oceans in the Variations of Length of Day at High Frequencies – 310

ODORS
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 229

OILS
Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

OLIGOMERS
Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes – 37

OMNIDIRECTIONAL ANTENNAS
Omnidirectional-dual Polarized Antenna for Wireless Indoor Applications at Millimeter Waves – 90

ON-LINE SYSTEMS
A Fast and Accurate Scheme for Calibration of Active Phased-array Antennas – 117

Development of On-Line Temperature Measurement Instrumentation for Gasification Process Control – 36

OPACITY
Modelling Opacity using Petri Nets – 236

OPERATIONAL PROBLEMS
Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

OPERATIONS RESEARCH
MORS Workshop. Operations Analysis Support to Network Centric Operations. Held in McLean, VA on 27-29 January 2004 – 271

OR Modeling of a Conceptual System of Systems for Maritime Littoral Dominance in 2020 – 272

OPTICAL COMMUNICATION
Retrocommunication – 63

OPTICAL COMPUTERS
University of South Carolina CB Support, Basic Research in Materials and Techniques for Optical Computing Standoff Sensors – 271

OPTICAL DATA PROCESSING
University of South Carolina CB Support, Basic Research in Materials and Techniques for Optical Computing Standoff Sensors – 271

OPTICAL EQUIPMENT
Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

Two-Dimensional Photonic Crystals for Near IR and Visible Optoelectronics Applications – 294

OPTICAL FIBERS
Shape Sensing a Morphed Wing with an Optical Fiber Bragg Grating – 16

Three Dimensional Optical Fiber Simulation – 117

OPTICAL MATERIALS
Ultra-Smooth As-Deposited Optical Films – 137

OPTICAL MEASUREMENT
Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

OPTICAL MEASURING INSTRUMENTS
Shedding Light on the Battlefield: Tactical Applications of Photonic Technology – 167

OPTICAL PROPERTIES
Aerosol Optical Depth Model Assessment With High Resolution Multiple Angle Sensors – 23

Collaborative Investigations of Shallow Water Optics Problems – 270

Database of Material Properties for Optical Signature Modelling – 293

Pigments With Potential for Adaptable Optical Properties – 51

The Optical Counterpart of M101 ULX-1 – 313

Tunable Optical Polymer Systems – 53

Ultrashort X-Ray Pulse Science – 276

OPTICAL RADAR
Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion – 167

OPTICAL RESONATORS
Integrated Microphotonic Receiver for Ka-Band – 140

Slow and Fast Light in Coupled Microresonators – 294

OPTICAL THICKNESS
Aerosol Optical Depth Model Assessment With High Resolution Multiple Angle Sensors – 23

OPTICS
New Class Microwave Antennas Based on the Elements of the Diffraction Quasioptics: Advantages and Applications – 65

OPTIMAL CONTROL
Optimum Amplitude and Phase Control for an Adaptive Linear Array Using a Genetic Algorithm – 65

OPTIMIZATION
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Characterization of Complex Dielectric Properties of Materials Using a Hybrid Iterative Method – 147

Fundamentals of Combinatorial Optimization and Algorithms Design: December Report – 263

Optimization of Linear Array Antenna Performance – 104

Recalculating Linear Array Antennas to Compensate for Failed Elements While Maintaining Fixed Nulls – 102

Unraveling the Material Processing Conditions for Optimizing FSW Process – 175

OPTOELECTRONIC DEVICES
Integrated Microphotonic Receiver for Ka-Band – 140

Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components – 153

ORBITAL ASSEMBLY
Autonomous Assembly of Modular Structures in Space and on Extraterrestrial Locations – 251

ORDNANCE
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264

ORGANIZATIONS
Insider Threat Study: Illicit Cyber Activity in the Banking and Finance Sector – 232

ORTHOGONAL FUNCTIONS
An Optimal Algorithm for Radar Imaging – 84

ORTHOGONALITY
A Comparison of Frequency Offset Estimation Methods in Orthogonal Frequency Division Multiplexing (OFDM) Systems – 273

OSCILLATIONS
Implementation of Gas Bubble Loading in 2DCAV – 61

Self-Organized Criticality and Stochastic Resonance in the Human Brain – 281

OSTEOCALCIN
Do Integrins Mediate the Skeletal Response to Altered Loading? – 230

OXIDATION
Oxidation of Mercury Across SCR Catalysts in Coal-Fired Power Plants Burning Low Rank Fuels. Quarterly Progress Report April 1, 2004-June 30, 2004 – 185

Residual Gas Effects on Detached Solidification in Microgravity – 297

Sulfur Oxidation and Contrail Precursor Chemistry – 47

OXYGEN ATOMS
Atomic Oxygen Treatment and Its Effect on a Variety of Artist's Media – 38

Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane – 52

Simulated Space Environment Effects on Tether Materials with Protective Coatings – 37

Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

OXYGEN IONS
Thermal N+ in the Inner Magnetosphere – 295

OXYGEN PRODUCTION
ISS ECLSS Technology Evolution for Exploration – 230

OXYGEN
Energetics of Oxygen Interstitials in Cr and V – 50

Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane – 52

Oxygen Monitoring Cells at FERMILAB – 276

PACKAGING
Differences and Similarities in Andra's Assessment of Activities Carried Out by Radioactive Waste Generators and Affecting the Quality of IL-LL Short-Lived Waste Packages and HL-IL Long-Lived Waste Packages – 187

Fuel From Self-Degrading Bioengineering Packaging – 225

Interconnect and Packaging Electrical Circuits Network – 124

PAINTS
Atomic Oxygen Treatment and Its Effect on a Variety of Artist's Media – 38

PARABOLIC BODIES
Shaped Reflector and Multi-feed Paraboloid: A Comparison – 60

PARABOLIC DIFFERENTIAL EQUATIONS
Parabolic Equation-Based Propagation Fields Near Surface Irregularities Including Backscatter – 266

PARALLEL PROCESSING (COMPUTERS)
Electromagnetic Parallel Processing Using the Personal Computers of a Local Area Network – 242

Parallel Domain Decomposition Formulation and Software for Large-Scale Sparse Symmetrical/Unsymmetrical Aeroacoustic Applications – 239

Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

Wireless Network Security: Design Considerations for an Enterprise Network – 81

PARALLEL PROGRAMMING
Visual Language for Parallel, Object-Oriented Programming – 237

PARAMETER IDENTIFICATION
Developing Adaptive Models and Estimating the Uncertainty of Presampled Spectral Data – 241

PARASITIC ELEMENTS (ANTENNAS)
Wideband Single Layer Microstrip Array at 28 GHz – 98

PARTICLE ACCELERATION
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

PARTICLE COLLISIONS
Symplectic Treatment of a Finite Crossing Angle in the Beam-Beam Collision – 282

PARTICLE DECAY
B0 --\g K+ pi- pi0 Dalitz Plot Analysis – 287

Constraints on r(sub B) and gamma in B(sup (+-)) rightarrow D(sup 0)K(sup (+-)) decays by a Dalitz analysis of D(sup 0) Greater Than K(sub S) pi(sup -) pi(sup +) – 282

D+ --\g K-K+pi+ Meson Decays: A Search for CP Violation and a Measurement of the Branching Ratio – 285

Measurement of CP-violating parameters in fully reconstructed B--\gD(*)pi and B--\gDrho decays – 282

Measurement of the Branching Fractions for the Decays B(sup 0)--\gD*(sup -) p(bar p)(pi)(sup +), B(sup 0)--\gD(sup -)p(bar p)(pi)(sup +), B0--\gD*(sup 0) p(bar p) and B(sup 0)--\gD(sup 0) p(bar p) – 285

Measurement of the Ratio of Branching Fractions of Xic0 Decays to Xi- pi+ and to Omega- K+ – 287

Measurements of Branching Fraction, Polarization, and Direct CP-Violating Asymmetry in B(sup +) --\g K*(sup 0) (rho)(sup +) Decays – 283

Search for an X(3872) charged partner in the decay mode X- Yields J/psi pi- pi0 in the B meson decays B0 Yields X- K+ and B- Yields X- Ks – 282

Search for the Decay B+ Yields K+ nu nubar – 282

Searches for Charmless Decays B0 --\g eta omega, B0 --\g eta K0, B+ --\g eta rho+, and B+ --\g eta' pi+ – 283

Study of (bar B)(sup 0) --\g D(*)(sup 0) (bar K)(*)(sup 0) Decays – 283

PARTICLE EMISSION
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 174

PARTICLE IMAGE VELOCIMETRY
Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43

PARTICLE PRODUCTION
Measurement of the Ratio of Branching Fractions of Xic0 Decays to Xi- pi+ and to Omega- K+ – 287

PARTICLE SIZE DISTRIBUTION
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 174

Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

PARTICLE SPIN
Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures – 297

PARTICULATES
Demonstration of Potential for Selective Catalytic Reduction and Diesel Particulate Filters – 184

PASSENGERS
Turbulence Hazard Metric Based on Peak Accelerations for Jetliner Passengers – 8

PATCH ANTENNAS
A Procedure to Design Wide-Band Electromagnetically-coupled Stacked Microstrip Antennas Based on a Simple Network Model – 114

A T-Strip Loaded Rectangular Microstrip Patch Antenna for Dual-Frequency Operation – 112

Broad Band Patch Antennas Using a Wedge-shaped Air Dielectric Substrate – 124

Design of Large Broadband Patch Arrays – 123

External Substrate Perforation Applied to Patch Antennas for Mitigating Surface Wave Effects – 110

Fast Spectral Domain Analysis of Large Finite Microstrip Patch Arrays – 101

FDTD Analysis of Mutual Coupling between Microstrip Patch Antennas on Curved Surfaces – 71

Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas – 112

Microstrip Patch Antenna for GSM 1800 Handsets – 90

Omnidirectional-dual Polarized Antenna for Wireless Indoor Applications at Millimeter Waves – 90

Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

Parameters of Microstrip Patch Antenna under the Consideration Using the Piecewise Basis Functions – 121

PBG-Assisted Gain Enhancement of Patch Antennas on High-dielectric Constant Substrate – 109

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas – 150

S-Parameter Extraction of 3-D Microwave Structures by Using 3D-FDFD Method in Conjunction with Asymptotic Waveform Evaluation Technique – 106

PATENT APPLICATIONS

Low Frequency Sonar Countermeasure – 139

PATHOGENESIS

Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

PATHOGENS

Molecular Mechanisms of Filovirus Cellular Trafficking – 222

PATIENTS

Center for Behavioral Research: Individual Interventions for Breast Cancer Patients – 211

Gangliosides During Tumor Progression in Patients With Prostate Cancer – 209

Patient Warming Device for Casualty Care – 222

PAVEMENTS

Evaluation of HPC Pavement in Nelsonville, Ohio – 38

PAYLOADS

Lightweight Nonmetallic Thermal Protection Materials Technology – 51

PEPTIDES

Nanoparticle-Mediated Rescue of p53 Through Targeted Degradation of MDM2 – 215

PERFECTLY MATCHED LAYERS

An Enhanced Higher-Order FDTD Technique for the Construction of Efficient Reflectionless PMLs in 3-D Generalized Curvilinear Coordinate Systems – 274

Employing PML Absorbers in the Design and Simulation of Ground Penetrating Radars – 266

PML and PSTD Algorithm for Arbitrary Lossy Bianisotropic Media – 259

PML-FDTD Method for Elastic Waves in Cylindrical and Spherical Coordinates – 257

Reciprocity in Perfectly Matched Absorbers – 278

PERFORMANCE PREDICTION

Array Configurations and Wideband Radiators Suitable for Shared Apertures – 83

Performance Estimation of Space-Time Adaptive Processing via Subband Processing in Mobile Communications – 69

Performance Improvement of Estimation Direction-of-arrival via Array Geometry Arrangement – 86

PERFORMANCE TESTS

Computer Aided Design of Holographic Antennas – 242

Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

Situation Assessment and Information Fusion: An Experimental Framework for Performance Evaluation – 302

PERIODIC FUNCTIONS

Accurate and Efficient Computation of the Periodic Green's Function in Multilayered Media via a Hybrid Spectral/Spatial Summation with Optimized Complex Images – 146

PERIODIC VARIATIONS

Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components – 153

PERMEABILITY

Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials – 146

Filtering Characteristics of Thin, Planar 3D Printed Element Arrays – 153

PERMITTIVITY

An Improved Renormalization Technique for Profile Inversion – 267

Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials – 146

External Substrate Perforation Applied to Patch Antennas for Mitigating Surface Wave Effects – 110

Numerical Amplification of the Excitation Source in Waveguide Structure – 266

Static Permittivity of a Multiphase System of Spheres – 274

PERSONAL COMPUTERS

2.4GHz ISM Band Antenna for PC Cards – 241

Electromagnetic Parallel Processing Using the Personal Computers of a Local Area Network – 242

PESTICIDES

Aerial Applicators Spray Nozzle Handbook – 9

PETRI NETS

Applying Petri Nets to Systems Biology using XML Technologies – 237

Computing Shortest Violation Traces in Model Checking Based on Petri Net Unfoldings and SAT – 236

Modelling Opacity using Petri Nets – 236

PHARMACOLOGY

Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220

PHASE CONJUGATION

A Novel Phase Conjugator for Retrodirective Array Application – 84

PHASE CONTROL

Optimum Amplitude and Phase Control for an Adaptive Linear Array Using a Genetic Algorithm – 65

Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

PHASE SHIFT CIRCUITS

An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

PHASED ARRAYS

A Fast and Accurate Scheme for Calibration of Active Phased-array Antennas – 117

Computation of Radar Cross Section of Waveguide Arrays – 99

Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface – 66

Digital Phased Array Architectures for Radar and Communications Based on Off-the-Shelf Wireless Technologies – 134

Experimental Validation of a Neural Network Direction Finder – 142

Infinite Phased Array Analysis Using FDTD Periodic Boundary Conditions: Pulse Scanning in Oblique Directions – 265

Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems – 91

Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

PHENOL FORMALDEHYDE

How to Prevent Runaway Reactions. Case Study: Phenol-Formaldehyde Reaction Hazards – 190

PHENOMENOLOGY

Jefferson Lab Phenomenology: An Overview – 277

PHENOTYPE

Neoplastic Consequences of a Mutator Phenotype in Human Breast Epithelial Cells: A Prospective Analysis – 226

PHOTOCHEMICAL REACTIONS

Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

PHOTOELECTRON SPECTROSCOPY
Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane – 52

PHOTOMETERS
Alternate Configurations for Blocked Impurity Band Detectors – 262

High Responsivity Tunable Step Quantum Well Infrared Photodetector – 165

Hybrid Molecular and Spin-Semiconductor Based Research – 168

Millimeter-wave Photodetection and Direct Integration with Microstrip Slot Antenna Array – 91

PHOTONICS
Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials – 146

Photonic Analog-to-Digital Conversion Technology – 133

PHOTONS
Design Studies for Flux and Polarization Measurements of Photons and Positrons for SLAC Proposal E166: An Experiment to Test Polarized Positron Production in the FFTB – 286

Shedding Light on the Battlefield: Tactical Applications of Photonic Technology – 167

Silicon-Based Visible/Near-Infrared Affordable Missile Warning – 292

PHOTOPRODUCTION
Charged Pion Photoproduction from Hydrogen and Deuterium at Jefferson Lab – 277

PHOTORECEPTORS
Hybrid Molecular and Spin-Semiconductor Based Research – 168

PHOTORESISTS
UV Baked/Cured Photoresist Used as a Sacrificial Layer in MEMS Fabrication – 280

PHYSICAL EXERCISE
Do the Effects of Exercise on Breast Cancer Prevention Vary With Environment – 213

Lessons Learned: The 'Pale Horse' Bioterrorism Response Exercise – 214

PHYSICAL OPTICS
A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108

Development of Eight Meters Inverse Cosecant Square Reflector Antenna – 67

Efficient and Accurate Inclusion of Radomes into Antenna Analysis – 71

PHYSICS
NASA Celebrates the World Year of Physics – 306

PHYSIOLOGICAL EFFECTS
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 229

PHYSIOLOGICAL RESPONSES
Health Impact of Nitric Oxide: Effects on Lung Function and Cellular and Biochemical Processes in Healthy Humans – 179

PHYSIOLOGY
Elastic Response of Crimped Collagen Fibrils – 228

PIEZOELECTRIC TRANSDUCERS
Low Frequency Sonar Countermeasure – 139

PIGMENTS
Pigments With Potential for Adaptable Optical Properties – 51

PILOT PERFORMANCE
Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs) – 231

PILOTLESS AIRCRAFT
Simulations of Diversity Techniques for Urban UAV Data Links – 11

PIONS
Charged Pion Photoproduction from Hydrogen and Deuterium at Jefferson Lab – 277

PIPES (TUBES)
Inspection of Fusion Joints in Plastic Pipe – 52

PLANAR STRUCTURES
A New Time Domain Analysis of Vertical Dipole in the Vicinity of a Planar Dielectric Interface – 114

Discrete Mode Matching Method for the Analysis of Quasi-planar Structures – 145

Higher-order Impedance Boundary Conditions for Complex Layered Planar Coatings – 130

Metallic Zone Plates for Sectoral Horns – 119

Planar Handset Antennas with Electronically Steerable Parameters – 105

Planar Trapezoidal and Pentagonal Monopoles with Impedance Bandwidths in Excess of 10:1 – 88

Quasi-static Analysis of Asymmetric Cylindrical Coplanar Waveguide – 151

Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems – 91

PLANE WAVES
Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials – 132

Numerical Calculation of the Volterra Integral Equation for a Time-varying Medium – 109

Scattering of Plane Waves by Two-Dimensional Periodic Impedance Surface – 85

The Multilevel Plane Wave Time Domain Algorithm for the Fast Analysis of Transient Scattering Phenomena – 254

Transient Plane Wave Scattering from Objects Near Lossy Ground with FDTD – 150

PLANETARY GEOLOGY
A Viable Scheme for Elemental Extraction and Purification Using In-Situ Planetary Resources – 318

Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

PLANETARY METEOROLOGY
Solar Cycle/Seasonal Variations of H, D, H2 and He Distributions and Escape on Mars as Determined by the Mars Thermosphere Global Circulation Model (MTGCM) – 324

PLANETARY QUARANTINE
Interim Report of the Defense Science Board Task Force on SARS Quarantine – 226

PLANNING
A Model-Based Approach to Battle Execution Monitoring – 302

PLASMA CURRENTS
A Detection of the Same Hot Plasma in the Corona: During a CME and Later at Ulysses – 192

PLASMA FLUX MEASUREMENT
Numerical Solution of Plasma Fluid Equations Using Locally Refined Grids – 294

PLASMA GENERATORS
Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

PLASMA JETS
3-D GRMHD Simulations of Disk-Jet Coupling and Associated Variabilities and Emission – 316

Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

PLASMA WAVES
Investigation of Characteristics of High-Power Wide-Band Plasma-Filled Traveling Wave Tubes (TWT) – 295

PLASMAPAUSE
IMAGE-POLAR Concurrent Plasmapause Observations – 195

PLASMAS (PHYSICS)
Volume and Surface Plasmas – 296

PLASMASPHERE
Thermal N+ in the Inner Magnetosphere – 295

PLASTIC PROPERTIES
Inspection of Fusion Joints in Plastic Pipe – 52

PLUTONIUM
Disposal of True Waste from the Plutonium Finishing Plant in Pipe Overpack Containers to WIPP Including New Security Requirements – 187

POLAND
International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004 – 54

POLAR REGIONS
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

POLARIMETRY
A Novel Design of an Ultra-Fast Wideband Polarimetric Radar – 107

Polarimetric Backscatter Characterization of Road Surface Faults at Millimeterwave Frequencies – 80

Polarimetric Radar Measurements for Vehicle Control and Warning Applications – 305

Radar Polarimetry – 165

Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62

POLARIZATION CHARACTERISTICS
Multi-band Antennas – 65

POLARIZATION (CHARGE SEPARATION)
Efficient MoM Analysis of Polarization Selective Surfaces Using Trefoil Knot Arrays – 293

POLARIZATION
Design Studies for Flux and Polarization Measurements of Photons and Positrons for SLAC Proposal E166: An Experiment to Test Polarized Positron Production in the FFTB – 286

Measurements of Branching Fraction, Polarization, and Direct CP-Violating Asymmetry in B(sup +) --\g K*(sup 0) (rho)(sup +) Decays – 283

POLARIZED ELECTROMAGNETIC RADIATION
An Improved Renormalization Technique for Profile Inversion – 267

Omnidirectional-dual Polarized Antenna for Wireless Indoor Applications at Millimeter Waves – 90

POLARIZERS
Dual-band Compact Square Waveguide Corrugated Polarizer – 112

Rational Krylov Reduced Order Modeling of Frequency Selective Surfaces Through the Blazing Onset Using Woodbury Singularity Extraction – 265

POLICIES
Interim Report of the Defense Science Board Task Force on SARS Quarantine – 226

Iraq and Failures in U.S. Compellence Policy 1990-2003 – 279

POLLUTION CONTROL
Achieving New Source Performance Standards (NSPS) Emission Standards Through Integration of Low-No(x) Burners with an Optimization Plan for Boiler Combustion. Quarterly Technical Progress Report for January 2003 - March 2003 – 183

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000 – 180

RACT/BACT/LAER Clearinghouse (RBLC) Clean Air Technology Center Annual Report for 2003 – 186

Using Non-Thermal Plasma to Control Air Pollutants – 183

POLLUTION MONITORING
Developing Spatially Interpolated Surfaces and Estimating Uncertainty – 182

POLYETHYLENES
Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane – 52

POLYIMIDES
Fundamental Issues Regarding the High Temperature Failure Properties of Graphite/Polyimide Fabric Composites – 40

POLYMERIC FILMS
Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

POLYMERIZATION
Cell Sheet Engineering with Intelligent Polymer-Grafted Surfaces – 54

Morphology and Properties of Model Block and Graft Copolymers – 54

POLYMERS
Cell Sheet Engineering with Intelligent Polymer-Grafted Surfaces – 54

Development of a Conductive-polymer, Composite, Direction-finding Antenna – 106

POLYSTYRENE
Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes – 37

POROSITY
Porous Media Combustors for Clean Gas Turbine Engines – 42

The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

POROUS MATERIALS
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Porous Media Combustors for Clean Gas Turbine Engines – 42

PORTABLE EQUIPMENT
Planar Handset Antennas with Electronically Steerable Parameters – 105

PORTS (OPENINGS)
Symmetry Synthesis of the Multiport Scattering Matrix as a First Step in the Design of Electromagnetic Devices and Components with Bianisotropic Media – 132

POSITION ERRORS
Adaptive Autonomous Navigation of Mobile Robots in Unknown Environments – 238

POSITION (LOCATION)
An Inexpensive Distance Measuring System for Location of Robotic Vehicles – 93

Geographically Locating an Internet Node Using Network Latency Measurement – 242

Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

POWDER (PARTICLES)
Pigments With Potential for Adaptable Optical Properties – 51

POWER GAIN
Numerical Computation on Radiation Characteristics of Square Loop Antennas at the Wrist Position of a Human Body in Personal Wireless Communications – 116

POWER PLANTS
Boiler Materials for Ultrasupercritical Coal Power Plants. Third Quarterly Report April 1 to June 30, 2004 – 48

Oxidation of Mercury Across SCR Catalysts in Coal-Fired Power Plants Burning Low Rank Fuels. Quarterly Progress Report April 1, 2004-June 30, 2004 – 185

PRANDTL NUMBER
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers – 162

PRECIPITATION (METEOROLOGY)
Contributions of TRMM to Our Understanding of Precipitation Processes and Climate Variability – 204

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 1: Temperature. Climatography of the USA No. 85 – 200

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 2: Precipitation. Climatography of the USA No. 85 – 201

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 4: Cooling Degree Days. Climatography of the USA No. 85 – 202

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 5: Divisional Maps, 1971-2000. Climatography of the USA No. 85 – 201

State Monthly Temperature, Precipitation, and Degree Days 1971-2000 (and Previous Normals Periods). Section 1: State Maps, 1971-2000. Historical Climatography Series No. 4 and 5 – 198

State Monthly Temperature, Precipitation, and Degree Days 1971-2000 (and Previous Normals Periods). Section 2: State Maps, 1931-2000. Historical Climatography Series No. 4 and 5 – 198

USA Climate Normals, 1971-2000. Monthly Precipitation Probabilities and Quintiles, 1971-2000. Climatography of the USA No. 81. Supplement No. 1 – 203

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Cooling Degree Days Weighted by Population (2000 Census) 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 5-2 – 200

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Heating Degree Days Weighted by Population (2000 Census) 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 5-1 – 198

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Precipitation Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-2 – 199

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Temperature and Precipitation Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-3 – 199

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Temperature Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-1 – 199

PREDICTION ANALYSIS TECHNIQUES

Science-Based Prediction for Complex Systems – 275

The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

PREDICTIONS

Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion – 45

PREFLIGHT OPERATIONS

STS Derived Exploration Launch Operations – 22

PREMIXING

Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43

PRESSURE VESSELS

Distributed Sensing of Composite Overwrapped Pressure Vessel Using Fiber-Bragg Gratings at Ambient and Cryogenic Temperatures – 39

PRESSURIZED WATER REACTORS

Dismantling of the Upper RPV Components of the Karlsruhe Multi-Purpose Research Reactor (MZFR), Germany – 291

PREVENTION

Do the Effects of Exercise on Breast Cancer Prevention Vary With Environment – 213

Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

PRINTED CIRCUITS

A New Genetic-Algorithm-based Frequency Selective Surface Design for Dual Frequency Applications – 145

PRINTING

Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP) – 49

PRIORITIES

Uncertainties in the Analytic Hierarchy Process – 272

PROBABILITY THEORY

A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data – 270

Design and Evaluation of a QoS-Adaptive System for Reliable Multicasting – 82

Robust Control Design for Systems With Probabilistic Uncertainty – 18

PROBLEM SOLVING

Collaborative Assistant for Rapid Knowledge Formation and Reasoning – 303

PROCEDURES

Telemarketing: Implementation of the National Do-Not-Call Registry – 232

PRODUCT DEVELOPMENT

Quiet Plan for Tomorrow's Jet Engines – 17

PROGRAM VERIFICATION (COMPUTERS)

Computing Shortest Violation Traces in Model Checking Based on Petri Net Unfoldings and SAT – 236

Extending the Horizons of DSE (GC6) – 234

Notations for the Specification and Verification of Composite Web Services – 304

PROGRAMMING LANGUAGES

Black Tie Optional: Modeling Programming Language Concepts – 235

Component Composition for Embedded Systems Using Semantic Aspect-Oriented Programming – 245

Notations for the Specification and Verification of Composite Web Services – 304

Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology – 243

PROJECT MANAGEMENT

Oak Ridge National Laboratory Radiation Control Program-Partners in Site Restoration – 278

PROJECT PLANNING

Assessment of the NASA AvSTAR Project Plan – 1

PROPAGATION

Causality and Restrictions on the Initial-Boundary Conditions for Signal Propagation in Attenuating Medium – 147

PROPELLERS

Performance of Propeller 4381 in Crashback – 160

PROPULSION SYSTEM CONFIGURATIONS

A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

Materials Requirements for Advanced Propulsion Systems – 35

Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module – 33

Solar Electric and Chemical Propulsion for a Titan Mission – 32

Trial by Fire – 25

PROPULSION SYSTEM PERFORMANCE

Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module – 33

SMART Use for Electric Propulsion – 35

Solar Electric and Chemical Propulsion for a Titan Mission – 32

Trial by Fire – 25

PROSTATE GLAND

Development of Artificial Antigen Presenting Cells for Prostate Cancer Immunotherapy – 207

Gangliosides During Tumor Progression in Patients With Prostate Cancer – 209

Regulation of TRAIL-Mediated Apoptosis in Prostate Cancer by Overexpression in XIAP – 223

PROTECTION
Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter – 43
Homeland Security: Protecting Airliners from Terrorist Missiles – 12

PROTECTIVE CLOTHING
Bond Testing for Effects of Silicone Contamination – 173
Protective Clothing Based on Permselective Membrane and Carbon Adsorption – 230

PROTECTIVE COATINGS
Simulated Space Environment Effects on Tether Materials with Protective Coatings – 37

PROTEINS
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221
Hybrid Molecular and Spin-Semiconductor Based Research – 168
Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206
Liquid Between Macromolecules in Protein Crystals: Static Versus Dynamics – 192
Protein Kinase Pathways That Regulate Neuronal Survival and Death – 208
Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210
The Mechanism of Retinoblastoma Protein-Mediated Terminal Cell Cycle Arrest – 218

PROTOCOL (COMPUTERS)
Assessing the Risk and Valie of Adopting Emerging and Unstable Web Services Specifications – 234
Design and Evaluation of an Efficient Reliable Manycast Protocol for Ad-hoc Networks – 83
Device Profiling Analysis in Device-Aware Network – 249
Performance Analysis of Mobile Ad Hoc Networking Routing Protocols – 261

PROTONS
Hard Photodisintegration of a Proton Pair in 3He – 286
Single-Spin Polarization Effects and the Determination of Timelike Proton Form Factors – 286

PROTOTYPES
Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs) – 231

PSYCHOLOGY
Modelling Intention Recognition for Intelligent Agent Systems – 252

PUBLIC HEALTH
Interim Report of the Defense Science Board Task Force on SARS Quarantine – 226

PULSARS
Emission From Rotation-Powered Pulsars and Magnetars – 312
The Chandra X-Ray Observatory: The Past, the Present, and the Future – 314

PULSE DETONATION ENGINES
Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163
Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

PULSE DURATION
Long-Lag, Wide-pulse Gamma-Ray Bursts – 312

PULSEJET ENGINES
Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

PURIFICATION
A Viable Scheme for Elemental Extraction and Purification Using In-Situ Planetary Resources – 318
Production and Purification of Refolded Recombinant Human IL-7 From Inclusion Bodies – 227

QUADRATURES
Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna – 205

QUALITY CONTROL
Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors – 139

QUANTUM CHROMODYNAMICS
Charged Pion Photoproduction from Hydrogen and Deuterium at Jefferson Lab – 277

QUANTUM COMPUTATION
Experimental Implementation of Efficient Linear Optics Quantum Computation – 138
Student Support for Quantum Computation With Superconducting Quantum Devices – 280

QUANTUM ELECTRONICS
Experimental Implementation of Efficient Linear Optics Quantum Computation – 138

QUANTUM NUMBERS
Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures – 297

QUANTUM OPTICS
Experimental Implementation of Efficient Linear Optics Quantum Computation – 138

QUANTUM THEORY
Polymer Waveguides for Quantum Information – 55
Student Support for Quantum Computation With Superconducting Quantum Devices – 280

QUANTUM WELLS
High Responsivity Tunable Step Quantum Well Infrared Photodetector – 165

QUANTUM WIRES
A Novel InAs Quantum Wire System – 139

RADAR ABSORBERS
Fundamental Limit on the Performance of Radar Absorbing Materials – 109

RADAR ANTENNAS
Radar Polarimetry – 165

RADAR BEAMS
Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

RADAR CROSS SECTIONS
A Parametric Approach to Radar Processing of Reentry Vehicle Signatures – 95
Computation of Radar Cross Section of Waveguide Arrays – 99
Scattering from Dielectric Bodies – 69
The World's First Comparison of Outdoor RCS Test Ranges – 143

RADAR DETECTION
Advance Path Measurement for Automotive Radar – 102
Radar Search and Detection With the CASA 212 S43 Aircraft – 165
The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces – 253

RADAR ECHOES
Wideband Radar Echoes from Cylindrical Rods – 74

RADAR IMAGERY
A Fast Multilevel Domain Decomposition Algorithm for Radar Imaging – 103
A Novel Design of an Ultra-Fast Wideband Polarimetric Radar – 107
An Optimal Algorithm for Radar Imaging – 84
Battle Damage Assessment Using Inverse Synthetic Aperture Radar (ISAR) – 164
Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform – 103
Ultrawide-band Noise Synthetic Aperture Radar: Theory and Experiment – 87

RADAR MEASUREMENT
A Parametric Approach to Radar Processing of Reentry Vehicle Signatures – 95

Polarimetric Radar Measurements for Vehicle Control and Warning Applications – 305

RADAR NAVIGATION

Array Configurations and Wideband Radiators Suitable for Shared Apertures – 83

Polarimetric Radar Measurements for Vehicle Control and Warning Applications – 305

RADAR SCATTERING

Scattering from Dielectric Bodies – 69

The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces – 253

RADAR SIGNATURES

Complex Natural Resonances Extracted from Radar Signatures Measured in Time Domain with UWB Laboratory System – 65

RADAR TARGETS

Scattering from Dielectric Bodies – 69

RADARSAT

Design Concepts for the Radarsat-2 SAR Antenna – 88

RADIAL DISTRIBUTION

Study of e(sup +)e(sup -) --\g (pi)(sup +)(pi)(sup -)(pi)(sup 0) Process Using Initial State Radiation with BaBar – 283

RADIANCE

The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

RADIATION ABSORPTION

Advancement of Methodology for RF Dosimetry – 126

RADIATION DISTRIBUTION

Broad Band Patch Antennas Using a Wedge-shaped Air Dielectric Substrate – 124

Synthesis of Shaped-Beam Pattern for Mobile Antenna – 143

RADIATION DOSAGE

Nanosensors to Monitor Space Radiation Exposure – 326

Site-Specific Analysis of a Spent Nuclear Fuel Transportation Accident – 184

RADIATION EFFECTS

Effects of Nuclear Interactions in Space Radiation Transport – 229

Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements – 156

RADIATION MEASUREMENT

Measurement of Radiation Efficiency of Antennas in the Vicinity of Human Head Model Proposed By COST 244 – 131

The Human Exploration Initative: Space Radiation Measurement Needs – 306

RADIATION PROTECTION

Materials Challenges in Space Exploration – 36

Oak Ridge National Laboratory Radiation Control Program-Partners in Site Restoration – 278

Release of Residues from Melting Norm-Contaminated Steel Scrap. A German Approach – 50

RADIATION SHIELDING

In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

RADIATION SOURCES

Far Field Analysis of Radiation Sources – 110

RADIATION THERAPY

Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220

RADIATION TRANSPORT

Effects of Nuclear Interactions in Space Radiation Transport – 229

RADIO ASTRONOMY

Emission From Rotation-Powered Pulsars and Magnetars – 312

Recent Results on Ultra-Luminous X-ray Sources – 313

RADIO COMMUNICATION

3D Super Resolution Algorithm for Analysis of Multi-path Propagation Structure – 148

Applications of Smart Antennas in Cellular Networks – 75

RADIO DIRECTION FINDERS

Experimental Validation of a Neural Network Direction Finder – 142

RADIO EMISSION

Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content – 313

RADIO FREQUENCIES

Active Integrated Antennas for New RF Architectures – 64

Advancement of Methodology for RF Dosimetry – 126

Design and Simulation of Active Spiral Inductors for RF Integrated Circuits – 145

Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments – 62

Low Field Accelertor Structure Couplers and Design Techniques – 284

Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

Reflection and Transmission Properties of Reinforced Concrete Walls – 93

RF Stabilization for Storage of Antiprotons – 292

Significant RX Antenna Diversity Gain in 30 GHz Broadband Radio Channels Subject to Fading – 85

Superconducting RF Systems and Cryogenics. Subgroup Summary Report – 275

Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

RADIO JETS (ASTRONOMY)

Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content – 313

RADIO RECEIVERS

Pipeline Analog-to-Digital Converters for Wide-Band Wireless Communications – 140

RADIO SOURCES (ASTRONOMY)

An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

RADIO STARS

Radio Star Flux Density Expressions for Accurate Antenna Gain Measurements – 128

RADIO TELESCOPES

An Overview of the Green Bank Telescope – 311

RADIO TRANSMISSION

Measurement of Transmission Coefficients of Radiowaves through Building Materials in the 5.8 GHz Frequency Band – 142

RADIO WAVES

Radio Wave Studies of Irregular Ionospheric Phenomena at Midlatitude – 194

Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components – 153

RADIOACTIVE ISOTOPES

Release of Residues from Melting Norm-Contaminated Steel Scrap. A German Approach – 50

RADIOACTIVE WASTES

Differences and Similarities in Andra's Assessment of Activities Carried Out by Radioactive Waste Generators and Affecting the Quality of IL-LL Short-Lived Waste Packages and HL-IL Long-Lived Waste Packages – 187

Dismantling of the Upper RPV Components of the Karlsruhe Multi-Purpose Research Reactor (MZFR), Germany – 291

Envirocare of Utah: Expanding Waste Acceptance Criteria to Provide Low-Level and Mixed Waste Disposal Options – 187

Estimation of Radiolytic Gas Generation Rate for Cylindrical Radioactive Waste Packages - Application to Spent Ion Exchange Resin Containers – 41

Rail Access to Yucca Mountain: Critical Issues – 191

Regulatory Approaches for Solid Radioactive Waste Storage in Russia – 181

Six Sigma Evaluation of the High Level Waste Tank Farm Corrosion Control Program at the Savannah River Site – 41

RADIOLOGY

Oak Ridge National Laboratory Radiation Control Program-Partners in Site Restoration – 278

RADIOMETERS

The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

RADIOMETRIC CORRECTION

Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps – 169

RADIOTELEPHONES

Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

Wireless Network Security: Design Considerations for an Enterprise Network – 81

RAIL TRANSPORTATION

Rail Access to Yucca Mountain: Critical Issues – 191

RAIN

Lightning Contribution to Improvement of Passive Microwave Vertical Structure and Rainfall Estimation – 196

RAMAN SPECTRA

University of South Carolina CB Support, Basic Research in Materials and Techniques for Optical Computing Standoff Sensors – 271

RANDOM NOISE

ISAR Turntable Experiments Using a Coherent Ultrawideband Random Noise Radar – 84

RANDOM VARIABLES

Robust Control Design for Systems With Probabilistic Uncertainty – 18

RANGEFINDING

Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Uni-polar Scanning Method for Near-field Measurements of Antennas – 154

RATINGS

A Review of Man-Rating in Past and Current Manned Space Flight Programs – 21

The Reliability and Validity of the Outcome Rating Scale: A Replication Study of a Brief Clinical Measure – 214

RATS

Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

RAY TRACING

A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves – 269

Application of Differential Geometry to Acoustics: Development of a Generalized Paraxial Ray-Trace Procedure from Geodesic Deviation – 273

Bistatic Scattering Characterization of a Complex Object – 87

REACTANCE

Revisited Generalized Wood Anomalies – 239

REACTION KINETICS

Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion – 45

Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

REACTOR CORES

Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module – 33

REACTOR TECHNOLOGY

Sabatier Methanation Reactor for Space Exploration – 321

REAL TIME OPERATION

An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Aspects in Analysis and Model-Based Sound Synthesis of Plucked String Instruments – 290

Femtosecond Real-Time Probing of Energetic Reactions: Complex Organics and Advanced Techniques – 291

Gas System Upgrade for the BaBar IFR Detector at SLAC – 283

Twist Model Development and Results From the Active Aeroelastic Wing F/A-18 Aircraft – 15

Two Trees: Migrating Fault Trees to Decision Trees for Real Time Fault Detection on International Space Station – 306

RECEIVERS

Computer Simulated and Analytical Results of MSE in Adaptive Integrated Reduced-complexity Receiver for Multipath DS/CDMA Systems – 73

Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60

Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92

Integrated Microphotonic Receiver for Ka-Band – 140

Interference Cancellation Systems for Electromagnetically Dense Platforms – 148

Low Complexity Space-frequency Rake Receivers for WCDMA – 131

RECEPTION DIVERSITY

A Simple Theoretical Model for Polarization Diversity Reception in Wireless Mobile Environments – 68

Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems – 90

Significant RX Antenna Diversity Gain in 30 GHz Broadband Radio Channels Subject to Fading – 85

Simulation Performance of Multiple-Input Multiple-Output Systems Employing Single-Carrier Modulation and Orthogonal Frequency Division Multiplexing – 279

RECIPROCITY THEOREM

Reciprocity in Perfectly Matched Absorbers – 278

RECONNAISSANCE AIRCRAFT

MAV State-of-the-Art and Technology Drivers – 11

RECORDS MANAGEMENT

Integrity Through Mediated Interfaces – 248

RECTANGULAR WAVEGUIDES

Design of a TEM Waveguide for Ultra-wideband Applications – 154

Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

Precise Dielectric Properties Determination of Laminar-shaped Materials in a Partially-filled Waveguide – 146

RECYCLING

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 30

RED SHIFT

Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

REENTRY VEHICLES

A Parametric Approach to Radar Processing of Reentry Vehicle Signatures – 95

REFERENCE ATMOSPHERES

GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

REFINING

Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs) – 231

REFLECTANCE

Analysis of Reflection from Multilayer Cylinder by Using a Black-hole Approach – 315

Collaborative Investigations of Shallow Water Optics Problems – 270

Reflection and Transmission Properties of Reinforced Concrete Walls – 93

REFLECTOMETERS

Vectorial Waveguide Reflectometer for Dielectric Characterization of Materials Under Power Microwaves – 147

REFLECTOR ANTENNAS

A Reflector Antenna with High Gain and Wide Angle Beam Steering Capabilities – 76

A Shaped Relector Antenna for Mobile Communications – 85

Accurate and Efficient Computation of the Periodic Green's Function in Multilayered Media via a Hybrid Spectral/Spatial Summation with Optimized Complex Images – 146

An Analysis of a Dual Gridded Reflector Antenna – 67

An Overview of the Green Bank Telescope – 311

ARISE: A Challenging 25-m Space Antenna Design – 88

Design and Characterization of Diagonal Horn Antennas Using UCLA Bi-Polar Near-Field Measurement and Imaging Facilities – 155

Design Features of the Large Millimeter Telescope (LMT) – 101

Design of a Focal Plane Dielectric Rod Array for Feeding a Multiple Beams Reflector Antenna – 76

Design of Cylindrical Reflector Antennas with Caustic-located Array Feeding – 60

Design of Two-layer Printed Reflect Arrays for Bandwidth Enhancement – 78

Development of Eight Meters Inverse Cosecant Square Reflector Antenna – 67

EIRP and Power Efficiency of Reconfigurable Active Transmit Antennas – 77

IEEE Antennas and Propagation Society International Symposium – 83

Ka-Band Beam Steering Reflectarray Study – 86

Nickel Sandwich Technology for High Precision Reflector Antennas – 97

Rigorous Analysis of Practical Reflector Antennas – 80

REFLECTORS

A Confocal Reflector System – 77

Analysis and Design of a Planar Two-Dimensional Retrodirective Array Reflector – 86

On Inflatable Antenna State of the Art Precision – 100

Shaped Reflector and Multi-feed Paraboloid: A Comparison – 60

The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII – 104

The AstroMesh Deployable Reflector – 154

REFLEXES

Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

REFUELING

Limited Evaluation of Automated Aerial Refueling Algorithm (Project Self Serve) – 7

REGIONS

OR Modeling of a Conceptual System of Systems for Maritime Littoral Dominance in 2020 – 272

Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES) – 289

REGOLITH

Characterization Strategies and Requirements for Lunar Regolith Simulant Materials – 322

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Present Status of Lunar Regolith Simulants, Workshop Overview and Objectives – 322

REGRESSION ANALYSIS

Regression Equations for Estimating Flood Flows for the 2-, 10-, 25-, 50-, 100-, and 500-Year Recurrence Intervals in Connecticut – 237

The Effect of the USA Naval Academy Foundation Preparatory Program on the Performance of Naval Academy Midshipmen – 263

REGULATIONS

Connecting the Globe: A Regulator's Guide to Building a Global Information Community – 63

RELATIVISTIC ELECTRON BEAMS

Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

RELIABILITY ANALYSIS

Coherent Seeker Guided Antiship Missile Performance Analysis – 167

Demonstration and Validation of the Excited Dielectric Test (Trade Name) Method to Detect and Locate Defects in Aircraft Wiring Systems – 141

Performance Analysis of Mobile Ad Hoc Networking Routing Protocols – 261

Vehicle Integrated Performance Analysis, the VIPA Experience: Reconnecting with Technical Integration – 175

RELIABILITY

A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data – 270

Design and Evaluation of a QoS-Adaptive System for Reliable Multicasting – 82

The Reliability and Validity of the Outcome Rating Scale: A Replication Study of a Brief Clinical Measure – 214

REMOTE CONTROL

Remote System Technologies for Deactivating Hanford Hot Cells – 141

REMOTE SENSING

ISAR Turntable Experiments Using a Coherent Ultrawideband Random Noise Radar – 84

On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

RESCUE OPERATIONS

Nanoparticle-Mediated Rescue of p53 Through Targeted Degradation of MDM2 – 215

RESEARCH AND DEVELOPMENT

Cooperative Agreement in Space Sciences (CPSS) NCC5-637 – 305

High Speed Research Program Structural Acoustics Multi-Year Summary Report – 290

Research Opportunities Supporting the Vision for Space Exploration from the Transformation of the Former Microgravity Materials Science Program – 36

Strategic Research Partnerships for Exploration – 319

The Defense Science Board 2001 Summer Study on Defense Science and Technology – 61

RESEARCH PROJECTS

Research Supporting Satellite Communications Technology – 110

RESIDUAL GAS

Residual Gas Effects on Detached Solidification in Microgravity – 297

RESIDUES

Disposal of True Waste from the Plutonium Finishing Plant in Pipe Overpack Containers to WIPP Including New Security Requirements – 187

RESONANT FREQUENCIES

A Multi-frequency Microstrip-fed Shorted Square Ring Slot Line Antenna – 71

A New Method to Compute the Fundamental Mode Resonant Frequencies of Microstrip Annular Rings – 121

A T-Strip Loaded Rectangular Microstrip Patch Antenna for Dual-Frequency Operation – 112

Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

RESONATORS
Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159
Moment Method Based Analysis of Dielectric-resonator Antennas – 122
Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

RESOURCES MANAGEMENT
Dynamic Allocation of Servers in a Grid Hosting Environment – 237

RESPIRATORY SYSTEM
Computational Analysis and Simulation of Toxic Particle Deposition in the Human Respiratory System – 56

RESTORATION
Oak Ridge National Laboratory Radiation Control Program-Partners in Site Restoration – 278

RETINA
The Mechanism of Retinoblastoma Protein-Mediated Terminal Cell Cycle Arrest – 218

RETIREMENT FOR CAUSE
ISOP To Focus on Shuttle Transition – 26

REUSE
Reuse International Space Station (ISS) Modules as Lunar Habitat – 318

REYNOLDS NUMBER
Evolving Computational Capability for Ship Hydrodynamics – 264

RICCATI EQUATION
An Improved Renormalization Technique for Profile Inversion – 267

RIGID STRUCTURES
Comments on the paper by Zinoviev and Bies 'On Acoustic Radiation by a Rigid Object in a Fluid Flow' – 162

RISK
An Epidemiological Study of Leptospira-Induced Abortion in Mares in Central Kentucky (1990-2004) – 224
Development of Risk Assessment Matrix for NASA Engineering and Safety Center – 304
FLIGHTFAX: Army Aviation Risk-Management Information. Volume 32, Number 12 – 7
Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220
Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

RIVERS
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

ROADS
Polarimetric Backscatter Characterization of Road Surface Faults at Millimeter-wave Frequencies – 80

ROBOTICS
An Inexpensive Distance Measuring System for Location of Robotic Vehicles – 93
Martian Infotech – 26

ROBOTS
Adaptive Autonomous Navigation of Mobile Robots in Unknown Environments – 238
Explosive Chemical Signature-Based Detection of IEDs – 46

ROBUSTNESS (MATHEMATICS)
Broadband, Robust, Low-profile Monopole Incorporating Top Loading, Dielectric Loading, and a Distributed Capacitive Feed Mechanism – 104
Robust Control Design for Systems With Probabilistic Uncertainty – 18

ROCKET ENGINE DESIGN
Technology Challenges for Deep-Throttle Cryogenic Engines for Space Exploration – 33

RODS
Design of a Focal Plane Dielectric Rod Array for Feeding a Multiple Beams Reflector Antenna – 76
Wideband Radar Echoes from Cylindrical Rods – 74

ROOMS
Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

ROTATION
Possible Role of the Oceans in the Variations of Length of Day at High Frequencies – 310

RUNWAYS
Evaluation of Light Emitting Diode Linear Source Devices – 5

S MATRIX THEORY
A New Hybrid Mode-matching Method for the Analysis of Inductive Obstacles and Discontinuities – 257
An Inhomogeneous Waveguide Transformer with Hard Walls for the Excitation of Quasi-optical Amplifiers – 115
Symmetry Synthesis of the Multiport Scattering Matrix as a First Step in the Design of Electromagnetic Devices and Components with Bianisotropic Media – 132

SABATIER REACTION
Sabatier Methanation Reactor for Space Exploration – 321

SAFETY
Japanese Beetle Program Manual – 5

SALMONELLA
Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

SAMPLING
Gasoline Vehicle Exhaust Particle Sampling Study – 179

SANDWICH STRUCTURES
Nickel Sandwich Technology for High Precision Reflector Antennas – 97

SANITATION
Review of Marine Corps Expeditionary Force Preventive Medicine Materiel Requirements – 219

SATELLITE ANTENNAS
A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108
Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92
Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems – 91

SATELLITE COMMUNICATION
A Low Loss, Dual Polarized Switch for Polarization State Selection – 124
A Resonant Type Leaky-Wave Antenna Using an Image NRD Guide – 122
Channel Simulation of Leo Satellites – 92
Design and Development of Co-Polarized Ku-band Ground Terminal System for Very Small Aperture Terminal (VSAT) Application – 94
Multi-state Markov Model for Satellite Propagation Channels – 92
Research Supporting Satellite Communications Technology – 110

SATELLITE IMAGERY
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177
The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

SATELLITE OBSERVATION
IMAGE-POLAR Concurrent Plasmapause Observations – 195
The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

SATELLITE TRANSMISSION
Channel Simulation of Leo Satellites – 92

SCALARS
Robust Control Design for Systems With Probabilistic Uncertainty – 18

SCALE MODELS
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Model-Scale Aerodynamic Performance Testing of Proposed Modifications to the NASA Langley Low Speed Aeroacoustic Wind Tunnel – 287

The Co-conical Field Generation System - A 40 GHz Antenna Calibration Cell – 120

SCANNING
Uni-polar Scanning Method for Near-field Measurements of Antennas – 154

SCATTERING CROSS SECTIONS
Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Non-palpable Breast Tumors – 158

SCATTERING
A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves – 269

Bistatic Scattering Characterization of a Complex Object – 87

Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform – 103

Fast Computation of Scattering from (Near-)Resonant Structures – 233

Filtering Characteristics of Thin, Planar 3D Printed Element Arrays – 153

Scattering by Resistively Loaded, Multilayer Frequency Selective Surfaces over Two-octave Bandwidth – 98

Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62

The Hybrid(sup 2)-Method: Combination of the FE/BE Hybrid Method with the UTD – 267

SCHEDULING
A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic – 6

Circadian Rhythms, Fatigue, and Manpower Scheduling – 229

SCHOOLS
California's K-12 Public Schools. How Are They Doing? – 301

SCORING
California's K-12 Public Schools. How Are They Doing? – 301

SCREW DISLOCATIONS
Ab-Initio Simulation of a/2\h110\g Screw Dislocations Gamma-TiAl – 49

SEA ICE
On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

SEA LEVEL
Constraints of Melting, Sea-Level and the Paleoclimate from GRACE – 196

SEA URCHINS
Bio-Derived Photonic Assemblies – 45

SEAMS (JOINTS)
Unraveling the Material Processing Conditions for Optimizing FSW Process – 175

SEARCH RADAR
Radar Search and Detection With the CASA 212 S43 Aircraft – 165

SEAS
Estimation of Geoacoustic Properties in the South China Sea Shelf Using a Towed Source and Vertical Line Hydrophone Array – 288

SECONDARY FLOW
Automated Extraction of Secondary Flow Features – 159

SECURITY
China's Development of Asymmetric Warfare and the Security of Taiwan, Republic of China – 301

Mobile Ubiquitous Security Environment (MUSE) – 250

Secure Distribution of Open Source Information – 302

Use of OpenSSH Support for Remote Login to a Multilevel Secure System – 244

Wireless Network Security: Design Considerations for an Enterprise Network – 81

SEDIMENTS
Compilation of Data Sources Used to Construct Bottom-Sediment Province Maps for the USA East Coast Continental Shelf from Cape Kennedy to Cape Hatteras and for Various Indonesian Waters – 176

SEGMENTS
Closed Form Expression For Mutual Partial Inductance Between Two Skewed Linear Current Segments – 113

SELECTION RULES (NUCLEAR PHYSICS)
Comments on Extracting alpha from B to rho rho – 285

SELECTIVE SURFACES
A Fractal Based FSS with Dual Band Characteristics – 87

A New Genetic-Algorithm-based Frequency Selective Surface Design for Dual Frequency Applications – 145

Accurate and Efficient Computation of the Periodic Green's Function in Multilayered Media via a Hybrid Spectral/Spatial Summation with Optimized Complex Images – 146

Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Rational Krylov Reduced Order Modeling of Frequency Selective Surfaces Through the Blazing Onset Using Wood-bury Singularity Extraction – 265

Scattering by Resistively Loaded, Multilayer Frequency Selective Surfaces over Two-octave Bandwidth – 98

SEMANTICS
Black Tie Optional: Modeling Programming Language Concepts – 235

SEMICONDUCTOR DEVICES
Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

SEMICONDUCTOR LASERS
A Low-Cost, Man-Portable, Free-Space Optics Communications Device for Ethernet Applications – 170

Cryo Power and Heat Transfer – 171

SEMICONDUCTORS (MATERIALS)
Cryo Power and Heat Transfer – 171

Hybrid Molecular and Spin-Semiconductor Based Research – 168

Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures – 297

SENSITIVITY
Computational Fluid Dynamics Based Investigation of Sensitivity of Furnace Operational Conditions to Burner Flow Controls – 159

SENSORS
Array Configurations and Wideband Radiators Suitable for Shared Apertures – 83

SENSORY FEEDBACK
Demonstration of Adaptive Radio Node – 63

SEPARATED FLOW
Flow Over a Body of Revolution in a Steady Turn – 10

Research Instrumentation for Measurements of High-Speed Separated Flows – 170

SEPTUM
Spherical-multipole Analysis of the Field within a Canonical GTEM-cell – 257

SERUMS
Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

SEYFERT GALAXIES
The Chandra X-Ray Observatory: The Past, the Present, and the Future – 314

SHALLOW WATER
Collaborative Investigations of Shallow Water Optics Problems – 270

SHAPE CONTROL
A Prototype Actuator Concept for Membrane Boundary Vibration Control – 176

SHAPE OPTIMIZATION
Shape Reconstruction of a Perfectly Conducting Cylinder Using Real-coded Genetic Algorithm – 266

SHAPES
Shape Sensing a Morphed Wing with an Optical Fiber Bragg Grating – 16

Triple-band Planar Inverted F Antenna – 70

SHEAR STRESS
Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

SHEARING
Novel Optical Diagnostic Techniques for Studying Particle Contact and Deposition Upon a Large Cylinder in a Sheared Suspension – 163

SHIELDING
Interconnect and Packaging Electrical Circuits Network – 124

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

SHIPS
Evolving Computational Capability for Ship Hydrodynamics – 264

SHOCK (PHYSIOLOGY)
Microhematuria Associated With a Special Operations Craft Mission – 225

Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

SHUTTLE DERIVED VEHICLES
Shuttle-Derived Launch Vehicles' Capablities: An Overview – 22

STS Derived Exploration Launch Operations – 22

SIGNAL ANALYSIS
Complex Natural Resonances Extracted from Radar Signatures Measured in Time Domain with UWB Laboratory System – 65

On the Performance of the VESPA Algorithm for Blind Beamforming and Signal Detection of Multi-source Multipath Signals – 73

SIGNAL DETECTION
On the Performance of the VESPA Algorithm for Blind Beamforming and Signal Detection of Multi-source Multipath Signals – 73

SIGNAL FADING
Significant RX Antenna Diversity Gain in 30 GHz Broadband Radio Channels Subject to Fading – 85

SIGNAL PROCESSING
A Parametric Approach to Radar Processing of Reentry Vehicle Signatures – 95

Application of Conjugate Gradient Algorithm to Adaptive Beamforming – 255

Improved Wavelet-Based Beamformers with Dynamic Subband Selection – 256

Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces – 253

Ultrawide-band Noise Synthetic Aperture Radar: Theory and Experiment – 87

Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES) – 289

SIGNAL RECEPTION
Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems – 90

SIGNAL TO NOISE RATIOS
A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

SIGNAL TRANSMISSION
Low Frequency Sonar Countermeasure – 139

SIGNATURES
Database of Material Properties for Optical Signature Modelling – 293

Explosive Chemical Signature-Based Detection of IEDs – 46

SIGNS AND SYMPTOMS
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 229

SILICATES
Reaction Mechanisms of Magnesium Silicates with Carbon Dioxide in Microwave Fields – 41

SILICON CARBIDES
Demonstration of Silicon Carbide Power Devices in Practical Power Conversion Systems – 46

SILICON DIOXIDE
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP) – 49

SILICON NITRIDES
Infrared Characterization of SiN Films on Si for High Speed Electronics Applications – 43

SILICONES
Bond Testing for Effects of Silicone Contamination – 173

Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

SILOXANES
Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes – 37

SIMULATED ANNEALING
Using Adaptive Simulated Annealing to Estimate Ocean Bottom Acoustic Properties from Acoustic Data – 288

SIMULATION
A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data – 270

Ab-Initio Simulation of a/2\h110\g Screw Dislocations Gamma-TiAl – 49

Computational Analysis and Simulation of Toxic Particle Deposition in the Human Respiratory System – 56

DRI internal Wave Simulations – 289

Flight and Aerospace Research: Airborne Simulation and Research Investigations, 1999 - 2004 – 11

Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62

Simulation Modeling and Analysis of Device-Aware Network Architectures – 240

Simulation Performance of Multiple-Input Multiple-Output Systems Employing Single-Carrier Modulation and Orthogonal Frequency Division Multiplexing – 279

Simulations of Diversity Techniques for Urban UAV Data Links – 11

The General NMM Solution for 2-D EMF Problems with Arbitrary Excitations under General Coordinates – 205

Using Agent-Based Modeling to Assess the Impact of Martial Law on a Representative Iraqi Town – 244

SIMULATORS
Development Of A Control Moment Gyroscope Controlled, Three Axis Satellite Simulator, With Active Balancing For The Bifocal Relay Mirror Initiative – 24

SINE WAVES
Surface Wave Scattering by Finite Periodic Structure of Arbitrary Profile in a Ground Plane: TE case – 84

SINGLE CRYSTALS
Analyses of Elemental Partitioning in Advanced Nickel-Base Superalloy Single Crystals – 14

SINGLE EVENT UPSETS
Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digital Converter – 140

SITUATIONAL AWARENESS
An Assessment of Alternative SAR Display Formats: Orientation and Situational Awareness – 302

Human Factors Assessment of the UH-60M Crew Station During the Early User Demonstration Number 2 (EUD2) – 12

Human Interfaces for Space Situational Awareness – 25

SIZE DISTRIBUTION
Uni-polar Scanning Method for Near-field Measurements of Antennas – 154

SKEWNESS
Closed Form Expression For Mutual Partial Inductance Between Two Skewed Linear Current Segments – 113

SLEEP DEPRIVATION
Circadian Rhythms, Fatigue, and Manpower Scheduling – 229

SLEEVES
A Novel Sleeve Monopole with Broad Bandwidth – 74

The Sleeve-cage Monopole and Sleeve Helix for Wideband Operation – 80

SLOPES
Stochastic Cross-Sections Based on the Small Slope Approximation: Theory – 269

SLOT ANTENNAS
A Multi-frequency Microstrip-fed Shorted Square Ring Slot Line Antenna – 71

A New Broad-band, Dual-frequency Coplanar Waveguide Fed Slot-Antenna – 66

Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas – 91

Development of a Tri-plate Ring-Slot Antenna for mm-Wave Frequency Band – 99

Microstrip Line Fed Slot Antenna with PBG Superstrate – 89

Millimeter-wave Photodetection and Direct Integration with Microstrip Slot Antenna Array – 91

Moment Method Analysis of Parallel Plate Slot Antennas – 66

Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

SLOTS
Designs of Broadband Microstrip Antennas with Embedded Slots – 126

SLURRIES
Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP) – 49

SMART STRUCTURES
Smart Structures for Vibration Control on Long-Term Space Exploration and Habitation Missions – 323

SOFT GAMMA REPEATERS
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Emission From Rotation-Powered Pulsars and Magnetars – 312

Observations of Soft Gamma Repeaters – 314

SOFTWARE DEVELOPMENT TOOLS
Code Review and Personality: Is Performance Linked to MBTI Type – 236

SOFTWARE ENGINEERING
Code Review and Personality: Is Performance Linked to MBTI Type – 236

Use of OpenSSH Support for Remote Login to a Multilevel Secure System – 244

SOILS
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 323

SOLAR ACTIVITY EFFECTS
A Mechanism For Solar Forcing of Climate: Did the Maunder Minimum Cause the Little Ice Age? – 203

Solar Cycle/Seasonal Variations of H, D, H2 and He Distributions and Escape on Mars as Determined by the Mars Thermosphere Global Circulation Model (MTGCM) – 324

SOLAR ACTIVITY
How Large Scales Flows May Influence Solar Activity – 325

SOLAR ARRAYS
ACTS Battery and Solar Array Assembly On-Orbit Measured Performance – 27

SOLAR CELLS
Manufacture of Solar Cells on the Moon – 57

SOLAR CONVECTION (ASTRONOMY)
How Large Scales Flows May Influence Solar Activity – 325

SOLAR CYCLES
A Mechanism For Solar Forcing of Climate: Did the Maunder Minimum Cause the Little Ice Age? – 203

Solar Cycle/Seasonal Variations of H, D, H2 and He Distributions and Escape on Mars as Determined by the Mars Thermosphere Global Circulation Model (MTGCM) – 324

Thermal N+ in the Inner Magnetosphere – 295

SOLAR ELECTRIC PROPULSION
Solar Electric and Chemical Propulsion for a Titan Mission – 32

SOLAR FLARES
Compact Flares and CMEs – 309

Slow-rise and Fast-rise Phases of an Erupting Solar Filament and Flare Emission Onset – 325

SOLAR INTERIOR
Seismic Study of the Solar Interior: Inferences from SOI/MDI Observations During Solar Activity – 325

SOLAR MAGNETIC FIELD
How Large Scales Flows May Influence Solar Activity – 325

SOLAR PROMINENCES
Slow-rise and Fast-rise Phases of an Erupting Solar Filament and Flare Emission Onset – 325

SOLAR SYSTEM
GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

Space Resource Utilization and Extending Human Presence Across the Solar System – 319

SOLAR WIND
A Detection of the Same Hot Plasma in the Corona: During a CME and Later at Ulysses – 192

Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

SOLDERING
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

SOLID ELECTROLYTES
Solid Acid Based Fuel Cells – 178

SOLID SUSPENSIONS
Novel Optical Diagnostic Techniques for Studying Particle Contact and Deposition Upon a Large Cylinder in a Sheared Suspension – 163

SOLID WASTES
Innovative Integrated Approach to Minimizing Gypsum and Pyrite Wastes by Conversion to Marketable Products – 42

Regulatory Approaches for Solid Radioactive Waste Storage in Russia – 181

SOLIDIFICATION
Residual Gas Effects on Detached Solidification in Microgravity – 297

SOLIDS
Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings – 55

Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

SONAR
Low Frequency Sonar Countermeasure – 139

Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES) – 289

SOUND GENERATORS
Low Frequency Sonar Countermeasure – 139

SOUND WAVES
Low Frequency Sonar Countermeasure – 139

SOUNDING
Improvement of an Acoustic Sounder Device Used to Measure Atmospheric Turbulence – 194

SPACE CAPSULES
From Mercury to CEV: Space Capsules Reemerge – 31

SPACE COLONIES
Are we There Yet? ... Developing In-Situ Fabrication and Repair (ISFR) Technologies to Explore and Live on the Moon and Mars – 18

SPACE COMMERCIALIZATION
Strategic Research Partnerships for Exploration – 319

SPACE ENVIRONMENT SIMULATION
Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

Simulated Space Environment Effects on Tether Materials with Protective Coatings – 37

Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

SPACE ERECTABLE STRUCTURES
Autonomous Assembly of Modular Structures in Space and on Extraterrestrial Locations – 251

SPACE EXPLORATION
A Viable Scheme for Elemental Extraction and Purification Using In-Situ Planetary Resources – 318

Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module – 33

Sabatier Methanation Reactor for Space Exploration – 321

Smart Structures for Vibration Control on Long-Term Space Exploration and Habitation Missions – 323

Strategic Research Partnerships for Exploration – 319

Technology Challenges for Deep-Throttle Cryogenic Engines for Space Exploration – 33

The Human Exploration Initative: Space Radiation Measurement Needs – 306

Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

Trial by Fire – 25

SPACE HABITATS
In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19

SPACE MAINTENANCE
A Strategic Roadmap to Centauri – 19

Are we There Yet? ... Developing In-Situ Fabrication and Repair (ISFR) Technologies to Explore and Live on the Moon and Mars – 18

High Tensile Strength Amalgams for In-Space Repair and Fabrication – 48

Tests Narrowed – 26

SPACE MISSIONS
Nuclear Power Systems for Manned Mission to Mars – 20

Smart Structures for Vibration Control on Long-Term Space Exploration and Habitation Missions – 323

SPACE PROCESSING
Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

SPACE SHUTTLE BOOSTERS
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

SPACE SHUTTLES
Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles – 30

ISOP To Focus on Shuttle Transition – 26

Tests Narrowed – 26

SPACE STATION MODULES
Reuse International Space Station (ISS) Modules as Lunar Habitat – 318

SPACE STATIONS
Hypervelocity Impact Analysis of International Space Station Whipple and Enhanced Stuffed Whipple Shields – 23

SPACE SUITS
Materials Challenges in Space Exploration – 36

SPACE TRANSPORTATION SYSTEM
Shuttle-Derived Launch Vehicles' Capablities: An Overview – 22

SPACE WEATHER
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

The Utility of Auroral Image-based Activities Metrics – 193

SPACEBORNE EXPERIMENTS
Observation of an Aligned Gas - Solid 'Eutectic' during Controlled Directional Solidification Aboard the International Space Station - Comparison with Ground-based Studies – 58

Reproducible Crystal Growth Experiments in Microgravity Science Glovebox at the International Space Station (SUBSA Investigation) – 57

SPACECRAFT CHARGING
Time-Domain Analysis of the Electromagnetic Coupling in Satellite Environments – 31

SPACECRAFT CONFIGURATIONS
Learning Lessons from the X-37 Project – 29

SPACECRAFT DESIGN
Atmospheric/Space Environment Support Lessons Learned Regarding Aerospace Vehicle Design and Operations – 28

From Mercury to CEV: Space Capsules Reemerge – 31

Preliminary Design of a Manned Nuclear Electric Propulsion Vehicle Using Genetic Algorithms – 34

SPACECRAFT DOCKING
Concepts to Automate Fluid Transfer Capability of Low Impact Docking System (LIDS) – 27

SPACECRAFT ELECTRONIC EQUIPMENT
Time-Domain Analysis of the Electromagnetic Coupling in Satellite Environments – 31

SPACECRAFT EQUIPMENT
Miniature Heat Transport System for Spacecraft Thermal Control – 162

SPACECRAFT LAUNCHING
STS Derived Exploration Launch Operations – 22

SPACECRAFT POWER SUPPLIES
ACTS Battery and Solar Array Assembly On-Orbit Measured Performance – 27

Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module – 33

SPACECRAFT PROPULSION
A Strategic Roadmap to Centauri – 19

SMART Use for Electric Propulsion – 35

SPACECRAFT STRUCTURES
Autonomous Assembly of Modular Structures in Space and on Extraterrestrial Locations – 251

SPACECRAFT TEMPERATURE
Miniature Heat Transport System for Spacecraft Thermal Control – 162

SPACECREWS
Skeleton Crew for the Space Station – 31

Tests Narrowed – 26

SPACE-TIME ADAPTIVE PROCESSING
Beamspace STAP for Circular Arrays – 120

Performance Estimation of Space-Time Adaptive Processing via Subband Processing in Mobile Communications – 69

SPACING
A Procedure to Design Wide-Band Electromagnetically-coupled Stacked Microstrip Antennas Based on a Simple Network Model – 114

SPARE PARTS
A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data – 270

SPATIAL DISTRIBUTION
Generalized Coincident Arrays for the Direct Measurement of the Principal Solution in Radio Astronomy – 127

SPATIAL FILTERING
Radiation Properties of Two Cylindrical Conformal Arrays Isolated by a Space Filter – 59

SPATIAL RESOLUTION
An Integrated Procedure for Measuring the Spatial and Temporal Resolution of Visual Displays – 138

Initial On-Orbit Spatial Resolution Characterization of OrbView-3 Panchromatic Images – 307

Neural Network for Image-to-Image Control of Optical Tweezers – 169

Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

SPECIFIC IMPULSE

Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

SPECIFICATIONS

Assessing the Risk and Valie of Adopting Emerging and Unstable Web Services Specifications – 234

SPECTRAL METHODS

A 2.5-D PSTD Algorithm in Cylindrical Coordinates – 259

PML and PSTD Algorithm for Arbitrary Lossy Bianisotropic Media – 259

SPECTRAL RESOLUTION

Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

SPECTRA

Fast Spectral Domain Algorithm for Hybrid Finite Element/Boundary Integral Modeling of Infinite Periodic Arrays – 260

Lost Tribes of Charmonium – 276

Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

SPECTROGRAPHS

Eta Carinae: What We have learned recently with HST/STIS, VLT/UVES and VLTI: What We Might Learn with VLT/VLTI across the 2008/9 Minimum – 312

SPECTROMETERS

First Results from the CEBAF CLAS Spectrometer – 274

SPECTRORADIOMETERS

Aerosol Optical Depth Model Assessment With High Resolution Multiple Angle Sensors – 23

Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps – 169

SPECTROSCOPY

Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Practical Gamma Spectroscopy Assay Techniques for Large Volume Low-Level Waste Boxes – 231

The Optical Counterpart of M101 ULX-1 – 313

Ultrafast Spectroscopy of Energetic Materials: Toward a Molecular Understanding of Impact Sensitivity – 292

SPECTRUM ANALYSIS

A Concept for the Inclusion of Analytical and Computational Capability in Existing Systems for Measurement of Neutron Flux – 164

Fast Spectral Domain Analysis of Large Finite Microstrip Patch Arrays – 101

Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas – 112

SPEED REGULATORS

Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB-1493 Rulemarking – 186

SPENT FUELS

Estimation of Radiolytic Gas Generation Rate for Cylindrical Radioactive Waste Packages - Application to Spent Ion Exchange Resin Containers – 41

Site-Specific Analysis of a Spent Nuclear Fuel Transportation Accident – 184

SPHERES

Adaptive Nulling with Spherical Arrays Using a Genetic Algorithm – 107

Static Permittivity of a Multiphase System of Spheres – 274

SPHERICAL COORDINATES

An Enhanced Higher-Order FDTD Technique for the Construction of Efficient Reflectionless PMLs in 3-D Generalized Curvilinear Coordinate Systems – 274

PML-FDTD Method for Elastic Waves in Cylindrical and Spherical Coordinates – 257

SPIN-LATTICE RELAXATION

Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

SPIN

Precision Measurements of the Neutron Spin Structure at Jefferson Lab Hall A – 278

SPIRAL ANTENNAS

A Conformal Spiral Array Antenna Radiating an Omnidirectional Circularly-Polarized Wave – 70

Archimedean Spiral-mode Microstrip Antenna with Improved Axial Ratio – 79

SPONTANEOUS COMBUSTION

EPA Chemical Accident Investigation Report: Tosco Avon Refinery Martinez, California – 189

SPRAY NOZZLES

Aerial Applicators Spray Nozzle Handbook – 9

SPRAYERS

An Experimental Study of Steady State High Heat Flux Removal Using Spray Cooling – 160

SPREADSHEETS

A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow – 16

STABILITY

Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

STAINLESS STEELS

Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor – 49

STANDARD DEVIATION

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 1: Temperature. Climatography of the USA No. 85 – 200

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 2: Precipitation. Climatography of the USA No. 85 – 201

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 4: Cooling Degree Days. Climatography of the USA No. 85 – 202

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 5: Divisional Maps, 1971-2000. Climatography of the USA No. 85 – 201

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Cooling Degree Days Weighted by Population (2000 Census) 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 5-2 – 200

STANDARD MODEL (PARTICLE PHYSICS)

Signatures of Long-lived Gluinos in Split Supersymmetry – 284

STANDARDIZATION

Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

STATIC CHARACTERISTICS

Quasi-static Analysis of Asymmetric Cylindrical Coplanar Waveguide – 151

Static Permittivity of a Multiphase System of Spheres – 274

STATIC PRESSURE

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

STATIC STABILITY

Wind Tunnel Investigation of the Static Stability and Control Effectiveness of a Rotary Tail in a Portable UAV – 4

STATISTICAL ANALYSIS

Constraints of Melting, Sea-Level and the Paleoclimate from GRACE – 196

Science-Based Prediction for Complex Systems – 275

Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

STEADY STATE
An Experimental Study of Steady State High Heat Flux Removal Using Spray Cooling – 160

STEERABLE ANTENNAS
Planar Handset Antennas with Electronically Steerable Parameters – 105

STELLAR CORONAS
Chemical Compositions and Anomalies in Stellar Coronae ADP99 – 315

STELLAR FLARES
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

STELLAR LUMINOSITY
Recent Results on Ultra-Luminous X-ray Sources – 313

The Optical Counterpart of M101 ULX-1 – 313

STELLAR ROTATION
Emission From Rotation-Powered Pulsars and Magnetars – 312

STELLAR TEMPERATURE
The Warm-Hot Intergalactic Medium – 314

STOCHASTIC PROCESSES
Dynamic Allocation of Servers in a Grid Hosting Environment – 237

Stochastic Cross-Sections Based on the Small Slope Approximation: Theory – 269

STOICHIOMETRY
Relationship of Magnetocrystalline Anisotropy and Stoichiometry in Epitaxial L1(sup 0) CoPt(001) and FePT (001) Thin Films – 297

STRAIN RATE
Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

STRATEGIC MATERIALS
Materials Requirements for Advanced Propulsion Systems – 35

Research Opportunities Supporting the Vision for Space Exploration from the Transformation of the Former Microgravity Materials Science Program – 36

STRATEGY
Iraq and Failures in U.S. Compellence Policy 1990-2003 – 279

STRESS RELAXATION
Influence of Stress Relaxation in Hybrid Composite/Metal Bolted Connections – 175

STRESS-STRAIN RELATIONSHIPS
A Method of Monitoring Explosive Under Cyclic Mechanical Stress – 54

Distributed Sensing of Composite Overwrapped Pressure Vessel Using Fiber-Bragg Gratings at Ambient and Cryogenic Temperatures – 39

STRUCTURAL ANALYSIS
A New Approach for Accurate Analysis of Antennas Above Real Ground – 152

Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

STRUCTURAL DESIGN
The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII – 104

STRUCTURAL ENGINEERING
Civil Works Operations & Maintenance Management Tools Research Program: Program Summary FY 2000 - FY 2002 – 272

STRUCTURAL FAILURE
Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

STRUCTURAL STRAIN
Comparison of Fiber Optic Strain Demodulation Implementations – 168

STUDENTS
Interdisciplinary Breast Cancer Training Program – 225

Student Hands-On Training (SHOT) Workshop Summer 2003 and 2004 – 24

Student Support for Quantum Computation With Superconducting Quantum Devices – 280

SUBDUCTION (GEOLOGY)
Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

SUBGROUPS
Lattices. Subgroup Summary Report – 275

SUBMARINES
The U.S. Navy Submarine Hydrodynamics/ Hydroacoustic Community: A Case Study in Strategic Planning for a Decentralized, Multi-Organizational, Military Community – 288

SUBMILLIMETER WAVES
Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60

SUBSONIC FLOW
Application of Differential Geometry to Acoustics: Development of a Generalized Paraxial Ray-Trace Procedure from Geodesic Deviation – 273

SUBSONIC SPEED
Applications of Endothermic Reaction Technology to HSCT and AST – 16

SUBSONIC WIND TUNNELS
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

SUBSTRATES
Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

SULFUR DIOXIDES
Verification of Ship Emission Estimates with Monitoring Measurements to Improve Inventory and Modeling – 178

SULFUR
Sulfur Oxidation and Contrail Precursor Chemistry – 47

SUMMER
Student Hands-On Training (SHOT) Workshop Summer 2003 and 2004 – 24

The Defense Science Board 2001 Summer Study on Defense Science and Technology – 61

SUPERCONDUCTING DEVICES
Student Support for Quantum Computation With Superconducting Quantum Devices – 280

SUPERCONDUCTIVITY
Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors – 139

SUPERCONDUCTORS (MATERIALS)
Student Support for Quantum Computation With Superconducting Quantum Devices – 280

SUPERHIGH FREQUENCIES
A Resonant Type Leaky-Wave Antenna Using an Image NRD Guide – 122

Design and Development of Co-Polarized Ku-band Ground Terminal System for Very Small Aperture Terminal (VSAT) Application – 94

History and Evolution of Fresnel Zone Plate Antennas For Microwaves and Millimeter Waves – 119

Some Developments in Fresnel Zone Plate Lens Antennas – 111

SUPERNOVA REMNANTS
The Chandra X-Ray Observatory: The Past, the Present, and the Future – 314

SUPERSONIC AIRCRAFT
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

SUPERSONIC COMBUSTION
The Measurement of Gain in a Supersonic, Combustion-Driven Generator for NCl(a1Delta) – 171

SUPERSONIC FLOW
Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport – 15

SUPERSONIC SPEED
Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport – 15

SUPERSONIC TRANSPORTS
Applications of Endothermic Reaction Technology to HSCT and AST – 16

High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

Nozzle Aerodynamic Stability During a Throat Shift – 1

SUPERSONIC WIND TUNNELS
High Speed Research Program Structural Acoustics Multi-Year Summary Report – 290

SUPERSYMMETRY
Signatures of Long-lived Gluinos in Split Supersymmetry – 284

SUPPLYING
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

Estimating Supplies Program: Evaluation Report – 245

Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

Proceedings of the Workshop on Power Sources for Distributed Autonomous Systems – 137

Review of Marine Corps Expeditionary Force Preventive Medicine Materiel Requirements – 219

The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

SUPPORT SYSTEMS
Component Middleware to Support Nonrepudiable Service Interactions – 82

SUPPRESSORS
The Role of the Prohibition Gene in Apoptosis of Breast Cancer Cells – 215

SURFACE ACOUSTIC WAVE DEVICES
IEEE Sensors 2004 Conference – 138

SURFACE CRACKS
Polarimetric Backscatter Characterization of Road Surface Faults at Millimeter-wave Frequencies – 80

SURFACE NAVIGATION
Polarimetric Radar Measurements for Vehicle Control and Warning Applications – 305

SURFACE PROPERTIES
Cell Sheet Engineering with Intelligent Polymer-Grafted Surfaces – 54

Modeling Surface Currents on Electrically Large Impedance Cylinders - 2D, TM Case – 120

Surface Integral Equations for Three Dimensional Surfaces Containing Circuit Analog Sheets – 143

SURFACE REACTIONS
Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

SURFACE ROUGHNESS EFFECTS
Propagation of Electromagnetic Waves Near the Surface of a Half-space Dielectric with Rough Interface – 257

The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces – 253

SURFACE ROUGHNESS
Effect of Canopy-Air Interface Roughness on HF-VHF Wave Propagation in Forest – 86

Fast Generalized Forward-backward Method by Using a Spectral Acceleration – 255

SURFACE TO AIR MISSILES
Homeland Security: Protecting Airliners from Terrorist Missiles – 13

SURFACE WATER
Regional Deformation Studies with GRACE and GPS – 253

SURFACE WAVES
An Annular-Ring Reduced Surface Wave Microstrip Antenna – 114

Efficient Electromagnetic Modeling of Microstrip Structures in Multilayer Media – 113

Moment Method Based Analysis of Dielectric-resonator Antennas – 122

Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas – 122

Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

PBG-Assisted Gain Enhancement of Patch Antennas on High-dielectric Constant Substrate – 109

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas – 150

SURFACES
Semi-Empirical IR Signature Model for Tilted Surfaces – 197

SURGEONS
Appropriate Treatment of Head Injuries by Surgeons During the Civil War – 213

SURGERY
Harnessing Technology for Evidence-Based Education and Training in Minimally Invasive Surgery – 219

Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

SURVEILLANCE
Array Configurations and Wideband Radiators Suitable for Shared Apertures – 83

SURVIVAL
Protein Kinase Pathways That Regulate Neuronal Survival and Death – 208

SWITCHES
A Low Loss, Dual Polarized Switch for Polarization State Selection – 124

Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

SWITCHING
Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

SYMBIOTIC STARS
Simultaneous X-Ray and UV Spectroscopy of the Symbiotic HD 154791 – 317

SYMMETRY
Analysis of Radiation from Two Separate Axisymmetric Horns Using the Method of Moments – 114

Design and Characterization of Diagonal Horn Antennas Using UCLA Bi-Polar Near-Field Measurement and Imaging Facilities – 155

New Canonical Representative Marking Algorithms for Place/Transition-Nets – 238

Parallel Domain Decomposition Formulation and Software for Large-Scale Sparse Symmetrical/Unsymmetrical Aeroacoustic Applications – 239

Symmetry Synthesis of the Multiport Scattering Matrix as a First Step in the Design of Electromagnetic Devices and Components with Bianisotropic Media – 132

SYNCHRONISM
Chaotic Wave Scattering and Synchronization – 75

SYNTAX
Visual Language for Parallel, Object-Oriented Programming – 237

SYNTHESIS
Aspects in Analysis and Model-Based Sound Synthesis of Plucked String Instruments – 290

SYNTHETIC APERTURE RADAR
A Broadband Microstrip Antenna for SAR Applications – 75

An Assessment of Alternative SAR Display Formats: Orientation and Situational Awareness – 302

Battle Damage Assessment Using Inverse Synthetic Aperture Radar (ISAR) – 164

Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform – 103

ESA's Ground Breaking Synthetic Aperture Radar: The ENVISAT-1 ASAR Active Antenna – 100

ISAR Turntable Experiments Using a Coherent Ultrawideband Random Noise Radar – 84

Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62

Ultrawide-band Noise Synthetic Aperture Radar: Theory and Experiment – 87

SYNTHETIC APERTURES
Probe Pulse Shape Estimation in Synthetic Aperture Method – 88

SYSTEM EFFECTIVENESS
An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

California's K-12 Public Schools. How Are They Doing? – 301

Flight and Aerospace Research: Airborne Simulation and Research Investigations, 1999 - 2004 – 11

SYSTEMS ANALYSIS
Solar Electric and Chemical Propulsion for a Titan Mission – 32

SYSTEMS ENGINEERING
A Novel Design of an Ultra-Fast Wideband Polarimetric Radar – 107

Active Integrated Antennas for New RF Architectures – 64

Engineering Lessons Learned and Systems Engineering Applications – 59

Modelling Intention Recognition for Intelligent Agent Systems – 252

Monitoring of Contractual Service Level Agreement – 232

SYSTEMS HEALTH MONITORING
Comparison of Fiber Optic Strain Demodulation Implementations – 168

IVHM Framework for Intelligent Integration for Vehicle Health Management – 250

SYSTEMS INTEGRATION
Active Integrated Antennas for New RF Architectures – 64

An Analysis and Design Tool for Evaluation of Integrated Antenna Diversity Systems in Portable Wireless Devices – 90

Aspects in Analysis and Model-Based Sound Synthesis of Plucked String Instruments – 290

Core Financial System Requirements: Checklist for Reviewing Systems under the Federal Financial Management Improvement Act – 300

Integrated Network Application Management (INAM) – 249

IVHM Framework for Intelligent Integration for Vehicle Health Management – 250

SYSTEMS SIMULATION
Advanced Technology Lifecycle Analysis System (ATLAS) Technology Tool Box (TTB) – 300

SYSTEMS STABILITY
Challenges and Opportunities in Grid Performability – 235

TAIWAN
China's Development of Asymmetric Warfare and the Security of Taiwan, Republic of China – 301

TAPERING
Tapered Leaky-wave Ultra Wide-band Microstrip Antenna – 112

TARGET RECOGNITION
Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform – 103

Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

TARGETS
Composite Combat Identification (CCID) Common Reasoning Algorithm Development Program – 262

Radar Polarimetry – 165

Tracking and Sensor Fusion Issues in the Tactical Land Environment – 304

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

TECHNOLOGIES
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Technology Development: New DOD Space Science and Technology Strategy Provides Basis for Optimizing Investments, but Future Versions Need to Be More Robust – 20

The Defense Science Board 2001 Summer Study on Defense Science and Technology – 61

TECHNOLOGY ASSESSMENT
A Strategic Roadmap to Centauri – 19

Assessment of the NASA AvSTAR Project Plan – 1

TECHNOLOGY UTILIZATION
An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

Applications of Endothermic Reaction Technology to HSCT and AST – 16

Defense Information Warfare Technology Applications (DIWTA) Automated Intrusion Detection Environment (AIDE) Advanced Concept Technology Demonstration (ACTD) – 249

Internet Access in US Public Schools and Classrooms: 1994-2003 – 83

Low Noise Exhaust Nozzle Technology Development – 2

Lunar and Martian Sub-surface Habitat Structure Technology Development and Application – 320

Research Supporting Satellite Communications Technology – 110

Technology Challenges for Deep-Throttle Cryogenic Engines for Space Exploration – 33

TECTONICS
Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

TELECOMMUNICATION
Compact Reconfigurable HF-UHF Antennas – 136

Downlink Propagation Measurements in the GSM 900 and 1800 MHz Bands – 93

Dual Purpose Simulation: New Data Link Test and Comparison With VDL-2 – 2

Martian Infotech – 26

Telemarketing: Implementation of the National Do-Not-Call Registry – 232

TELEPHONES
Applications of Smart Antennas in Cellular Networks – 75

TELEVISION SYSTEMS
Characteristics of Digital Terrestrial Broadcasting Antennas – 105

Kosovo Media Assessment – 64

TEMPERATE REGIONS
Radio Wave Studies of Irregular Ionospheric Phenomena at Midlatitude – 194

TEMPERATURE CONTROL
Development of Improved Thermal Control Coatings for Space Assets – 20

Miniature Heat Transport System for Spacecraft Thermal Control – 162

TEMPERATURE DEPENDENCE
Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 4: Cooling Degree Days. Climatography of the USA No. 85 – 202

Electrical Conductivity of HgTe at High Temperatures – 133

TEMPERATURE EFFECTS
Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

TEMPERATURE GRADIENTS
Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 1: Temperature. Climatography of the USA No. 85 – 200

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 2: Precipitation. Climatography of the USA No. 85 – 201

Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normals period). Section 5: Divisional Maps, 1971-2000. Climatography of the USA No. 85 – 201

TEMPERATURE MEASUREMENT
Development of On-Line Temperature Measurement Instrumentation for Gasification Process Control – 36

Morphological Evolution of Directional Solidification Interfaces in Microgravity: An Analysis of Model Experiments Performed on the International Space Station – 204

TEMPERATURE MEASURING INSTRUMENTS

Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms – 85

TEMPERATURE

State Monthly Temperature, Precipitation, and Degree Days 1971-2000 (and Previous Normals Periods). Section 1: State Maps, 1971-2000. Historical Climatography Series No. 4 and 5 – 198

State Monthly Temperature, Precipitation, and Degree Days 1971-2000 (and Previous Normals Periods). Section 2: State Maps, 1931-2000. Historical Climatography Series No. 4 and 5 – 198

USA Climate Normals, 1971-2000. State, Regional, and National Monthly Temperature and Precipitation Weighted by Area 1971-2000 (and Previous Normals Periods). Historical Climatography Series No. 4-3 – 199

TEMPLATES

Lightweight Nonmetallic Thermal Protection Materials Technology – 51

TEMPORAL RESOLUTION

An Integrated Procedure for Measuring the Spatial and Temporal Resolution of Visual Displays – 138

TENSILE STRENGTH

High Tensile Strength Amalgams for In-Space Repair and Fabrication – 48

TERRAIN

On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

TEST EQUIPMENT

Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

TEST FACILITIES

Hardware Progress Made in the Early Flight Fission Test Facilities (EFF-TF) To Support Near-Term Space Fission Systems – 29

TEST RANGES

The World's First Comparison of Outdoor RCS Test Ranges – 143

TEST STANDS

Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter – 43

The Adaptive Control of Optical Beam Jitter – 170

X-Ray Calibration Facility/Advanced Video Guidance Sensor Test – 32

TETHERLINES

Simulated Space Environment Effects on Tether Materials with Protective Coatings – 37

THEOREMS

Radar Polarimetry – 165

THERAPY

An Oncotropic Adenovirus Vector System for Breast Cancer Treatment – 218

Anti-Angiogenesis Therapeutic Indicators in Breast Cancer – 211

Appropriate Treatment of Head Injuries by Surgeons During the Civil War – 213

Center for Innovative Minimally Invasive Therapy (CIMIT) – 205

Numerical Analysis of Thin Coaxial Antennas for Microwave Coagulation Therapy – 112

Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

THERMAL ANALYSIS

Characterization of 3 to 5 Micron Thermal Imagers and Analysis of Narrow Band Images – 252

THERMAL CONDUCTIVITY

The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

THERMAL CONTROL COATINGS

Development of Improved Thermal Control Coatings for Space Assets – 20

THERMAL EXPANSION

GRCop-84: A High-Temperature Copper Alloy for High-Heat-Flux Applications – 50

THERMAL PLASMAS

Using Non-Thermal Plasma to Control Air Pollutants – 183

THERMAL PROTECTION

Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

Lightweight Nonmetallic Thermal Protection Materials Technology – 51

Nondestructive Evaluation of Space Shuttle External Tank Foam – 28

Tests Narrowed – 26

THERMAL RADIATION

The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

THERMAL STABILITY

The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII – 104

THERMODYNAMIC PROPERTIES

Database of Material Properties for Optical Signature Modelling – 293

Modeling Thermal Ignition of Energetic Materials – 299

THERMODYNAMICS

Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

THERMOELECTRIC GENERATORS

Thermoelectrical Energy Recovery from the Exhaust of a Light Truck – 173

THERMOPHYSICAL PROPERTIES

GRCop-84: A High-Temperature Copper Alloy for High-Heat-Flux Applications – 50

THIN FILMS

Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

Ultra-Smooth As-Deposited Optical Films – 137

THREAT EVALUATION

Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

THREE DIMENSIONAL MODELS

3-D GRMHD Simulations of Disk-Jet Coupling and Associated Variabilities and Emission – 316

3-D Numerical Mode-Matching (NMM) Method for Inhomogeneous Media – 254

3-D Spectral Domain Green's Function for Arbitrarily Multilayered Dielectric Structure – 118

A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions – 72

Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

Global Positioning System Data Integration and Development of a Three-Dimensional Spatial Model of the Kansas Highway Network – 59

Three Dimensional Optical Fiber Simulation – 117

Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Non-palpable Breast Tumors – 158

Three-Dimensional Simulation of Gas Conductance Measurement Experiments on Alcator C-Mod – 284

Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion – 167

THROATS

Nozzle Aerodynamic Stability During a Throat Shift – 1

THROTTLING

Technology Challenges for Deep-Throttle Cryogenic Engines for Space Exploration – 33

THUNDERSTORMS
Space-Borne Observations of Intense Gamma-Ray Flashes Above Thunderstorms – 326

TILES
Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles – 30

Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

TIME DIVISION MULTIPLE ACCESS
GSM/TDMA Adaptive Antenna Field-Trial Results – 75

TIME DIVISION MULTIPLEXING
A New Calibration Method of Adaptive Array for TDD Systems – 74

TIME DOMAIN ANALYSIS
A 2.5-D PSTD Algorithm in Cylindrical Coordinates – 259

A Fast Time Domain Integral Equation Technique for Analyzing EMC/EMI Problems – 258

A New Time Domain Analysis of Vertical Dipole in the Vicinity of a Planar Dielectric Interface – 114

Beamforming in Time-Domain Arrays – 106

Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports – 130

FDTD Modeling of Ceramic Multi-layer Capacitors Using Lumped Equivalent Models – 253

Full-wave Analysis of HF Antennas on Helicopters Using the FDTD, FEM and NEC – 128

PML and PSTD Algorithm for Arbitrary Lossy Bianisotropic Media – 259

The Multilevel Plane Wave Time Domain Algorithm for the Fast Analysis of Transient Scattering Phenomena – 254

Time Domain Green's Function for a Phased Semi-infinite Periodic Line Array of Dipoles – 261

Time-Domain Modelling of Propagation in Nonlinear Dielectrics Using TLM – 258

Time-domain Techniques for Reconstructing Lossy Layered Media from One-sided Scattering – 129

TIME MEASUREMENT
Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years – 316

TIME SERIES ANALYSIS
Regional Deformation Studies with GRACE and GPS – 253

Self-Organizing Maps in Sequence Processing – 238

TITANIUM ALUMINIDES
Ab-Initio Simulation of a/2\h110\g Screw Dislocations Gamma-TiAl – 49

TITAN
GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

Solar Electric and Chemical Propulsion for a Titan Mission – 32

TOKAMAK DEVICES
Diamond Wire Cutting of the Tokamak Fusion Test Reactor – 295

TOMOGRAPHY
A 2.5-D Diffraction Tomography Inversion Scheme for Ground Penetrating Radar – 97

Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection – 215

Report on Measurement at Ohio University to Estimate Backgrounds for Neutron Radiography in the 10-14 MeV Region – 275

TOPOGRAPHY
Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

TOPOLOGY
A Topological Viewpoint on Consistency Aspects of Electromagnetic Theory on a Lattice – 131

Designing a Forcenet Information Topology – 248

TOUGHNESS
Fracture Toughness Improvement of Composites Reinforced with Optimally Shaped Short Ductile Fibers – 40

TOXICITY
Computational Analysis and Simulation of Toxic Particle Deposition in the Human Respiratory System – 56

Pre/Post-Strike Atmospheric Assessment System (PAAS) – 182

Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

TRACE CONTAMINANTS
Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model – 197

TRACE ELEMENTS
Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model – 197

TRACKING (POSITION)
Deployment and Evaluation of the Helicopter In-Flight Tracking System (HITS) – 8

TRAFFIC CONTROL
Advance Path Measurement for Automotive Radar – 102

TRAJECTORY OPTIMIZATION
Multiple Satellite Trajectory Optimization – 25

TRANSDUCERS
Dual-band Compact Square Waveguide Corrugated Polarizer – 112

TRANSFER FUNCTIONS
Matrix Pade Via Lanczos for FEM Problems – 142

TRANSFORMERS
An Inhomogeneous Waveguide Transformer with Hard Walls for the Excitation of Quasi-optical Amplifiers – 115

TRANSIENT HEATING
Transient Approximation of SAFE-100 Heat Pipe Operation – 32

TRANSISTORS
Infrared Characterization of SiN Films on Si for High Speed Electronics Applications – 43

TRANSMISSION EFFICIENCY
EIRP and Power Efficiency of Reconfigurable Active Transmit Antennas – 77

TRANSMISSION LINES
A Low-Cost, Man-Portable, Free-Space Optics Communications Device for Ethernet Applications – 170

FDTD Modeling of Ceramic Multi-layer Capacitors Using Lumped Equivalent Models – 253

Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129

Interconnect and Packaging Electrical Circuits Network – 124

On the Accuracy of the Transmission Line Theory for the Insulated Linear Antenna – 113

The Co-conical Field Generation System - A 40 GHz Antenna Calibration Cell – 120

Time-Domain Modelling of Propagation in Nonlinear Dielectrics Using TLM – 258

Time-domain Techniques for Reconstructing Lossy Layered Media from One-sided Scattering – 129

TRANSMISSION LOSS
Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES) – 289

TRANSMISSION
Efficient and Accurate Inclusion of Radomes into Antenna Analysis – 71

TRANSMITTER RECEIVERS
Effect of Canopy-Air Interface Roughness on HF-VHF Wave Propagation in Forest – 86

Retrocommunication – 63

TRANSMITTERS
A Remote Calibration for DBF Transmitting Array Antennas by Using Synchronous Orthogonal Codes – 69
Complexity Issues in Inverse Scattering Problems – 149
Development and Evaluation Test of DBF Equipment for Transmitting – 72
Interference Cancellation Systems for Electromagnetically Dense Platforms – 148

TRANSONIC FLOW
Measurements of Flow Turbulence in the NASA Langley Transonic Dynamics Tunnel – 10

TRANSONIC WIND TUNNELS
Measurements of Flow Turbulence in the NASA Langley Transonic Dynamics Tunnel – 10

TRANSPARENCE
Slow and Fast Light in Coupled Microresonators – 294

TRANSPORT AIRCRAFT
Turbulence Hazard Metric Based on Peak Accelerations for Jetliner Passengers – 8

TRANSPORT PROPERTIES
Transport Coefficients and Molecular Dynamics: Alternatives – 161

TRANSPORTATION
Aviation Security: Measures for Testing the Impact of Using Commercial Data for the Secure Flight Program – 8
Global Climate Change and the Transportation Sector: An Update on Issues and Mitigation Options – 185
Site-Specific Analysis of a Spent Nuclear Fuel Transportation Accident – 184
Spent Fuel Transportation Package Performance Study Experimental Design Challenges – 56

TRAPEZOIDS
Planar Trapezoidal and Pentagonal Monopoles with Impedance Bandwidths in Excess of 10:1 – 88

TRAVELING WAVE TUBES
Investigation of Characteristics of High-Power Wide-Band Plasma-Filled Traveling Wave Tubes (TWT) – 295

TRMM SATELLITE
An Orbital 'Virtual Radar' from TRMM Passive Microwave and Lightning Observations – 203
Contributions of TRMM to Our Understanding of Precipitation Processes and Climate Variability – 204

TROPOSPHERE
A Mechanism For Solar Forcing of Climate: Did the Maunder Minimum Cause the Little Ice Age? – 203

TRUCKS
State-of-the-Art and Emerging Truck Engine Technologies for Optimized Performance, Emissions and Life Cycle Costs – 172
Thermoelectrical Energy Recovery from the Exhaust of a Light Truck – 173

TUMOR SUPPRESSOR GENES
Functional Interactions of the TACC2 Breast Tumor Suppressor Gene and Its Relevance to Breast Tumor Progression – 210

TUMORS
Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast – 208
Functional Interactions of the TACC2 Breast Tumor Suppressor Gene and Its Relevance to Breast Tumor Progression – 210
Gangliosides During Tumor Progression in Patients With Prostate Cancer – 209
HOXB7: An Oncogenic Gene in Breast Cancer Cells – 217
The Mechanism of Retinoblastoma Protein-Mediated Terminal Cell Cycle Arrest – 218
Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

TURBINE ENGINES
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

TURBINES
Economic Impact Analysis (EIA) for the Proposed Stationary Combustion Turbines NSPS – 184

TURBOJET ENGINES
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

TURBULENCE EFFECTS
Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup – 158

TURBULENCE MODELS
Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup – 158
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers – 162

TURBULENCE
Improved Approximations for Wave Structure Functions in a Turbulent Atmosphere – 195
Measurements of Flow Turbulence in the NASA Langley Transonic Dynamics Tunnel – 10
Turbulence Hazard Metric Based on Peak Accelerations for Jetliner Passengers – 8

TURBULENT COMBUSTION
Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43

TURBULENT FLAMES
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

TURBULENT FLOW
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160
Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43

TURBULENT HEAT TRANSFER
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers – 162

TWO DIMENSIONAL MODELS
2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265
A Diagonal Translation Operator for the Fast Evaluation of Two-dimensional Transient Wave Fields – 260
Acceleration of Two-dimensional Time Domain Integral Equation Solvers Using a Hilbert Transform – 261
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2
The General NMM Solution for 2-D EMF Problems with Arbitrary Excitations under General Coordinates – 205

TYROSINE
Outcome Based Screening for Prognostic Phospho-RTK (Receptor Tyrosine Kinase) Antibodies Using Tissue Microarrays) – 227

ULTRAHIGH FREQUENCIES
Compact Reconfigurable HF-UHF Antennas – 136
Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

ULTRAHIGH VACUUM
Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane – 52

ULTRASONIC RADIATION
Identification Versus Imaging – 149

ULTRAVIOLET ASTRONOMY
Slow-rise and Fast-rise Phases of an Erupting Solar Filament and Flare Emission Onset – 325

ULTRAVIOLET IMAGERY
IMAGE-POLAR Concurrent Plasmapause Observations – 195

ULTRAVIOLET RADIATION
Current Sheet Evolution in the Aftermath of a CME Event – 324

Experiments on Dust Grain Charging – 315

Simulated Space Environment Effects on Tether Materials with Protective Coatings – 37

ULTRAVIOLET SPECTROSCOPY
Simultaneous X-Ray and UV Spectroscopy of the Symbiotic HD 154791 – 317

ULYSSES MISSION
A Detection of the Same Hot Plasma in the Corona: During a CME and Later at Ulysses – 192

UNCERTAIN SYSTEMS
Uncertainties in the Analytic Hierarchy Process – 272

UNDERWATER ACOUSTICS
Application of Differential Geometry to Acoustics: Development of a Generalized Paraxial Ray-Trace Procedure from Geodesic Deviation – 273

DRI internal Wave Simulations – 289

The U.S. Navy Submarine Hydrodynamics/ Hydroacoustic Community: A Case Study in Strategic Planning for a Decentralized, Multi-Organizational, Military Community – 288

UNDERWATER VEHICLES
Clean Gas Reformer - A Compact Fuel Reformer for Undersea Vehicle Fuel Cells – 178

UNITED STATES
Compilation of Data Sources Used to Construct Bottom-Sediment Province Maps for the USA East Coast Continental Shelf from Cape Kennedy to Cape Hatteras and for Various Indonesian Waters – 176

The Effect of the USA Naval Academy Foundation Preparatory Program on the Performance of Naval Academy Midshipmen – 263

UNIVERSITIES
Uniformed Services University of the Health Sciences Journal 2003 Edition – 226

UNIVERSITY PROGRAM
A Program of Research and Education in Astronautics – 21

UNSTRUCTURED GRIDS (MATHEMATICS)
Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics – 291

UPGRADING
Trial by Fire – 25

UPLINKING
Channel Simulation of Leo Satellites – 92

URINALYSIS
Microhematuria Associated With a Special Operations Craft Mission – 225

USER REQUIREMENTS
Design and Evaluation of an Efficient Reliable Manycast Protocol for Ad-hoc Networks – 83

VACCINES
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

The Mechanism of Retinoblastoma Protein-Mediated Terminal Cell Cycle Arrest – 218

Vaccines and Animal Models for Arboviral Encephalitides – 222

VALIDITY
A New Approach for Accurate Analysis of Antennas Above Real Ground – 152

VANADIUM
Energetics of Oxygen Interstitials in Cr and V – 50

VAPOR PHASES
Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000 – 180

VAPORS
Explosive Chemical Signature-Based Detection of IEDs – 46

VARIABILITY
Contributions of TRMM to Our Understanding of Precipitation Processes and Climate Variability – 204

VARIABLE CYCLE ENGINES
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

VARIABLE STARS
Eta Carinae: What We have learned recently with HST/STIS, VLT/UVES and VLTI: What We Might Learn with VLT/VLTI across the 2008/9 Minimum – 312

VECTOR ANALYSIS
Performance Analysis of Mobile Ad Hoc Networking Routing Protocols – 261

VELOCITY DISTRIBUTION
Pre/Post-Strike Atmospheric Assessment System (PAAS) – 182

VERTICAL DISTRIBUTION
An Orbital 'Virtual Radar' from TRMM Passive Microwave and Lightning Observations – 203

VERTICAL TAKEOFF
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

VERY HIGH FREQUENCIES
Effect of Canopy-Air Interface Roughness on HF-VHF Wave Propagation in Forest – 86

Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

VERY LARGE SCALE INTEGRATION
Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129

VIBRATION DAMPING
A Prototype Actuator Concept for Membrane Boundary Vibration Control – 176

Smart Structures for Vibration Control on Long-Term Space Exploration and Habitation Missions – 323

VIBRATION TESTS
Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

VIBRATION
The Adaptive Control of Optical Beam Jitter – 170

VIDEO COMMUNICATION
X-Ray Calibration Facility/Advanced Video Guidance Sensor Test – 32

VIRUSES
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

Ebola and Marburg Viruses Replicate in Monocyle- Derived Dendritic Cells without Inducing the Production of Cytokines and Full Maturation – 221

Lessons Learned: The 'Pale Horse' Bioterrorism Response Exercise – 214

Molecular Mechanisms of Filovirus Cellular Trafficking – 222

Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

Vaccines and Animal Models for Arboviral Encephalitides – 222

Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

VISCOELASTICITY
Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes – 37

VISUAL ACUITY
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264

Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators – 166

VISUAL AIDS
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

VISUAL FLIGHT
Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators – 166

VISUAL PERCEPTION
An Integrated Procedure for Measuring the Spatial and Temporal Resolution of Visual Displays – 138

Implicit Memory, Perception and the Rapid Deployment of Visual Attention and Action – 241

VOLATILE ORGANIC COMPOUNDS
Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings – 55

VOLCANOES
Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

VOLTAGE CONVERTERS (DC TO DC)
Design of Robust Controllers for Telecom Power Supplies – 140

VOLTERRA EQUATIONS
Numerical Calculation of the Volterra Integral Equation for a Time-varying Medium – 109

VORTICES
Automated Extraction of Secondary Flow Features – 159

EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

VOTING
Simplified Version of the Chaum Voting Scheme – 235

WARFARE
An Architecture for Network Centric Operations in Unconventional Crisis: Lessons Learnt from Singapore's SARS Experience – 303

Appropriate Treatment of Head Injuries by Surgeons During the Civil War – 213

China's Development of Asymmetric Warfare and the Security of Taiwan, Republic of China – 301

Defense Information Warfare Technology Applications (DIWTA) Automated Intrusion Detection Environment (AIDE) Advanced Concept Technology Demonstration (ACTD) – 249

Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 229

Shedding Light on the Battlefield: Tactical Applications of Photonic Technology – 167

Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology – 243

WARNING SYSTEMS
Advance Path Measurement for Automotive Radar – 102

Defense Information Warfare Technology Applications (DIWTA) Automated Intrusion Detection Environment (AIDE) Advanced Concept Technology Demonstration (ACTD) – 249

Silicon-Based Visible/Near-Infrared Affordable Missile Warning – 292

WASTE DISPOSAL
Disposal of True Waste from the Plutonium Finishing Plant in Pipe Overpack Containers to WIPP Including New Security Requirements – 187

WASTE MANAGEMENT
Envirocare of Utah: Expanding Waste Acceptance Criteria to Provide Low-Level and Mixed Waste Disposal Options – 187

Estimation of Radiolytic Gas Generation Rate for Cylindrical Radioactive Waste Packages - Application to Spent Ion Exchange Resin Containers – 41

Innovative Integrated Approach to Minimizing Gypsum and Pyrite Wastes by Conversion to Marketable Products – 42

WATER COLOR
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264

WATER POLLUTION
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

WAVE DIFFRACTION
A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78

History and Evolution of Fresnel Zone Plate Antennas For Microwaves and Millimeter Waves – 119

WAVE EQUATIONS
A Diagonal Translation Operator for the Fast Evaluation of Two-dimensional Transient Wave Fields – 260

WAVE EXCITATION
Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas – 122

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas – 150

WAVE FRONTS
New Class Microwave Antennas Based on the Elements of the Diffraction Quasioptics: Advantages and Applications – 65

WAVE FUNCTIONS
Improved Approximations for Wave Structure Functions in a Turbulent Atmosphere – 195

Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

WAVE GENERATION
Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

WAVE PROPAGATION
A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78

A New FDTD Formulation with Reduced Dispersion for the Simulation of Wave Propagation Through Inhomogeneous Media – 254

An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz – 76

Design of a TEM Waveguide for Ultra-wideband Applications – 154

Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

Effect of Canopy-Air Interface Roughness on HF-VHF Wave Propagation in Forest – 86

Inhomogeneous Cylindrical Waves: An Approach to Complex Beams – 255

Modeling of Gaussian Beam Diffraction from a Thick Single-slit Perfectly Conducting Screen: Finite-Difference Time-Domain Method Versus Rigorous Theory – 269

Modelling Wave Propagation in Diagonal Microstrip Lines Using Enhanced FDTD Equations – 128

Numerical Amplification of the Excitation Source in Waveguide Structure – 266

Propagation of Electromagnetic Waves Near the Surface of a Half-space Dielectric with Rough Interface – 257

Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components – 153

WAVE SCATTERING
A Diagonal Translation Operator for the Fast Evaluation of Two-dimensional Transient Wave Fields – 260

Extensions of the Single-integral-equation Method – 258

Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components – 153

Surface Wave Scattering by Finite Periodic Structure of Arbitrary Profile in a Ground Plane: TE case – 84

The Multilevel Plane Wave Time Domain Algorithm for the Fast Analysis of Transient Scattering Phenomena – 254

Transient Plane Wave Scattering from Objects Near Lossy Ground with FDTD – 150

WAVEGUIDE ANTENNAS

A Resonant Type Leaky-Wave Antenna Using an Image NRD Guide – 122

Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section – 118

Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas – 91

Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

WAVEGUIDES

A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256

An Inhomogeneous Waveguide Transformer with Hard Walls for the Excitation of Quasi-optical Amplifiers – 115

Analysis of Shielded CPW Spatial Power Combiners – 151

Computation of Radar Cross Section of Waveguide Arrays – 99

Design and Characterization of Diagonal Horn Antennas Using UCLA Bi-Polar Near-Field Measurement and Imaging Facilities – 155

Design and Development of Co-Polarized Ku-band Ground Terminal System for Very Small Aperture Terminal (VSAT) Application – 94

Discrete Mode Matching Method for the Analysis of Quasi-planar Structures – 145

Experimental Characterization of Photonic Band Crystals for Tera Hertz Devices – 134

Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

Physical Realization of Magnetic Walls Using Finite-thickness 3D Printed Arrays – 108

Polymer Waveguides for Quantum Information – 55

Quasi-static Analysis of Asymmetric Cylindrical Coplanar Waveguide – 151

Representation of Absolute Electric Fieldstrength by Superposition of Radiated and Guided Waves – 111

Small Antenna Efficiency by the Reflection and the Q Measurement Methods – 145

Surface Wave Scattering by Finite Periodic Structure of Arbitrary Profile in a Ground Plane: TE case – 84

Vectorial Waveguide Reflectometer for Dielectric Characterization of Materials Under Power Microwaves – 147

WAVELET ANALYSIS

A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

Improved Wavelet-Based Beamformers with Dynamic Subband Selection – 256

WAVES

An Efficient High-frequency Boundary Integral Equation – 260

Linear Inverse Problems in Wave Motion: Non-self-adjoint Integral Equations of the First Kind – 273

WEAPON SYSTEMS

Analyzing and Sharing Data for Surface Combat Weapons Systems – 246

Environmental Life Cycle Techniques for New Weapons Acquisition Systems – 45

WEAR RESISTANCE

Fibrous Monolith Wear Resistant Components for the Mining Industry. Semi-Annual Report No. 4 – 51

WEATHER

Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

WEIBULL DENSITY FUNCTIONS

A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data – 270

WELDED JOINTS

Inspection of Fusion Joints in Plastic Pipe – 52

WETTING

The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

WHITE DWARF STARS

A Survey of Helium Accreting White Dwarfs – 317

WIDEBAND COMMUNICATION

Pipeline Analog-to-Digital Converters for Wide-Band Wireless Communications – 140

WIND TUNNEL TESTS

Measurements of Flow Turbulence in the NASA Langley Transonic Dynamics Tunnel – 10

Model-Scale Aerodynamic Performance Testing of Proposed Modifications to the NASA Langley Low Speed Aeroacoustic Wind Tunnel – 287

Wind Tunnel Investigation of the Static Stability and Control Effectiveness of a Rotary Tail in a Portable UAV – 4

WIND TURBINES

Electromagnetic Interference from Wind Turbines – 147

WIND VELOCITY

Evaluations of Global Wind Prediction at Fleet Numerical Meteorology and Oceanography Center: from the Perspective of a Wave Modeler – 197

WINGS

Shape Sensing a Morphed Wing with an Optical Fiber Bragg Grating – 16

Twist Model Development and Results From the Active Aeroelastic Wing F/A-18 Aircraft – 15

WIRELESS COMMUNICATION

A Multi-Branch Monopole Antenna for Dual-Band Cellular Applications – 105

A Simple Theoretical Model for Polarization Diversity Reception in Wireless Mobile Environments – 68

Active Integrated Antennas for New RF Architectures – 64

Adaptive Arrays for Wideband Interference Suppression in Wireless Communications – 94

An Analysis and Design Tool for Evaluation of Integrated Antenna Diversity Systems in Portable Wireless Devices – 90

Digital Phased Array Architectures for Radar and Communications Based on Off-the-Shelf Wireless Technologies – 134

Downlink Propagation Measurements in the GSM 900 and 1800 MHz Bands – 93

Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments – 62

Integrated Dipole Antennas on Silicon Substrates for Intra-chip Communication – 102

Numerical Computation on Radiation Characteristics of Square Loop Antennas at the Wrist Position of a Human Body in Personal Wireless Communications – 116

Pipeline Analog-to-Digital Converters for Wide-Band Wireless Communications – 140

Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

WIRE

A Novel InAs Quantum Wire System – 139

Accurate Model of Arbitrary Wire Antennas in Free Space, Above or Inside Lossy Ground – 97

Diamond Wire Cutting of the Tokamak Fusion Test Reactor – 295

Measured Back Scattering Cross Section of Thin Wires – 156

WIRING
Demonstration and Validation of the Excited Dielectric Test (Trade Name) Method to Detect and Locate Defects in Aircraft Wiring Systems – 141

WORKLOADS (PSYCHOPHYSIOLOGY)
Human Factors Assessment of the UH-60M Crew Station During the Early User Demonstration Number 2 (EUD2) – 12

WORLD WIDE WEB
Assessing the Risk and Valie of Adopting Emerging and Unstable Web Services Specifications – 234

Distributed Enactment of Composite Web Services – 82

Notations for the Specification and Verification of Composite Web Services – 304

Using Web Services to Build Grid Applications-The No Risk WSGAF Profile – 235

X RAY ASTRONOMY
Development of High Resolution Hard X-Ray Telescope with Multi-Layer Coatings – 311

Five Years of Observations with the Chandra X-Ray Observatory – 310

Slow-rise and Fast-rise Phases of an Erupting Solar Filament and Flare Emission Onset – 325

Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

X RAY ASTROPHYSICS FACILITY
Five Years of Observations with the Chandra X-Ray Observatory – 310

Observations of Compact X-Ray Binaries with Chandra – 315

The Chandra X-Ray Observatory: The Past, the Present, and the Future – 314

X RAY BINARIES
Observations of Compact X-Ray Binaries with Chandra – 315

X RAY DIFFRACTION
Fundamental Issues Regarding the High Temperature Failure Properties of Graphite/Polyimide Fabric Composites – 40

X RAY SOURCES
Recent Results on Ultra-Luminous X-ray Sources – 313

The Optical Counterpart of M101 ULX-1 – 313

Ultrashort X-Ray Pulse Science – 276

Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

X RAY SPECTROSCOPY
Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane – 52

Simultaneous X-Ray and UV Spectroscopy of the Symbiotic HD 154791 – 317

X RAY TELESCOPES
Development of High Resolution Hard X-Ray Telescope with Multi-Layer Coatings – 311

Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

X RAYS
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Autonomous Underwater X-Ray – 164

Compact Flares and CMEs – 309

Fluorescent Approaches to High Throughput Crystallography – 296

Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

X-Ray Calibration Facility/Advanced Video Guidance Sensor Test – 32

X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years – 316

X-33 REUSABLE LAUNCH VEHICLE
Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

X-37 VEHICLE
Learning Lessons from the X-37 Project – 29

YAGI ANTENNAS
A Uniplanar Quasi-yagi Antenna with Wide Bandwidth and Low Mutual Coupling Characteristics – 71

YEAST
Identification of Functions of Neurofibromin Distinct from the RASGAP domain – 216

ZINC OXIDES
Development of Improved Thermal Control Coatings for Space Assets – 20

Personal Author Index

Abbas, M. N.
Experiments on Dust Grain Charging – 315

Abbot, Philip
Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES) – 289

Abe, H.
Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

Abeles, E.
Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB-1493 Rulemarking – 186

AbouEl-Soud, Ahmed K.
On the Performance of the VESPA Algorithm for Blind Beamforming and Signal Detection of Multi-source Multipath Signals – 73

Abubakar, A.
Nonlinear Inversion in Three-dimensional Cross-well Induction Logging using Full-Vectorial Multi-Frequency Data – 148

Acharya, R.
Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control – 188

Acree, Michael A.
Archimedean Spiral-mode Microstrip Antenna with Improved Axial Ratio – 79

Adams, Jim
The Human Exploration Initative: Space Radiation Measurement Needs – 306

Adams, M. L.
NASA Celebrates the World Year of Physics – 306

Adams, R. B.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Adler, Robert F.
Contributions of TRMM to Our Understanding of Precipitation Processes and Climate Variability – 204

Adrian, M. L.
IMAGE-POLAR Concurrent Plasmapause Observations – 195

Agius, A. A.
Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna – 205

Aguasca, A.
Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms – 85

Aguasca, Albert
Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

Vectorial Waveguide Reflectometer for Dielectric Characterization of Materials Under Power Microwaves – 147

Ahearn, E. A.
Regression Equations for Estimating Flood Flows for the 2-, 10-, 25-, 50-, 100-, and 500-Year Recurrence Intervals in Connecticut – 237

Ahlberg, Mikael
Downlink Propagation Measurements in the GSM 900 and 1800 MHz Bands – 93

Ahlin, L.
Demonstration of Adaptive Radio Node – 63

Akhtar, M. J.
An Improved Renormalization Technique for Profile Inversion – 267

Akiyama, A.
Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas – 91

Ala-Laurinaho, Juha
On the Planarity Errors of the Hologram of the CATR – 92

Alam, M.
Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control – 188

Alapaty, K.
Modeling the Transport and Chemical Evolution on Onshore and Offshore Emissions and Their Impact on Local and Regional Air Quality Using a Variable-Grid-Resolution Air Quality Model – 188

Alaydrus, M.
The Hybrid(sup 2)-Method: Combination of the FE/BE Hybrid Method with the UTD – 267

Albrecht, Mark
Patient Warming Device for Casualty Care – 222

Albyn, Keith
Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

Alderfer, David W.
Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

Alena, Richard L.
Two Trees: Migrating Fault Trees to Decision Trees for Real Time Fault Detection on International Space Station – 306

Alexander, R.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Alexander, Terri G.
Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

Alexopoulos, Nicolaos G.
Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials – 146

Filtering Characteristics of Thin, Planar 3D Printed Element Arrays – 153

Microstrip Line Fed Slot Antenna with PBG Superstrate – 89

Physical Realization of Magnetic Walls Using Finite-thickness 3D Printed Arrays – 108

The Field Transmitted into a PBG Crystal due to an Electric Line Source – 108

Alhorn, Dean C.
Autonomous Assembly of Modular Structures in Space and on Extraterrestrial Locations – 251

Allan, G.
Demonstration and Validation of the Excited Dielectric Test (Trade Name) Method to Detect and Locate Defects in Aircraft Wiring Systems – 141

Allard, L.
Retrocommunication – 63

Allen, Michael J.
Twist Model Development and Results From the Active Aeroelastic Wing F/A-18 Aircraft – 15

Alonso, Juan J.
Computational Algorithms for High-Fidelity Multidisciplinary Design of Complex Aerospace Systems – 3

Altstatt, Richard
Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

Alvarez-Cabanillas, M. A.
Modeling of Gaussian Beam Diffraction from a Thick Single-slit Perfectly Conducting Screen: Finite-Difference Time-Domain Method Versus Rigorous Theory – 269

Alvin, M. A.
Advanced Second Generation Ceramic Candle Filters – 181

Al-Zoubi, Asem
Quasi-static Analysis of Asymmetric Cylindrical Coplanar Waveguide – 151

Aman, M. J.
Ebola and Marburg Viruses Replicate in Monocyle- Derived Dendritic Cells without Inducing the Production of Cytokines and Full Maturation – 221

Molecular Mechanisms of Filovirus Cellular Trafficking – 222

Amari, Smain
A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256

Amendola, G.
A Broadband Microstrip Antenna for SAR Applications – 75

Ammann, M. J.
Planar Trapezoidal and Pentagonal Monopoles with Impedance Bandwidths in Excess of 10:1 – 88

Amoroso, Paul J.
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

Amromin, Eduard
Multi-Disciplinary Computational Tools for Naval Design – 264

Anand, Gaurav
Residual Gas Effects on Detached Solidification in Microgravity – 297

Anantha, Veeraraghavan
FDTD Computed Numerical Diffraction Coefficients of 3-D Infinite Material Wedges – 265

Anastasi, Robert F.
Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles – 30

Anderson, B. Jeffrey
Atmospheric/Space Environment Support Lessons Learned Regarding Aerospace Vehicle Design and Operations – 28

Anderson, Brittany
Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

Anderson, Gregory W.
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

Anderson, Robert C.
Neural Network for Image-to-Image Control of Optical Tweezers – 169

Anderson, Robert H.
Understanding the Insider Threat. Proceedings of a March 2004 Workshop – 301

Anderson, Soeren
GSM/TDMA Adaptive Antenna Field-Trial Results – 75

Anderson, T.
Wrapping the Future – 234

Ando, Makoto
Moment Method Analysis of Parallel Plate Slot Antennas – 66

Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

Ando, M.
Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas – 91

AndresdeMatey, Juan Miguel
Large 2-D Thinned Array for the Microwave Imaging Radiometer with Synthetic Aperture (MIRAS) – 100

Anguera, Jaume
A Procedure to Design Wide-Band Electromagnetically-coupled Stacked Microstrip Antennas Based on a Simple Network Model – 114

Anilkumar, A.
Observation of an Aligned Gas - Solid 'Eutectic' during Controlled Directional Solidification Aboard the International Space Station - Comparison with Ground-based Studies – 58

Antar, Y. M. M.
A New Broad-band, Dual-frequency Coplanar Waveguide Fed Slot-Antenna – 66

Arai, Y.
Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas – 91

Ares, F.
Recalculating Linear Array Antennas to Compensate for Failed Elements While Maintaining Fixed Nulls – 102

Arias, A. marcos
Antennas Feasibility Study for a LMDS Communication System – 91

Arkes, Jeremy
California's K-12 Public Schools. How Are They Doing? – 301

Armani, Clinton
Limited Evaluation of Automated Aerial Refueling Algorithm (Project Self Serve) – 7

Arndt, Fritz
Fast Spectral Domain Analysis of Large Finite Microstrip Patch Arrays – 101

Arnone, R.
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264

Askew, J. W.
Low Noise Exhaust Nozzle Technology Development – 2

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

Aspelmeyer, M.
Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

Atwater, Delmas W.
A Bipolar Electrode for Use in a Semi Fuel Cell – 139

Aubert, B.
Constraints on r(sub B) and gamma in B(sup (+-)) rightarrow D(sup 0)K(sup (+-)) decays by a Dalitz analysis of D(sup 0) Greater Than K(sub S) pi(sup -) pi(sup +) – 282

Measurement of CP Violating Asymmetries in B(sup 0) --\g f(sup 0)(980)Ks Decays – 285

Measurement of CP-Asymmetries for the Decays B(sup (+-)) --\g D(sub CP)(sup 0) K*(sup (+-)) with the BABAR Detector – 286

Measurement of CP-violating parameters in fully reconstructed B--\gD(*)pi and B--\gDrho decays – 282

Measurement of the B0--\gK0sK0sK0s Branching Fraction – 283

Measurements of Branching Fraction, Polarization, and Direct CP-Violating Asymmetry in B(sup +) --\g K*(sup 0)(rho)(sup +) Decays – 283

Search for an X(3872) charged partner in the decay mode X- Yields J/psi pi- pi0 in the B meson decays B0 Yields X- K+ and B- Yields X- Ks – 282

Search for the Decay B+ Yields K+ nu nubar – 282

Search for the Decay B(sup 0) Yields K*(sup +)(rho)(sup -) – 287

Searches for Charmless Decays B0 --\g eta omega, B0 --\g eta K0, B+ --\g eta rho+, and B+ --\g eta' pi+ – 283

Study of (bar B)(sup 0) --\g D(*)(sup 0)(bar K)(*)(sup 0) Decays – 283

Study of e(sup +)e(sup -) --\g (pi)(sup +)(pi)(sup -)(pi)(sup 0) Process Using Initial State Radiation with BaBar – 283

Aubert, H.
Interconnect and Packaging Electrical Circuits Network – 124

Austin, Thomas
High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

Aygun, K.
A Fast Time Domain Integral Equation Technique for Analyzing EMC/EMI Problems – 258

Ayotte, K. S.
Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

Baars, Jacob W. M.
Design Features of the Large Millimeter Telescope (LMT) – 101

Baccarelli, P.
Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

Back, G.
An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

Bader, A.
Deposition Diagnostics for Next-Step Devices – 296

Badessi, S.
Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92

Bailey, Debra A.
Shuttle-Derived Launch Vehicles' Capablities: An Overview – 22

Bailey, William R., III
Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

Baker, Nancy L.
The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

Balan, C.
Low Noise Exhaust Nozzle Technology Development – 2

Static Aerodynamic Performance Investigation of a Fluid Shield Nozzle – 14

Balanis, Constantine A.
Full-wave Analysis of HF Antennas on Helicopters Using the FDTD, FEM and NEC – 128

Baldridge, E.
Developing Spatially Interpolated Surfaces and Estimating Uncertainty – 182

Balzer, Robert
Integrity Through Mediated Interfaces – 248

Banks, Bruce A.
Atomic Oxygen Treatment and Its Effect on a Variety of Artist's Media – 38

Barate, R.
Study of e(sup +)e(sup -) --\g (pi)(sup +)(pi)(sup -)(pi)(sup 0) Process Using Initial State Radiation with BaBar – 283

Barber, T.
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Bard, A. J.
Tunable Optical Polymer Systems – 53

Bardatai, Fernando
Time-Domain Analysis of the Electromagnetic Coupling in Satellite Environments – 31

Barghouty, A. F.
Effects of Nuclear Interactions in Space Radiation Transport – 229

Barghouty, Nasser
The Human Exploration Initative: Space Radiation Measurement Needs – 306

Barlow, S. E.
Dynamometer Evaluation of Plasma-Catalyst for Diesel NOX Reduction – 171

Barmak, K.
Relationship of Magnetocrystalline Anisotropy and Stoichiometry in Epitaxial L1(sup 0) CoPt(001) and FePT (001) Thin Films – 297

Barnes, Robin J.
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Barreiros, Jacinto
Microstrip Patch Antenna for GSM 1800 Handsets – 90

Barrows, Ryan
Patient Warming Device for Casualty Care – 222

Barsky, Sanford H.
The Origin and Significance of Mammary Intraductal Foam Cells – 216

Bass, M.
Cryo Power and Heat Transfer – 171

Bassler, Julie A.
Are we There Yet? ... Developing In-Situ Fabrication and Repair (ISFR) Technologies to Explore and Live on the Moon and Mars – 18

Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Research Opportunities Supporting the Vision for Space Exploration from the Transformation of the Former Microgravity Materials Science Program – 36

Batra, R. C.
Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

Batygin, Y.
Design Studies for Flux and Polarization Measurements of Photons and Positrons for SLAC Proposal E166: An Experiment to Test Polarized Positron Production in the FFTB – 286

Baudrand, H.
A New Approach for Microstrip Active Antennas Using Modal FFT-algorithm – 98

Interconnect and Packaging Electrical Circuits Network – 124

Baum, Andrew
Center for Behavioral Research: Individual Interventions for Breast Cancer Patients – 211

Baumgartner, F.
Coupled Gravity and Elevation Measurement of Ice Sheet Mass Change – 195

Beck, B. Terry
Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

Beckman, Claes
Downlink Propagation Measurements in the GSM 900 and 1800 MHz Bands – 93

Bedrossian, Laura A.
Development of Improved Thermal Control Coatings for Space Assets – 20

Beene, D.
An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

Beier, Theodor H.
High Speed Research Program Structural Acoustics Multi-Year Summary Report – 290

Beisser, Kerri B.
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Bekraoui, Leila
Low Cost Broadband Microstrip Antenna for Satellite-TV Reception – 67

Bell, Daryl C.
ISAR Turntable Experiments Using a Coherent Ultrawideband Random Noise Radar – 84

Bemporad, A.
Current Sheet Evolution in the Aftermath of a CME Event – 324

Bengtson, Robert J.
Applications of Endothermic Reaction Technology to HSCT and AST – 16

Benvenuti, C.
Superconducting RF Systems and Cryogenics. Subgroup Summary Report – 275

Berge, Matthew E.
Assessment of the NASA AvSTAR Project Plan – 1

Berger, Brian
ISOP To Focus on Shuttle Transition – 26

Bergman, David R.
Application of Differential Geometry to Acoustics: Development of a Generalized Paraxial Ray-Trace Procedure from Geodesic Deviation – 273

Bergmann, J. R.
A Shaped Relector Antenna for Mobile Communications – 85

Berlin, G. T.
Remote System Technologies for Deactivating Hanford Hot Cells – 141

Berner, Robert A.
OR Modeling of a Conceptual System of Systems for Maritime Littoral Dominance in 2020 – 272

Bernhard, J. T.
An Analysis and Design Tool for Evaluation of Integrated Antenna Diversity Systems in Portable Wireless Devices – 90

Berning, Ellen
Modeling Thermal Ignition of Energetic Materials – 299

Berton, Jeffrey J.
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

Berube, Keith A.
Influence of Stress Relaxation in Hybrid Composite/Metal Bolted Connections – 175

Besada, Jose L.
Antennas Feasibility Study for a LMDS Communication System – 91

Best, Joel
STS Derived Exploration Launch Operations – 22

Best, Philip J.
Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative – 34

Bhardwal, Anil
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Bhat, Biliyar N.
Materials Challenges in Space Exploration – 36

Bhat, Waman V.
High Speed Research Program Structural Acoustics Multi-Year Summary Report – 290

Bhattacharya, Manojeet
The Human Exploration Initative: Space Radiation Measurement Needs – 306

Bhattacharya, P.
Hybrid Molecular and Spin-Semiconductor Based Research – 168

Bird, T. S.
Analysis of Radiation from Two Separate Axisymmetric Horns Using the Method of Moments – 114

Biscari, C.
Lattices. Subgroup Summary Report – 275

Bisognano, J.
Superconducting RF Systems and Cryogenics. Subgroup Summary Report – 275

Bissette, Gina M.
Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators – 166

Biwer, B. M.
Site-Specific Analysis of a Spent Nuclear Fuel Transportation Accident – 184

Black, David
Cooperative Agreement in Space Sciences (CPSS) NCC5-637 – 305

Black, Donald
Metallic Zone Plates for Sectoral Horns – 119

Blair, D. M.
Decontamination Technologies for Facility Reuse – 191

Blanchard, Sean P.
3-D Numerical Mode-Matching (NMM) Method for Inhomogeneous Media – 254

Blanski, Rusty L.
Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes – 37

Bliss, James P.
Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

Bloemenkamp, Richard F.
A Conjugate Gradient FFT Method for Transient Scattering by Dielectric Cylinders – 259

Blonski, Slawomir
Initial On-Orbit Spatial Resolution Characterization of OrbView-3 Panchromatic Images – 307

Blythe, G.
Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000 – 180

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, June 2000 – 180

Boag, A.
Electromagnetic Analysis of an Antenna Buried in a Composite Environment – 73

Boag, Amir
A Fast Multilevel Domain Decomposition Algorithm for Radar Imaging – 103

Boccippio, Dennis J.
An Orbital 'Virtual Radar' from TRMM Passive Microwave and Lightning Observations – 203

Boccippio, Dennis
Lightning Contribution to Improvement of Passive Microwave Vertical Structure and Rainfall Estimation – 196

Bodiford, Melanie P.
Are we There Yet? ... Developing In-Situ Fabrication and Repair (ISFR) Technologies to Explore and Live on the Moon and Mars – 18

Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Boeder, Paul
Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

Boehman, A.
Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control – 188

Bolkcom, Christopher
Homeland Security: Protecting Airliners from Terrorist Missiles – 12

Bolli, P.
A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108

Bolomey, J. Ch.
Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Bonavida, Benjamin
Regulation of TRAIL-Mediated Apoptosis in Prostate Cancer by Overexpression in XIAP – 223

Bond, Aleck C.
A Review of Man-Rating in Past and Current Manned Space Flight Programs – 21

Bonemetti, J.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Boni, R.
Superconducting RF Systems and Cryogenics. Subgroup Summary Report – 275

Bonnell, J. T.
Long-Lag, Wide-pulse Gamma-Ray Bursts – 312

Bonner, W. A.
Reproducible Crystal Growth Experiments in Microgravity Science Glovebox at the International Space Station (SUBSA Investigation) – 57

Booth, Earl R., Jr.
Model-Scale Aerodynamic Performance Testing of Proposed Modifications to the NASA Langley Low Speed Aeroacoustic Wind Tunnel – 287

Booysen, Adriaan J.
Aperture Theory And The Equivalence Theorem – 233

Borah, Deva
Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments – 62

Borges, Jose M.
Radar Search and Detection With the CASA 212 S43 Aircraft – 165

Boria, V. E.
A New Hybrid Mode-matching Method for the Analysis of Inductive Obstacles and Discontinuities – 257

Characterization of Complex Dielectric Properties of Materials Using a Hybrid Iterative Method – 147

Borissov, Eugene
Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements – 156

Borja, Carmen
A Procedure to Design Wide-Band Electromagnetically-coupled Stacked Microstrip Antennas Based on a Simple Network Model – 114

Bornemann, Jens
A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256

Borraccini, Joseph P.
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

Bosio, Catharine M.
Ebola and Marburg Viruses Replicate in Monocyle- Derived Dendritic Cells without Inducing the Production of Cytokines and Full Maturation – 221

Molecular Mechanisms of Filovirus Cellular Trafficking – 222

Bossart, S. J.
Decontamination Technologies for Facility Reuse – 191

Boston, Penelope J.
Lunar and Martian Sub-surface Habitat Structure Technology Development and Application – 320

Boto, K.
Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment – 69

Bougher, Stephen
Solar Cycle/Seasonal Variations of H, D, H2 and He Distributions and Escape on Mars as Determined by the Mars Thermosphere Global Circulation Model (MTGCM) – 324

Bouirig, Abdellah
Wide Band Modeling and Electromagnetic Pulse Propagation through HF Channel – 68

Boustany, Sami
Normalization of NEXRAD Antenna Gain for Overlapping Radars – 127

Boutigny, D.
Study of e(sup +)e(sup -) --\g (pi)(sup +)(pi)(sup -)(pi)(sup 0) Process Using Initial State Radiation with BaBar – 283

Bowles, Frederick A.
Compilation of Data Sources Used to Construct Bottom-Sediment Province Maps for the USA East Coast Continental Shelf from Cape Kennedy to Cape Hatteras and for Various Indonesian Waters – 176

Boyce, R.
Gas System Upgrade for the BaBar IFR Detector at SLAC – 283

Brackney, Richard C.
Understanding the Insider Threat. Proceedings of a March 2004 Workshop – 301

Bragg-Sitton, Shannon M.
Transient Approximation of SAFE-100 Heat Pipe Operation – 32

Branco, M. G. C.
A Shaped Relector Antenna for Mobile Communications – 85

Branduardi-Raymont, Graziella
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Branner, G. R.
Design of Low Sidelobe Circular Ring Arrays by Element Radius Optimization – 109

Optimization of Linear Array Antenna Performance – 104

Brausch, J. F.
Low Noise Exhaust Nozzle Technology Development – 2

Bregman, Joel
Galactic Winds and Intragroup Medium Energetics – 317

Brewitt-Taylor, C. R.
Fundamental Limit on the Performance of Radar Absorbing Materials – 109

Brickner, Michael S.
An Assessment of Alternative SAR Display Formats: Orientation and Situational Awareness – 302

Bridges, Jack E.
Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Nonpalpable Breast Tumors – 158

Bridges, W.
Photonic Analog-to-Digital Conversion Technology – 133

Bright, Harold J.
Proceedings of the Workshop on Power Sources for Distributed Autonomous Systems – 137

Bringhurst, David L.
The Reliability and Validity of the Outcome Rating Scale: A Replication Study of a Brief Clinical Measure – 214

Brinton, John C.
Development of High Resolution Hard X-Ray Telescope with Multi-Layer Coatings – 311

Brodsky, S. J.
Hard Photodisintegration of a Proton Pair in 3He – 286

Single-Spin Polarization Effects and the Determination of Timelike Proton Form Factors – 286

Brooks, D. J.
Dynamometer Evaluation of Plasma-Catalyst for Diesel NOX Reduction – 171

Brown, Bryan D.
Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators – 166

Brown, G. L.
The 1-MW Radiatively Driven Hypersonic Wind Tunnel Experiments – 60

Brown, Kendall K.
Technology Challenges for Deep-Throttle Cryogenic Engines for Space Exploration – 33

Brown, Kenneth W.
Electromagnetic Parallel Processing Using the Personal Computers of a Local Area Network – 242

Rigorous Analysis of Practical Reflector Antennas – 80

Bruggerman, Carl
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Brunner, Christopher
Low Complexity Space-frequency Rake Receivers for WCDMA – 131

Bryans, J.
Modelling Opacity using Petri Nets – 236

Simplified Version of the Chaum Voting Scheme – 235

Bryzik, Walter
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Brzymialkiewicz, Caryl N.
Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection – 215

Buchau, A.
2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

Buchenauer, C. J.
Beamforming in Time-Domain Arrays – 106

Buchner, Stephen
Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digital Converter – 140

Buck, C.
ESA's Ground Breaking Synthetic Aperture Radar: The ENVISAT-1 ASAR Active Antenna – 100

Buettner, Leonard C.
Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter – 43

Burdige, David J.
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

Burkholder, R. J.
Fast Generalized Forward-backward Method by Using a Spectral Acceleration – 255

The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces – 253

Burks, Kevin H.
In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Burnett, James C.
Molecular Mechanisms of Filovirus Cellular Trafficking – 222

Bush, C.
Comparison of Clean Diesel Buses to CNG Buses – 188

Bustamante, Ernesto
Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

Bustos, R.
Practical Gamma Spectroscopy Assay Techniques for Large Volume Low-Level Waste Boxes – 231

Butler, C. M.
Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

Butler, Chalmers M.
Analysis of a Charge Probe and its Response near Metallic and Dielectric Interface – 151

The Sleeve-cage Monopole and Sleeve Helix for Wideband Operation – 80

Byrnes, Graham
Applying Statistical Models to Mammographic Screening Data to Understand Growth and Progression of Ductal Carcinoma in Situ – 217

Byun, Joonho
FDTD Analysis of Mutual Coupling between Microstrip Patch Antennas on Curved Surfaces – 71

Caccese, Vincent
Influence of Stress Relaxation in Hybrid Composite/Metal Bolted Connections – 175

Caffrey, Peter
Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model – 197

Cai, Y.
Beam-beam Simulation Studies for PEP-II and KEKB – 284

Symplectic Treatment of a Finite Crossing Angle in the Beam-Beam Collision – 282

Cairon, P.
Differences and Similarities in Andra's Assessment of Activities Carried Out by Radioactive Waste Generators and Affecting the Quality of IL-LL Short-Lived Waste Packages and HL-IL Long-Lived Waste Packages – 187

Caldow, R.
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 174

Caldwell, Johnnie
Limited Evaluation of Automated Aerial Refueling Algorithm (Project Self Serve) – 7

Camanho, P. P.
Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

Cameirao, Pedro
Microstrip Patch Antenna for GSM 1800 Handsets – 90

Campbell, Arthur B.
Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digital Converter – 140

Campbell, W. F.
The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

Campisi, I. E.
Superconducting RF Systems and Cryogenics. Subgroup Summary Report – 275

Campo, Angela
Research and Development (R&D) on Advanced Nonstructural Materials. Delivery Order 0001: Study of Hydraulic System Component Storage With Operational and Rust-Inhibited Hydraulic Fluids – 53

Candler, Graham V.
APTU Nozzle Code Manual, Version 3.0 – 244

Candy, James V.
A Parametric Approach to Radar Processing of Reentry Vehicle Signatures – 95

Cangellaris, Andreas
Transient Plane Wave Scattering from Objects Near Lossy Ground with FDTD – 150

Canuto, V. M.
Modeling Ocean Deep Convection – 197

Cao, Qunscheng
An Anisotropic Perfectly Matched Layer (APML) Absorber for Mesh Truncation in the Context of a Multiresolution Time Domain Scheme – 89

Capolino, Filippo
Time Domain Green's Function for a Phased Semi-infinite Periodic Line Array of Dipoles – 261

Capone, R.
A Reflector Antenna with High Gain and Wide Angle Beam Steering Capabilities – 76

Cappelli, D.
Insider Threat Study: Illicit Cyber Activity in the Banking and Finance Sector – 232

Caratori, Julien
Wide Band Modeling and Electromagnetic Pulse Propagation through HF Channel – 68

Cardama, Angel
Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

Cardinal, Paul G.
Advancement of Methodology for RF Dosimetry – 126

Carlson, C. E.
Single-Spin Polarization Effects and the Determination of Timelike Proton Form Factors – 286

Carpenter, Paul K.
Characterization Strategies and Requirements for Lunar Regolith Simulant Materials – 322

Carrasquillo, Robyn
ISS ECLSS Technology Evolution for Exploration – 230

Sabatier Methanation Reactor for Space Exploration – 321

Carreiro, Louis G.
A Bipolar Electrode for Use in a Semi Fuel Cell – 139

Carroll, Stephen J.
California's K-12 Public Schools. How Are They Doing? – 301

Carter, Harold W.
Development, Exploitation, and Transition of Computer Aided Engineering (CAE) Tools – 135

Cascoato, Mark D.
Modeling Surface Currents on Electrically Large Impedance Cylinders - 2D, TM Case – 120

Cassapakis, Constatine
On Inflatable Antenna State of the Art Precision – 100

Castafter, Manuel Sierra
Moment Method Analysis of Parallel Plate Slot Antennas – 66

Castelnuovo, Stefano
Limited Evaluation of Automated Aerial Refueling Algorithm (Project Self Serve) – 7

Catala, J. M.
Characterization of Complex Dielectric Properties of Materials Using a Hybrid Iterative Method – 147

Catala-Civera, J. M.
Precise Dielectric Properties Determination of Laminar-shaped Materials in a Partially-filled Waveguide – 146

Caulev, Michael
Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments – 62

Cecil, D.
Lightning Contribution to Improvement of Passive Microwave Vertical Structure and Rainfall Estimation – 196

Censullo, A. C.
Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings – 55

Chadwick, K.
Computation of Radar Cross Section of Waveguide Arrays – 99

Chakrabarty, Deepto
Simultaneous X-Ray and UV Spectroscopy of the Symbiotic HD 154791 – 317

Chakravarthy, Sukumar
Introduction to CFD++, its Transient and Moving Body Capabilities – 246

Chalhoub, Nabil
Adaptation of Advanced Diesel Engines for Military Requirements Under Severe Environmental Conditions – 61

Chalmers, M. Butler
Coupling to a Probe in a Metal Can by an Electric Dipole – 240

Champagne, G. A.
Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport – 15

Chan, Chi-Hou
Synthesis of Shaped-Beam Pattern for Mobile Antenna – 143

Chan, K. K.
Computation of Radar Cross Section of Waveguide Arrays – 99

Chandra, D. C.
Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs) – 231

Chang, Dau-Chyrh
Development of Eight Meters Inverse Cosecant Square Reflector Antenna – 67

Chang, Hongrok
Slow and Fast Light in Coupled Microresonators – 294

Chang, Kai
A Multi-frequency Microstrip-fed Shorted Square Ring Slot Line Antenna – 71

Ka-Band Beam Steering Reflectarray Study – 86

Chang, Mai
Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62

Chang, S. I.
Global Positioning System Data Integration and Development of a Three-Dimensional Spatial Model of the Kansas Highway Network – 59

Chang, S.
A Design Procedure for Classical Offset Dragonian Antennas with Circular Apertures – 77

Chang, Seichoong
Measured Back Scattering Cross Section of Thin Wires – 156

Chao, Hsueh-Yung
Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268

Chapman, J.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Chatelain, Joshua W.
Compilation of Data Sources Used to Construct Bottom-Sediment Province Maps for the USA East Coast Continental Shelf from Cape Kennedy to Cape Hatteras and for Various Indonesian Waters – 176

Chelberg, David
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Chellappan, Srikumar
The Role of the Prohibition Gene in Apoptosis of Breast Cancer Cells – 215

Chen, B.
Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB-1493 Rulemarking – 186

Chen, C. P.
Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup – 158

Chen, C.-H. Rosie
The Optical Counterpart of M101 ULX-1 – 313

Chen, Fu-Chiang
Code-Division Multiplexing and Frequency-Division Multiplexing for Nonlinear Inverse Scattering – 267

Chen, Horng-Dean
Novel Designs of Broadband Equilateral-triangular Microstrip Antennas – 68

Chen, Hua-Ming
Reactively Loaded Microstrip Antenna for Dual-frequency Operation – 95

Chen, Hui
Performance Improvement of Estimation Direction-of-arrival via Array Geometry Arrangement – 86

Chen, J. C.
Study of e(sup +)e(sup -) --\g (pi)(sup +)(pi)(sup -)(pi)(sup 0) Process Using Initial State Radiation with BaBar – 283

Chen, Ji
Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129

Chen, Jiunn-Tsair
Improved Wavelet-Based Beamformers with Dynamic Subband Selection – 256

Chen, Qiang
Measurement of Radiation Efficiency of Antennas in the Vicinity of Human Head Model Proposed By COST 244 – 131

Chen, S. H.
Tunable Optical Polymer Systems – 53

Chen, S. Y.
Site-Specific Analysis of a Spent Nuclear Fuel Transportation Accident – 184

Chen, Wen-Tzu
Numerical Computation on Radiation Characteristics of Square Loop Antennas at the Wrist Position of a Human Body in Personal Wireless Communications – 116

Chen, Yinchao
An Anisotropic Perfectly Matched Layer (APML) Absorber for Mesh Truncation in the Context of a Multiresolution Time Domain Scheme – 89

Chen, Yung-Chang
Channel Simulation of Leo Satellites – 92

Chen, Zhi Ning
A Novel Sleeve Monopole with Broad Bandwidth – 74

Chen, Zhi-Ping
Experiment Research On MM Wavelength Radar Absorbing Materials – 155

Chen, Zhizhang
FDTD Modeling of Magnetized Ferrites Using Z Transforms – 254

Cheng, Jui-Ching
Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Cheng, K. A.
A Novel InAs Quantum Wire System – 139

Cheng, Y.
Modeling Ocean Deep Convection – 197

Cheng, Yi-Chung
Development of Eight Meters Inverse Cosecant Square Reflector Antenna – 67

Chernov, A. A.
Liquid Between Macromolecules in Protein Crystals: Static Versus Dynamics – 192

Chesnakas, Christopher J.
Performance of Propeller 4381 in Crashback – 160

Chevalier, Y.
Complex Natural Resonances Extracted from Radar Signatures Measured in Time Domain with UWB Laboratory System – 65

Chew, W. C.
A New FDTD Formulation with Reduced Dispersion for the Simulation of Wave Propagation Through Inhomogeneous Media – 254

A Topological Viewpoint on Consistency Aspects of Electromagnetic Theory on a Lattice – 131

Accurate Model of Arbitrary Wire Antennas in Free Space, Above or Inside Lossy Ground – 97

Complexity Issues in Inverse Scattering Problems – 149

Cylindrical 3D PML-PLRC-FDTD Schemes for Frequency-dispersive and Inhomogeneous Media – 118

Higher-Order MoM Implementation to Solve Integral Equations – 268

Chew, Weng Cho
Code-Division Multiplexing and Frequency-Division Multiplexing for Nonlinear Inverse Scattering – 267

Fast Computation of Scattering from (Near-)Resonant Structures – 233

Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268

Moment Method Based Analysis of Dielectric-resonator Antennas – 122

Chew, Weng-Cho
Fast Steepest Descent Path Algorithm for Electromagnetic Scattering Problems in Layered Medium – 278

Chiappetta, L.
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Chiaveri, E.
Superconducting RF Systems and Cryogenics. Subgroup Summary Report – 275

Chin, A. H.
Ultrashort X-Ray Pulse Science – 276

Chiu, Tsenchieh
Propagation of Electromagnetic Waves Near the Surface of a Half-space Dielectric with Rough Interface – 257

Cho, Bum Jun
An Aperture-coupled Small Microstrip Antenna with Enhanced Bandwidth – 67

Cho, Keizo
A New Calibration Method of Adaptive Array for TDD Systems – 74

Cho, Ung Hee
Revisited Generalized Wood Anomalies – 239

Surface Wave Scattering by Finite Periodic Structure of Arbitrary Profile in a Ground Plane: TE case – 84

Cho, Young Ki
Revisited Generalized Wood Anomalies – 239

Surface Wave Scattering by Finite Periodic Structure of Arbitrary Profile in a Ground Plane: TE case – 84

Chong, M. S.
Flow Over a Body of Revolution in a Steady Turn – 10

Chow, L. C.
Cryo Power and Heat Transfer – 171

Christensen, Carissa B.
Advanced Technology Lifecycle Analysis System (ATLAS) Technology Tool Box (TTB) – 300

Christensen, Marc P.
Shedding Light on the Battlefield: Tactical Applications of Photonic Technology – 167

Christodoulou, C. G.
Experimental Validation of a Neural Network Direction Finder – 142

Christopoulos, C.
Time-Domain Modelling of Propagation in Nonlinear Dielectrics Using TLM – 258

Chu, C. W.
Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors – 139

Chu, You-Hua
The Optical Counterpart of M101 ULX-1 – 313

Chuang, Huey-Ru
Numerical Computation on Radiation Characteristics of Square Loop Antennas at the Wrist Position of a Human Body in Personal Wireless Communications – 116

Chung, Shyh-Jong
Analysis and Design of a Planar Two-Dimensional Retrodirective Array Reflector – 86

Chung, T.
Cryo Power and Heat Transfer – 171

Chung, Y. T.
Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

Chung, You Chung
Adaptive Nulling with Spherical Arrays Using a Genetic Algorithm – 107

Cima, Michael J.
Gradient-Index (GRIN) Lenses by Slurry-Based Three-Dimensional Printing (S-3DP) – 49

Ciric, I. R.
Reduced-Order Models for the Field Analysis of Hybrid Systems – 152

Clancy, Michael
Evaluations of Global Wind Prediction at Fleet Numerical Meteorology and Oceanography Center: from the Perspective of a Wave Modeler – 197

Clarricoats, P.
Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60

Clayton, L.
Economic Impact Analysis of Final Iron and Steel Foundries NESHAP – 183

Clenet, M.
Wideband Single Layer Microstrip Array at 28 GHz – 98

Clinton, R. G., Jr.
Materials Requirements for Advanced Propulsion Systems – 35

Research Opportunities Supporting the Vision for Space Exploration from the Transformation of the Former Microgravity Materials Science Program – 36

Clisset, J. R.
A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow – 16

Coccioli, R.
PBG-Assisted Gain Enhancement of Patch Antennas on High-dielectric Constant Substrate – 109

Cocker, D.
Internal Combustion Engine (ICE) Air Toxic Emissions – 173

Coffey, K. R.
Relationship of Magnetocrystalline Anisotropy and Stoichiometry in Epitaxial L1(sup 0) CoPt(001) and FePT (001) Thin Films – 297

Cogollos, S.
A New Hybrid Mode-matching Method for the Analysis of Inductive Obstacles and Discontinuities – 257

Characterization of Complex Dielectric Properties of Materials Using a Hybrid Iterative Method – 147

Cohen, J. M.
Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Colburn, J. S.
External Substrate Perforation Applied to Patch Antennas for Mitigating Surface Wave Effects – 110

Colella, P.
Numerical Solution of Plasma Fluid Equations Using Locally Refined Grids – 294

Coleman, J. W.
Black Tie Optional: Modeling Programming Language Concepts – 235

Coleman, K.
Boiler Materials for Ultrasupercritical Coal Power Plants. Third Quarterly Report April 1 to June 30, 2004 – 48

Collins, Peter J.
Scattering from Dielectric Bodies – 69

Compeau, M. S.
Thermoelectrical Energy Recovery from the Exhaust of a Light Truck – 173

Contopanagoe, Harry F.
The Field Transmitted into a PBG Crystal due to an Electric Line Source – 108

Contopanagos, Harry F.
Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials – 146

Contopanagos, Harry
Filtering Characteristics of Thin, Planar 3D Printed Element Arrays – 153

Physical Realization of Magnetic Walls Using Finite-thickness 3D Printed Arrays – 108

Cook, Mary Beth
Materials Requirements for Advanced Propulsion Systems – 35

Research Opportunities Supporting the Vision for Space Exploration from the Transformation of the Former Microgravity Materials Science Program – 36

Cook, N.
Component Middleware to Support Non-repudiable Service Interactions – 82

Cooper, Anita E.
A Concept for the Inclusion of Analytical and Computational Capability in Existing Systems for Measurement of Neutron Flux – 164

Cooper, James A., Jr.
Demonstration of Silicon Carbide Power Devices in Practical Power Conversion Systems – 46

Cooray, F. R.
Analysis of Radiation from Two Separate Axisymmetric Horns Using the Method of Moments – 114

Copland, Evan
Energetics of Oxygen Interstitials in Cr and V – 50

Corbett, J. J.
Verification of Ship Emission Estimates with Monitoring Measurements to Improve Inventory and Modeling – 178

Coroller, P.
Comparative Study on Exhaust Emissions from Diesel- and CNG-Powered Urban Buses – 189

Costa, J. C W A.
Symmetry Synthesis of the Multiport Scattering Matrix as a First Step in the Design of Electromagnetic Devices and Components with Bianisotropic Media – 132

Costanzo, S.
A Broadband Microstrip Antenna for SAR Applications – 75

Coston, Calvin W., Jr.
Model-Scale Aerodynamic Performance Testing of Proposed Modifications to the NASA Langley Low Speed Aeroacoustic Wind Tunnel – 287

Covault, Craig
Martian Infotech – 26

Tests Narrowed – 26

Trial by Fire – 25

Coverstone, Victoria L.
Solar Electric and Chemical Propulsion for a Titan Mission – 32

Cox, B.
Developing Spatially Interpolated Surfaces and Estimating Uncertainty – 182

Craven, P. D.
Experiments on Dust Grain Charging – 315

IMAGE-POLAR Concurrent Plasmapause Observations – 195

Thermal N+ in the Inner Magnetosphere – 295

Cravens, Tom
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Crespo, Luis G.
Robust Control Design for Systems With Probabilistic Uncertainty – 18

Crook, Gentry
Broadband, Robust, Low-profile Monopole Incorporating Top Loading, Dielectric Loading, and a Distributed Capacitive Feed Mechanism – 104

Crowcrost, J.
Monitoring of Contractual Service Level Agreement – 232

Crowley, Michael R.
The Influence of Stromal Transforming Growth Factor-Beta Receptor Signaling on Mouse Mammary Neoplasia – 207

Crumbly, Chris
Shuttle-Derived Launch Vehicles' Capablities: An Overview – 22

Cui, T. J.
Accurate Model of Arbitrary Wire Antennas in Free Space, Above or Inside Lossy Ground – 97

Cuinas, Inigo
Measurement of Transmission Coefficients of Radiowaves through Building Materials in the 5.8 GHz Frequency Band – 142

Culbertson, J. C.
A Novel InAs Quantum Wire System – 139

Culick, Fred E.
Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

Cupples, Michael
Solar Electric and Chemical Propulsion for a Titan Mission – 32

Curren, Peter
Manufacture of Solar Cells on the Moon – 57

Curreri, Peter A.
Space Resource Utilization and Extending Human Presence Across the Solar System – 319

Curry, Matt
Multiple Strategy Bio-Detection Sensor Platforms Made from Carbon and Polymer Materials – 166

Cutler, Andrew D.
Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

Cutting, Kathleen
A Strategic Roadmap to Centauri – 19

Cwik, Tom
Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Cymerman, Allen
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

Da Cunha, A. D.
Code Review and Personality: Is Performance Linked to MBTI Type – 236

D'Agostino, Mark
Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

Dahlburg, Jill P.
Proceedings of the Workshop on Power Sources for Distributed Autonomous Systems – 137

Dailey, James
SJFHQ Simulation – 81

Dalke, Roger
Reflection and Transmission Properties of Reinforced Concrete Walls – 93

Dalton, Pamela
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 229

Daly, Timothy
Estimating Supplies Program: Evaluation Report – 245

Danehy, Paul M.
Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

D'Angelo, G.
Design and Simulation of Active Spiral Inductors for RF Integrated Circuits – 145

Daskalakis, Anastasios
Deployment and Evaluation of the Helicopter In-Flight Tracking System (HITS) – 8

Dass, Amala
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Datta, S.
Hybrid Molecular and Spin-Semiconductor Based Research – 168

Davidovich, M. V.
Parameters of Microstrip Patch Antenna under the Consideration Using the Piecewise Basis Functions – 121

Davidson, Amanda
Scholarly Research Program. Delivery Order 0007: Characterization of Ionic Liquids as Fuel Cell Electrolytes – 37

Davilla, C. G.
Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

Davis, J. L.
Climate-Driven Deformation of the Solid Earth from GRACE and GPS – 196

Regional Deformation Studies with GRACE and GPS – 253

Davis, James L.
Constraints of Melting, Sea-Level and the Paleoclimate from GRACE – 196

Davis, Lawrence
Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion – 167

De Maio, Antonio
Knowledge-Based Generalized Likelihood Ratio Test (KB-GLRT): Exploiting Knowledge of the Clutter Ridge in Airborne Radar – 167

Deal, W. R.
A Uniplanar Quasi-yagi Antenna with Wide Bandwidth and Low Mutual Coupling Characteristics – 71

Active Integrated Antennas for New RF Architectures – 64

DeBonis, James R.
High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

Decker, Arthur J.
Neural Network for Image-to-Image Control of Optical Tweezers – 169

Deffendol, Candace
Microstrip Antennas for Dielectric Property Measurement – 157

DeFiore, T.
Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

DeFlaviis, Franco
Dual Band Dual Linear Polarization Elliptical Microstrip Ring Antenna – 145

deFrutos, J.
Dual-band Compact Square Waveguide Corrugated Polarizer – 112

deHaro, Leandro
Antennas Feasibility Study for a LMDS Communication System – 91

Delisle, G.
Omnidirectional-dual Polarized Antenna for Wireless Indoor Applications at Millimeter Waves – 90

Delissle, Gilles Y.
Adaptive Arrays for Wideband Interference Suppression in Wireless Communications – 94

Dellinger, Ann M.
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

delosReyes, E.
Precise Dielectric Properties Determination of Laminar-shaped Materials in a Partially-filled Waveguide – 146

deMaagt, P.
Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60

Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92

Deng, Hai
Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform – 103

Deng, Sheng-Ming
A T-Strip Loaded Rectangular Microstrip Patch Antenna for Dual-Frequency Operation – 112

Denno, Patricia
Defense Information Warfare Technology Applications (DIWTA) Automated Intrusion Detection Environment (AIDE) Advanced Concept Technology Demonstration (ACTD) – 249

Depro, B. M.
Economic Impact Analysis of Final Iron and Steel Foundries NESHAP – 183

Depro, B.
Economic Impact Analysis (EIA) for the Proposed Stationary Combustion Turbines NSPS – 184

Derefeldt, G.
Thoughts Regarding Evaluation of the Human Perspectives in the 'Demonstrators' Work in the Armed Forces Transformation Program and Command and Control Development – 62

DeRoo, R. D.
A Novel Design of an Ultra-Fast Wideband Polarimetric Radar – 107

Desclos, L.
Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials – 132

Mixed Metallic Photonic Band-gap Material and Bragg Mirror – 298

Destrau, Sophie
Production and Purification of Refolded Recombinant Human IL-7 From Inclusion Bodies – 227

Deuflhard, P.
Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

Deverapalli, C.
The Utility of Auroral Image-based Activities Metrics – 193

Dewang, L.
Transactions of Nanjing University of Aeronautics & Astronautics, Vol. 21, No. 4, December 2004 – 4

DeWitt, Kenneth
Sulfur Oxidation and Contrail Precursor Chemistry – 47

DeZutter, Daniel
Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques – 253

DeZutter, D.
Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports – 130

Di Ferdinando, A.
Design and Evaluation of a QoS-Adaptive System for Reliable Multicasting – 82

Diashev, A.
Regulatory Approaches for Solid Radioactive Waste Storage in Russia – 181

Dib, Nihad
FDTD Modeling of Ceramic Multi-layer Capacitors Using Lumped Equivalent Models – 253

Quasi-static Analysis of Asymmetric Cylindrical Coplanar Waveguide – 151

Dietrich, F. S.
Report on Measurement at Ohio University to Estimate Backgrounds for Neutron Radiography in the 10-14 MeV Region – 275

Dilger, F.
Rail Access to Yucca Mountain: Critical Issues – 191

DiMassa, G.
A Broadband Microstrip Antenna for SAR Applications – 75

Dimmock, John O.
Slow and Fast Light in Coupled Microresonators – 294

DiNallo, C.
Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

Dix, Mary A.
Uniformed Services University of the Health Sciences Journal 2003 Edition – 226

Dlott, Dana D.
Ultrafast Spectroscopy of Energetic Materials: Toward a Molecular Understanding of Impact Sensitivity – 292

Dmitriev, Igor P.
An Oncotropic Adenovirus Vector System for Breast Cancer Treatment – 218

Dmitriev, V.
Symmetry Synthesis of the Multiport Scattering Matrix as a First Step in the Design of Electromagnetic Devices and Components with Bianisotropic Media – 132

Dobrzanski, Mark J.
Analysis of Tumor Antigen-Specific Tc1 and Tc2 CD8 Effector Cell Subpopulations as Potential Therapeutics Agents in the Treatment of Progressive Breast – 208

Dock, Matthew
Autonomous Underwater X-Ray – 164

Doehring, Todd C.
Elastic Response of Crimped Collagen Fibrils – 228

Dogliani, Harald
Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

Dolgashev, V.
Low Field Accelertor Structure Couplers and Design Techniques – 284

Domchek, Susan M.
Universal Breast Cancer Antigens as Targets Linking Early Detection and Therapeutic Vaccination – 213

Donahue, Benjamin B.
Solar Electric and Chemical Propulsion for a Titan Mission – 32

Donat, John R.
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

Donepudi, K. C.
Higher-Order MoM Implementation to Solve Integral Equations – 268

Donnelly, Martin J.
Performance of Propeller 4381 in Crashback – 160

Dooley, J. J.
Global Climate Change and the Transportation Sector: An Update on Issues and Mitigation Options – 185

Dordevic, Antonije R.
A New Approach for Accurate Analysis of Antennas Above Real Ground – 152

Dorney, Suzanne M.
Automated Extraction of Secondary Flow Features – 159

Dorr, M. R.
Numerical Solution of Plasma Fluid Equations Using Locally Refined Grids – 294

Dowty, James
Applying Statistical Models to Mammographic Screening Data to Understand Growth and Progression of Ductal Carcinoma in Situ – 217

Doyle, Monica
Advanced Technology Lifecycle Analysis System (ATLAS) Technology Tool Box (TTB) – 300

Drake, Jeremy
Chemical Compositions and Anomalies in Stellar Coronae ADP99 – 315

Dreher, A.
Discrete Mode Matching Method for the Analysis of Quasi-planar Structures – 145

Dreshfield, Robert L.
Analyses of Elemental Partitioning in Advanced Nickel-Base Superalloy Single Crystals – 14

Drews, Frank
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Driskill, T.
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

Droege, Alan
Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

Drosinos, John P.
The Effect of the USA Naval Academy Foundation Preparatory Program on the Performance of Naval Academy Midshipmen – 263

Drummond, J. Philip
Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

Du, J.
Cryo Power and Heat Transfer – 171

Dubovikov, M. S.
Modeling Ocean Deep Convection – 197

Dudley, D. G.
Linear Inverse Problems in Wave Motion: Non-self-adjoint Integral Equations of the First Kind – 273

Duke, Mike
Manufacture of Solar Cells on the Moon – 57

Duncan, Barry L.
The Reliability and Validity of the Outcome Rating Scale: A Replication Study of a Brief Clinical Measure – 214

Dupke, Renato
Galactic Winds and Intragroup Medium Energetics – 317

Durbin, David B.
Human Factors Assessment of the UH-60M Crew Station During the Early User Demonstration Number 2 (EUD2) – 12

Durbin, T. D.
Internal Combustion Engine (ICE) Air Toxic Emissions – 173

Durham, Paul
Multiple Strategy Bio-Detection Sensor Platforms Made from Carbon and Polymer Materials – 166

Dutton, J. C.
Research Instrumentation for Measurements of High-Speed Separated Flows – 170

Duvall, Aleta
GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

Dvorak, Steve
Transient Plane Wave Scattering from Objects Near Lossy Ground with FDTD – 150

Dybdal, R. B.
A Low Loss, Dual Polarized Switch for Polarization State Selection – 124

Dyer, Clive
Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digital Converter – 140

Eberly, S.
Developing Spatially Interpolated Surfaces and Estimating Uncertainty – 182

Eberwein, Walter J.
Design and Characterization of Diagonal Horn Antennas Using UCLA Bi-Polar Near-Field Measurement and Imaging Facilities – 155

Eckert, Klaus
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Eckert, Kristin A.
Neoplastic Consequences of a Mutator Phenotype in Human Breast Epithelial Cells: A Prospective Analysis – 226

Economou, D. P.
The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

Edwards, J. R.
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers – 162

Edwards, Nathan
Review of Marine Corps Expeditionary Force Preventive Medicine Materiel Requirements – 219

Ege, Tuncay
On the Incompatibility of Chirality Parameter Alpha and Chirality Admittance xi of Chiral Media – 155

Eibert, Thomas F.
Fast Spectral Domain Algorithm for Hybrid Finite Element/Boundary Integral Modeling of Infinite Periodic Arrays – 260

Eichler, D.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Eigel, Robert L., Jr.
Bistatic Scattering Characterization of a Complex Object – 87

Ekbom, Anders
Severe Caloric Restriction in Adolescence and Incidence of Breast Cancer – 210

Ekelman, E. P.
Radio Star Flux Density Expressions for Accurate Antenna Gain Measurements – 128

Elias, Bartholomew
Homeland Security: Protecting Airliners from Terrorist Missiles – 12

Elkamchouchi, Yasser H.
Design of Cylindrical Reflector Antennas with Caustic-located Array Feeding – 60

El-Khamy, Said E.
Design of Cylindrical Reflector Antennas with Caustic-located Array Feeding – 60

On the Performance of the VESPA Algorithm for Blind Beamforming and Signal Detection of Multi-source Multipath Signals – 73

Ellingson, S. W.
Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

Elliott, H. A.
Current Sheet Evolution in the Aftermath of a CME Event – 324

Ellis, David L.
GRCop-84: A High-Temperature Copper Alloy for High-Heat-Flux Applications – 50

Ellis, Thomas J.
A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies – 78

Elosegui, P.
Climate-Driven Deformation of the Solid Earth from GRACE and GPS – 196

Elosequi, P.
Regional Deformation Studies with GRACE and GPS – 253

El-Sallabi, Hassan M.
An Efficient Technique for Modelling Wideband Propagation in an Urban Parallel Street Microcellular Environment – 305

Elsner, Ron
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

ElZooghby, A. H.
Experimental Validation of a Neural Network Direction Finder – 142

Encinar, Jose A.
Design of Two-layer Printed Reflect Arrays for Bandwidth Enhancement – 78

Enders, A.
Representation of Absolute Electric Fieldstrength by Superposition of Radiated and Guided Waves – 111

Enneking, Arthur
Fast Spectral Domain Analysis of Large Finite Microstrip Patch Arrays – 101

Epps, Stephen J.
Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Erbas, Bircan
Applying Statistical Models to Mammographic Screening Data to Understand Growth and Progression of Ductal Carcinoma in Situ – 217

Ergin, A. A.
A Diagonal Translation Operator for the Fast Evaluation of Two-dimensional Transient Wave Fields – 260

Ergin, A. A
A Fast Time Domain Integral Equation Technique for Analyzing EMC/EMI Problems – 258

Ergin, A. Arif
The Multilevel Plane Wave Time Domain Algorithm for the Fast Analysis of Transient Scattering Phenomena – 254

Erkut, C.
Aspects in Analysis and Model-Based Sound Synthesis of Plucked String Instruments – 290

Erzberger, Heinz
A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic – 6

Transforming the NAS: The Next Generation Air Traffic Control System – 6

Esselle, Karu P.
Modelling Wave Propagation in Diagonal Microstrip Lines Using Enhanced FDTD Equations – 128

Esteban, H.
A New Hybrid Mode-matching Method for the Analysis of Inductive Obstacles and Discontinuities – 257

Characterization of Complex Dielectric Properties of Materials Using a Hybrid Iterative Method – 147

Estrada, Arthur
Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators – 166

Ethridge, Ed
Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Evans, Brian W.
Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Evans, J. A.
Planar Trapezoidal and Pentagonal Monopoles with Impedance Bandwidths in Excess of 10:1 – 88

Evans, Kurt
Bond Testing for Effects of Silicone Contamination – 173

Ezell, David D.
Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Ezhilchelvan, P. D.
From Crash Tolerance to Authenticated Byzantine Tolerance: A Structured Approach, the Cost and Benefits – 82

Ezhilchelvan, P.
Design and Evaluation of a QoS-Adaptive System for Reliable Multicasting – 82

Design and Evaluation of an Efficient Reliable Manycast Protocol for Ad-hoc Networks – 83

Fabrizio, Eve F.
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Fainman, Yeshayahu
Modeling of Gaussian Beam Diffraction from a Thick Single-slit Perfectly Conducting Screen: Finite-Difference Time-Domain Method Versus Rigorous Theory – 269

Falk, A. F.
Comments on Extracting alpha from B to rho rho – 285

Fallon, Corey
Reactions of Air Transport Flight Crews to Displays of Weather During Simulated Flight – 6

Fan, Guo-Xin
3-D Numerical Mode-Matching (NMM) Method for Inhomogeneous Media – 254

Fan, Lu
Ka-Band Beam Steering Reflectarray Study – 86

Fang, Shyh-Tirng
Novel Designs of Broadband Equilateral-triangular Microstrip Antennas – 68

Fang, Wen-Hsien
Improved Wavelet-Based Beamformers with Dynamic Subband Selection – 256

Faraji-Dana, R.
A New Time Domain Analysis of Vertical Dipole in the Vicinity of a Planar Dielectric Interface – 114

Farassat, F.
Comments on the paper by Zinoviev and Bies 'On Acoustic Radiation by a Rigid Object in a Fluid Flow' – 162

Farina, Alfonso
Knowledge-Based Generalized Likelihood Ratio Test (KB-GLRT): Exploiting Knowledge of the Clutter Ridge in Airborne Radar – 167

Feickert, Andrew
Homeland Security: Protecting Airliners from Terrorist Missiles – 13

Felix, R.
Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

Fellows, Patricia F.
Vaccines and Animal Models for Arboviral Encephalitides – 222

Felsen, Leopold B.
Time Domain Green's Function for a Phased Semi-infinite Periodic Line Array of Dipoles – 261

Fenech, H.
Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92

Feria, Alfonso
Inflatable Microstrip Reflectarray Antennas at X and Ka-band Frequencies – 97

Fernandez, Salvador
Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Ferrando, M.
A New Hybrid Mode-matching Method for the Analysis of Inductive Obstacles and Discontinuities – 257

Ferrando-Bataller, Miguel
Circuital Analysis of a Two-port Angular Sector – 143

Ferrazzoli, P.
Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92

Ferrier, G.
Economic Contribution of the California Air Pollution Control Industry – 190

Feuerstein, Martin J.
Applications of Smart Antennas in Cellular Networks – 75

Filippenko, A. V.
X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years – 316

Fillius, James B.
An Experimental Study of Steady State High Heat Flux Removal Using Spray Cooling – 160

Fincher, S.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Fincke, M.
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

Finckenor, Miria M.
Simulated Space Environment Effects on Tether Materials with Protective Coatings – 37

Finckenor, Miria
Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

Fischer, Nicholas
Nanoparticle-Mediated Rescue of p53 Through Targeted Degradation of MDM2 – 215

Fisher, Mark
Explosive Chemical Signature-Based Detection of IEDs – 46

Fisher, M.
Dynamic Allocation of Servers in a Grid Hosting Environment – 237

Fishman, G. J.
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

Fishman, Gerald
Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

Fishman, Jerry
Space-Borne Observations of Intense Gamma-Ray Flashes Above Thunderstorms – 326

Fiske, Michael R.
Are we There Yet? ... Developing In-Situ Fabrication and Repair (ISFR) Technologies to Explore and Live on the Moon and Mars – 18

Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19

Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Fitzpatrick, Brian K.
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

Flanagan, Ann
California's K-12 Public Schools. How Are They Doing? – 301

Fleeman, David
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Flinn, Edward D.
Nanosensors to Monitor Space Radiation Exposure – 326

Florjanczyk, Zbigniew
International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004 – 54

Floyd, Brian A.
Reuse International Space Station (ISS) Modules as Lunar Habitat – 318

Foltz, Heinrich
Broadband, Robust, Low-profile Monopole Incorporating Top Loading, Dielectric Loading, and a Distributed Capacitive Feed Mechanism – 104

Foltz, Stuart D.
Civil Works Operations & Maintenance Management Tools Research Program: Program Summary FY 2000 - FY 2002 – 272

Ford, K. E.
Measurement of the CKM Angles (alpha) and (gamma) at the BaBar Experiment – 283

Ford, Peter
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Forehand, David
Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

Forgy, E. A.
A New FDTD Formulation with Reduced Dispersion for the Simulation of Wave Propagation Through Inhomogeneous Media – 254

Foroughipour, Mahmoudreza
Modelling Wave Propagation in Diagonal Microstrip Lines Using Enhanced FDTD Equations – 128

Forssell, E.
An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

Forssell, G.
Database of Material Properties for Optical Signature Modelling – 293

Forster, N.
Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

Forsythe, Elizabeth
Fluorescent Approaches to High Throughput Crystallography – 296

Foster, D.
Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

Foulkes, S.
Gas System Upgrade for the BaBar IFR Detector at SLAC – 283

Fountanas, Leonidas
Principal Components Based Techniques for Hyperspectral Image Data – 244

Fowler, Samuel B.
Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

Fox, Nicola J.
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Frame, Edwin A.
Investigation of On-Vehicle Fuel Catalyst System – 44

Franchini, C.
Nickel Sandwich Technology for High Precision Reflector Antennas – 97

Frank, Thomas A.
Low Frequency Sonar Countermeasure – 139

Frank, W.
SCR Systems for Heavy Duty Trucks: Process Towards Meeting EURO 4 Emission Standards in 2005 – 172

Frankfurt, L.
Hard Photodisintegration of a Proton Pair in 3He – 286

Frantzis, P.
A Novel Design of an Ultra-Fast Wideband Polarimetric Radar – 107

Franza, O.
Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Frazier, Donald O.
Slow and Fast Light in Coupled Microresonators – 294

Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

Freed, Alan D.
Elastic Response of Crimped Collagen Fibrils – 228

Freundich, Alex
Manufacture of Solar Cells on the Moon – 57

Frezza, F.
Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

Frick, Glendon M.
Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model – 197

Friday, David K.
Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter – 43

Friedlander, Anne L.
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

Friman, H.
Thoughts Regarding Evaluation of the Human Perspectives in the 'Demonstrators' Work in the Armed Forces Transformation Program and Command and Control Development – 62

Froidevaux, L.
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

Frolik, J. L.
Time-domain Techniques for Reconstructing Lossy Layered Media from One-sided Scattering – 129

FROM
Optimum Amplitude and Phase Control for an Adaptive Linear Array Using a Genetic Algorithm – 65

Fruchter, A. S.
Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Fruscione, A.
X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years – 316

Fry, David J.
Performance of Propeller 4381 in Crashback – 160

Fuchs, Elaine
Role of E-Cadherin Homophilic Contacts in the Inhibition of Cell Growth of Primary Breast Cells – 218

Fulcher, M. L.
Fibrous Monolith Wear Resistant Components for the Mining Industry. Semi-Annual Report No. 4 – 51

Fuller, Kirk A.
Slow and Fast Light in Coupled Microresonators – 294

Funkhouser, G.
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

Furse, Cynthia
An Inexpensive Distance Measuring System for Location of Robotic Vehicles – 93

Microstrip Antennas for Dielectric Property Measurement – 157

Gadoura, I. A.
Design of Robust Controllers for Telecom Power Supplies – 140

Gaensler, B. M.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Gaffney, R. L., Jr.
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers – 162

Gago-Ribas, E.
Inhomogeneous Cylindrical Waves: An Approach to Complex Beams – 255

Galarneau, Michael
Estimating Supplies Program: Evaluation Report – 245

Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

Review of Marine Corps Expeditionary Force Preventive Medicine Materiel Requirements – 219

Galarneau, Mike R.
The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

Galdi, Vincenzo
Higher-order Impedance Boundary Conditions for Complex Layered Planar Coatings – 130

Gallagher, D. L.
IMAGE-POLAR Concurrent Plasmapause Observations – 195

Thermal N+ in the Inner Magnetosphere – 295

Gallagher, D. W.
Evaluation of Light Emitting Diode Linear Source Devices – 5

Gallaher, M. P.
Economic Impact Analysis of Final Iron and Steel Foundries NESHAP – 183

Gallaher, M.
Economic Impact Analysis (EIA) for the Proposed Stationary Combustion Turbines NSPS – 184

Gallegos, L.
Practical Gamma Spectroscopy Assay Techniques for Large Volume Low-Level Waste Boxes – 231

Galli, A.
Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

Gamble, E.
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Gan, Yeow-Beng
A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions – 72

Gandhi, Om P.
Extension and Validation of the Equivalent Sources Helical Antenna Modeling with the FDTD Code – 130

Gang, K.
Higher-Order MoM Implementation to Solve Integral Equations – 268

Ganguly, Biswa N.
Volume and Surface Plasmas – 296

Gao, H.
Charged Pion Photoproduction from Hydrogen and Deuterium at Jefferson Lab – 277

Garcia, Danny
Engineering Lessons Learned and Systems Engineering Applications – 59

Garcia, Jonathan C.
Alternate Configurations for Blocked Impurity Band Detectors – 262

Gardner, P.
Multi-band Antennas – 65

Garino, M. Sereno
Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas – 112

Garmatyuk, Dmitriy
Ultrawide-band Noise Synthetic Aperture Radar: Theory and Experiment – 87

Garrison, Aura R.
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

Gary, J. W.
Gas System Upgrade for the BaBar IFR Detector at SLAC – 283

Gascoyne, Peter R.
A General Purpose Analysis System Based on a Programmable Fluid Processor – 247

Gattis, Christy B.
Smart Structures for Vibration Control on Long-Term Space Exploration and Habitation Missions – 323

Ge, J. X.
Millimeter-wave Photodetection and Direct Integration with Microstrip Slot Antenna Array – 91

Geffen, C. A.
Global Climate Change and the Transportation Sector: An Update on Issues and Mitigation Options – 185

Geffrin, J. M.
Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Geisbert, Joan B.
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

Geisbert, Thomas W.
Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

Geiselman, Eric E.
Helmet-Mounted Display Targeting Symbology Color Coding: An Air-to-Air Scenario Evaluation – 231

Gelfand, J. D.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Gendron, Marlin L.
Moving-Map Composers System Version 3.4P Acceptance Test Procedures Developed for the Finnish Air Force Modification for FIAF MMC System Without DMUI/DMU – 177

Geng, Hai-Ping
Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes – 37

Genova, James J.
Coherent Seeker Guided Antiship Missile Performance Analysis – 167

Georgakopoulos, Stavros V.
Full-wave Analysis of HF Antennas on Helicopters Using the FDTD, FEM and NEC – 128

Georganopoulos, Markos
Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content – 313

Geri, George A.
An Integrated Procedure for Measuring the Spatial and Temporal Resolution of Visual Displays – 138

Germany, G.
The Utility of Auroral Image-based Activities Metrics – 193

Gerri, Norman J.
Modeling Thermal Ignition of Energetic Materials – 299

Gershon, E.
Error Control in the Reduced Expansion and Field Testing (REFT) Method for MoM Matrix Thinning – 233

Gertig, Dorota
Applying Statistical Models to Mammographic Screening Data to Understand Growth and Progression of Ductal Carcinoma in Situ – 217

Getty, David J.
An Evaluation of Stereoscopic Digital Mammography for Earlier Detection of Breast Cancer and Reduced Rate of Recall – 208

Gevros, P.
Monitoring of Contractual Service Level Agreement – 232

Ghafouri-Shiraz, H.
Triple-band Planar Inverted F Antenna – 70

Ghandhi, J.
Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

Ghorbani, K.
Design of Large Broadband Patch Arrays – 123

Ghosh, Kartik
Multiple Strategy Bio-Detection Sensor Platforms Made from Carbon and Polymer Materials – 166

Giblin, T. W.
Long-Lag, Wide-pulse Gamma-Ray Bursts – 312

Gibson, Roger L.
Interim Report of the Defense Science Board Task Force on SARS Quarantine – 226

Gido, Samuel P.
Morphology and Properties of Model Block and Graft Copolymers – 54

Giedd, Ryan
Multiple Strategy Bio-Detection Sensor Platforms Made from Carbon and Polymer Materials – 166

Gill, Paul S.
Engineering Lessons Learned and Systems Engineering Applications – 59

Gilley, Scott D.
Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Gillies, D.
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

Gilman, R.
Hard Photodisintegration of a Proton Pair in 3He – 286

Gimenes, Claude
Wide Band Modeling and Electromagnetic Pulse Propagation through HF Channel – 68

Gladstone, Randy
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Glickstein, Marvin R.
Applications of Endothermic Reaction Technology to HSCT and AST – 16

Glover, S. F.
Demonstration of Silicon Carbide Power Devices in Practical Power Conversion Systems – 46

Gogoi, Anup K.
Closed Form Expression For Mutual Partial Inductance Between Two Skewed Linear Current Segments – 113

Goldberg, Richard
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Goldblatt, Loel
Sabatier Methanation Reactor for Space Exploration – 321

Goldfinger, Chris
Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

Goldsmith, Charles L.
Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

Gonen, Ofer
OR Modeling of a Conceptual System of Systems for Maritime Littoral Dominance in 2020 – 272

Sequential Multiple Comparison Testing for Budget-Limited Applications – 263

Gonzalex, M. J.
Inhomogeneous Cylindrical Waves: An Approach to Complex Beams – 255

Gonzalez, J. M.
Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms – 85

Good, Brian S.
Energetics of Oxygen Interstitials in Cr and V – 50

Goossen, Keith W.
Shedding Light on the Battlefield: Tactical Applications of Photonic Technology – 167

Gordon, Andrew S.
Quantifying the Cycling of Toxic Metals and Metal-Complexing Ligands in a Major US Naval Harbor (Elizabeth River, VA) – 44

Gorenstein, Paul
Development of High Resolution Hard X-Ray Telescope with Multi-Layer Coatings – 311

Gorski, Joseph J.
Evolving Computational Capability for Ship Hydrodynamics – 264

Gosnell, T. B.
Gamma-Ray Identification of Nuclear Weapon Materials – 46

Goswami, Jaideva C.
Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

Goto, Naohisa
Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

Gottuk, Daniel T.
Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

Gould, R.
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264

Gouldin, F. C.
Support for Advanced Imaging of Premixed Turbulent Combustion Processes – 43

Granchi, A.
Design and Simulation of Active Spiral Inductors for RF Integrated Circuits – 145

Granot, J.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Grant, Joseph
Distributed Sensing of Composite Overwrapped Pressure Vessel Using Fiber-Bragg Gratings at Ambient and Cryogenic Temperatures – 39

Grcev, L.
Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

Greathead, D.
Code Review and Personality: Is Performance Linked to MBTI Type – 236

Green, Shaun E.
Solar Electric and Chemical Propulsion for a Titan Mission – 32

Green, William
Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

Greene, B.
Internet Access in US Public Schools and Classrooms: 1994-2003 – 83

Greenhill, L. J.
X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years – 316

Gregory, Don A.
Slow and Fast Light in Coupled Microresonators – 294

Gregory, P. A.
Flow Over a Body of Revolution in a Steady Turn – 10

Greiner, J.
Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Gridlay, Jonathan
Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

Griffith, A.
Regulatory Approaches for Solid Radioactive Waste Storage in Russia – 181

Grisham, L. R.
Experimental Evaluation of a Negative Ion Source for a Heavy Ion Fusion Negative Ion Driver – 281

Grogan, Case
Ebola and Marburg Viruses Replicate in Monocyle- Derived Dendritic Cells without Inducing the Production of Cytokines and Full Maturation – 221

Gross, Richard A.
Fuel From Self-Degrading Bioengineering Packaging – 225

Grossman, Y.
Beyond the Standard Model with a B and K Physics – 285

New Ways to Soft Leptogenesis – 277

Gruendi, Robert A.
The Optical Counterpart of M101 ULX-1 – 313

Gruetzmacher, K.
Practical Gamma Spectroscopy Assay Techniques for Large Volume Low-Level Waste Boxes – 231

Grugel, R. N.
High Tensile Strength Amalgams for In-Space Repair and Fabrication – 48

Morphological Evolution of Directional Solidification Interfaces in Microgravity: An Analysis of Model Experiments Performed on the International Space Station – 204

Observation of an Aligned Gas - Solid 'Eutectic' during Controlled Directional Solidification Aboard the International Space Station - Comparison with Ground-based Studies – 58

The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

Grugel, Richard N.
Back to the Future: A Historical Perspective of Lunar and Martian In-situ Fabrication and Repair – 320

Gschwender, Lois J.
Military Aerospace Fluids and Lubricants Workshop Proceedings – 53

Research and Development (R&D) on Advanced Nonstructural Materials. Delivery Order 0001: Study of Hydraulic System Component Storage With Operational and Rust-Inhibited Hydraulic Fluids – 53

Guan, Lim K.
Battle Damage Assessment Using Inverse Synthetic Aperture Radar (ISAR) – 164

Gubert, Michael K.
Lightweight Nonmetallic Thermal Protection Materials Technology – 51

Guenther, E.
Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Guerriero, L.
Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92

Guijarro, J.
ESA's Ground Breaking Synthetic Aperture Radar: The ENVISAT-1 ASAR Active Antenna – 100

Gull, Theodore R.
Eta Carinae: What We have learned recently with HST/STIS, VLT/UVES and VLTI: What We Might Learn with VLT/VLTI across the 2008/9 Minimum – 312

Gurel, Levent
Employing PML Absorbers in the Design and Simulation of Ground Penetrating Radars – 266
Fast Computation of Scattering from (Near-)Resonant Structures – 233

Haak, K. F. I.
Nonlinear Inversion in Three-dimensional Cross-well Induction Logging using Full-Vectorial Multi-Frequency Data – 148

Haardt, Martin
Low Complexity Space-frequency Rake Receivers for WCDMA – 131

Haas, M.
2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

Habashy, T. M.
Linear Inverse Problems in Wave Motion: Non-self-adjoint Integral Equations of the First Kind – 273

Hackett, Ronald
Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

Hackney, Anthony C.
Microhematuria Associated With a Special Operations Craft Mission – 225

Haellstig, E.
Retrocommunication – 63

Hagen, J. v
Efficient MoM Analysis of Polarization Selective Surfaces Using Trefoil Knot Arrays – 293

Hagerman, Bo
GSM/TDMA Adaptive Antenna Field-Trial Results – 75

Hagness, Susan C.
Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Nonpalpable Breast Tumors – 158

Hagobian, Todd A.
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

Hahto, S. K.
Experimental Evaluation of a Negative Ion Source for a Heavy Ion Fusion Negative Ion Driver – 281

Hahto, S. T.
Experimental Evaluation of a Negative Ion Source for a Heavy Ion Fusion Negative Ion Driver – 281

Haile, Sossina M.
Solid Acid Based Fuel Cells – 178

Haimes, Robert
Automated Extraction of Secondary Flow Features – 159

Haines, Amber I.
Development of Improved Thermal Control Coatings for Space Assets – 20

Hakkila, J.
Long-Lag, Wide-pulse Gamma-Ray Bursts – 312

Haldoupis, Cristos
Radio Wave Studies of Irregular Ionospheric Phenomena at Midlatitude – 194

Hall, David C.
An Epidemiological Study of Leptospira-Induced Abortion in Mares in Central Kentucky (1990-2004) – 224

Hall, J. M.
Gamma-Ray Identification of Nuclear Weapon Materials – 46
Report on Measurement at Ohio University to Estimate Backgrounds for Neutron Radiography in the 10-14 MeV Region – 275

Hall, P. S.
Advance Path Measurement for Automotive Radar – 102
Multi-band Antennas – 65
Triple-band Planar Inverted F Antenna – 70

Hallberg, T.
Pigments With Potential for Adaptable Optical Properties – 51

Haller, William J.
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

Halstead, R. J.
Rail Access to Yucca Mountain: Critical Issues – 191

Ham, C. L.
Gamma-Ray Identification of Nuclear Weapon Materials – 46

Hamamoto, Naokazu
The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII – 104

Hamilton, M. D.
Visual Language for Parallel, Object-Oriented Programming – 237

Hammond, P. T.
Tunable Optical Polymer Systems – 53

Hampson, G. A.
A Fast and Accurate Scheme for Calibration of Active Phased-array Antennas – 117

Han, Wong C.
OR Modeling of a Conceptual System of Systems for Maritime Littoral Dominance in 2020 – 272

Haney, Michael M.
Shedding Light on the Battlefield: Tactical Applications of Photonic Technology – 167

Hannemann, Jens
Spherical-multipole Analysis of the Field within a Canonical GTEM-cell – 257

Hansen, Charles E.
A Model-Based Approach to Battle Execution Monitoring – 302

Hansen, Gary
Patient Warming Device for Casualty Care – 222

Hansen, V.
The Hybrid(sup 2)-Method: Combination of the FE/BE Hybrid Method with the UTD – 267

Harackiewicz, Frances J.
FDTD Analysis of Mutual Coupling between Microstrip Patch Antennas on Curved Surfaces – 71

Haraldsdottir, Aslaug
Assessment of the NASA AvSTAR Project Plan – 1

Hardee, P.
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

Harding, Alice K.
Emission From Rotation-Powered Pulsars and Magnetars – 312

Harmer, Greg
IEEE Sensors 2004 Conference – 138

Haro, Josep
Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

Harrington, Douglas
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Harriott, L. R.
Improving Overlay in Nanolithography with a Deformable Mask Holder – 135

Harris, Chris
Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment – 69

Harris, Danny
Sabatier Methanation Reactor for Space Exploration – 321

Harris, David
A Strategic Roadmap to Centauri – 19

Hartley, Michael A.
A Simulation Study of the Error Induced in One-Sided Reliability Confidence Bounds for the Weibull Distribution Using a Small Sample Size with Heavily Censored Data – 270

Hartmann, D. H.
Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Harvey, James F.
Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Hassan, H. A.
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers – 162

Hasselmann, F. J. V.
A Shaped Relector Antenna for Mobile Communications – 85

Hathaway, D. H.
How Large Scales Flows May Influence Solar Activity – 325

Haupt, Randy L.
Optimum Amplitude and Phase Control for an Adaptive Linear Array Using a Genetic Algorithm – 65

Haupt,Randy L.
Adaptive Nulling with Spherical Arrays Using a Genetic Algorithm – 107

Hayashi, Yoshihiko
Numerical Analysis of Thin Coaxial Antennas for Microwave Coagulation Therapy – 112

Hayes, Jeffrey
The Warm-Hot Intergalactic Medium – 314

Hedborg-Karlsson, E.
Database of Material Properties for Optical Signature Modelling – 293

Hededal, C. B.
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

Hefnawi, Mostafa
Adaptive Arrays for Wideband Interference Suppression in Wireless Communications – 94

Heidebrink, Kelli D.
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

Heidenreich, Kim A.
Protein Kinase Pathways That Regulate Neuronal Survival and Death – 208

Heinze, Clint
Modelling Intention Recognition for Intelligent Agent Systems – 252

Helenbrook, B. T.
Thermoelectrical Energy Recovery from the Exhaust of a Light Truck – 173

Helliwell, John R.
Macromolecular Crystallization in Microgravity – 57

Henden, A. A.
Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Henderson, Edward M.
Shuttle-Derived Launch Vehicles' Capablities: An Overview – 22

Henein, Naeim A.
Adaptation of Advanced Diesel Engines for Military Requirements Under Severe Environmental Conditions – 61

Hensley, Lisa E.
Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

Herben, M. H. A. J.
Some Developments in Fresnel Zone Plate Lens Antennas – 111

Herbig, Christopher F.
Use of OpenSSH Support for Remote Login to a Multilevel Secure System – 244

Hermansson, P.
Database of Material Properties for Optical Signature Modelling – 293

Semi-Empirical IR Signature Model for Tilted Surfaces – 197

Hermant, Eric
SMART Use for Electric Propulsion – 35

Herrnstein, J. R.
X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years – 316

Hertel, Thornsten W.
On the Accuracy of the Transmission Line Theory for the Insulated Linear Antenna – 113

Hettak, K.
Omnidirectional-dual Polarized Antenna for Wireless Indoor Applications at Millimeter Waves – 90

Hewett, J. L.
Signatures of Long-lived Gluinos in Split Supersymmetry – 284

Heyman, E.
Electromagnetic Analysis of an Antenna Buried in a Composite Environment – 73

Hhekn, A.
Database of Material Properties for Optical Signature Modelling – 293

Hienonen, Sami
Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna – 79

Hilderman, Don R.
ACTS Battery and Solar Array Assembly On-Orbit Measured Performance – 27

Hill, Martin
Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

Hill, P. J.
Six Sigma Evaluation of the High Level Waste Tank Farm Corrosion Control Program at the Savannah River Site – 41

Hiller, J. R.
Hard Photodisintegration of a Proton Pair in 3He – 286

Hilller, J. R.
Single-Spin Polarization Effects and the Determination of Timelike Proton Form Factors – 286

Hirasawa, Kazuhiro
A Novel Sleeve Monopole with Broad Bandwidth – 74

Hirokawa, J.
Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas – 91

Hirokawa, Jiro
Moment Method Analysis of Parallel Plate Slot Antennas – 66

Hirvonen, Taavi
On the Planarity Errors of the Hologram of the CATR – 92

Hixon, R.
Validation of a High-Order Prefactored Compact Code on Nonlinear Flows with Complex Geometries – 4

Ho, L.-F.
Numerical Amplification of the Excitation Source in Waveguide Structure – 266

Hoard, J. W.
Dynamometer Evaluation of Plasma-Catalyst for Diesel NOX Reduction – 171

Hoare, E. G.
Advance Path Measurement for Automotive Radar – 102

Hoare, T.
Extending the Horizons of DSE (GC6) – 234

Hoashi, Takafumi
A Design Method of Offset Fresnel Zone Plate Reflector as Receiving Antenna – 119

Hodgdon, James A.
Microhematuria Associated With a Special Operations Craft Mission – 225

Hoferer, Robert A.
ARISE: A Challenging 25-m Space Antenna Design – 88

Hoffman, Robert A.
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Hogan, Patrick J.
Modeling Ocean Deep Convection – 197

Hogan, Robert
Ebola and Marburg Viruses Replicate in Monocyle- Derived Dendritic Cells without Inducing the Production of Cytokines and Full Maturation – 221

Hogan, T. F.
The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

Holdeman, J. D.
A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow – 16

Holekamp, Kara
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

Holfund, Gar
Multidisciplinary Oxygen Atom Erosion and Surface Characterization Studies of Polyhedral Oligomeric Silsesquioxane – 52

Holland, D.
Developing Spatially Interpolated Surfaces and Estimating Uncertainty – 182

Holloway, Christopher L.
Reflection and Transmission Properties of Reinforced Concrete Walls – 93

Holter, Henrik
Infinite Phased Array Analysis Using FDTD Periodic Boundary Conditions: Pulse Scanning in Oblique Directions – 265

Hong, Jae-Sub
Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

Hong, Wei
Domain Decomposition Method: A Direct Solution of Maxwell Equations – 258

S-Parameter Extraction of 3-D Microwave Structures by Using 3D-FDFD Method in Conjunction with Asymptotic Waveform Evaluation Technique – 106

Hopf, J.
Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems – 90

Hopkins, A. M.
Disposal of True Waste from the Plutonium Finishing Plant in Pipe Overpack Containers to WIPP Including New Security Requirements – 187

Hopkins, R.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Hoppel, William A.
Addition of Vertical Velocity to a One-Dimensional Aerosol and Trace Gas Model – 197

Hopperstad, Craig A.
Assessment of the NASA AvSTAR Project Plan – 1

Horan, Stephen
Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments – 62

Horan Stephen
Research Supporting Satellite Communications Technology – 110

Hori, Toshikazu
A New Calibration Method of Adaptive Array for TDD Systems – 74

Horton, Charles
Manufacture of Solar Cells on the Moon – 57

Hou, Jin
Simulation Modeling and Analysis of Device-Aware Network Architectures – 240

Howard, A.
Modeling Ocean Deep Convection – 197

Howard, P. J.
The 1-MW Radiatively Driven Hypersonic Wind Tunnel Experiments – 60

Howard, R. T.
X-Ray Calibration Facility/Advanced Video Guidance Sensor Test – 32

Hristov, H. D.
Some Developments in Fresnel Zone Plate Lens Antennas – 111

Variety of Cylindrical Fresnel Zone Plate Antennas – 120

Hruskovec, Tomislav
FDTD Modeling of Magnetized Ferrites Using Z Transforms – 254

Hsu, Larry
Evaluations of Global Wind Prediction at Fleet Numerical Meteorology and Oceanography Center: from the Perspective of a Wave Modeler – 197

Hsu, Rockwell
An Analysis of a Dual Gridded Reflector Antenna – 67

Hsu, Wen-Hsiu
Single-feed Dual-frequency Microstrip Antenna with Two Patches – 95

Hu, Bin
Fast Steepest Descent Path Algorithm for Electromagnetic Scattering Problems in Layered Medium – 278

Hu, Jin-Lin
Synthesis of Shaped-Beam Pattern for Mobile Antenna – 143

Hua, F.
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

Huang, Hanchen
Computational Nanomechanics of Materials – 281

Huang, John
Inflatable Microstrip Reflectarray Antennas at X and Ka-band Frequencies – 97

Ka-Band Beam Steering Reflectarray Study – 86

Huang, Yeqin
Electromagnetic Radiation of Antennas in the Presence of an Arbitrarily Shaped Dielectric Object: Green Dyadics and Their Applications – 132

Huber, C.
2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

Hulse, G.
Disposal of True Waste from the Plutonium Finishing Plant in Pipe Overpack Containers to WIPP Including New Security Requirements – 187

Hung, C.-C.
The Utility of Auroral Image-based Activities Metrics – 193

Hunstead, R. W.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Husain, A.
Estimation of Radiolytic Gas Generation Rate for Cylindrical Radioactive Waste Packages - Application to Spent Ion Exchange Resin Containers – 41

Huthwohl, G.
SCR Systems for Heavy Duty Trucks: Process Towards Meeting EURO 4 Emission Standards in 2005 – 172

Hwang, D. S.
Single-Spin Polarization Effects and the Determination of Timelike Proton Form Factors – 286

Hwang, James C.
Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

Hwang, R. B.
Scattering of Plane Waves by Two-Dimensional Periodic Impedance Surface – 85

Hwang, Soon M.
Sulfur Oxidation and Contrail Precursor Chemistry – 47

Ianni, John D.
Human Interfaces for Space Situational Awareness – 25

Iannotta, Ben
Skeleton Crew for the Space Station – 31

Iannucci, L.
Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

Igari, Kazuhisa
Measurement of Radiation Efficiency of Antennas in the Vicinity of Human Head Model Proposed By COST 244 – 131

Ignatiev, Alex
Manufacture of Solar Cells on the Moon – 57

Ilhan, Faysal
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

Ingram, M. A.
Array Pattern Synthesis with High Radiation Efficiency for Transmission Antenna Arrays – 89

Ioffe, A.
Discrete Mode Matching Method for the Analysis of Quasi-planar Structures – 145

Irick, D. K.
Energy Efficient Thermal Management for Natural Gas Engine Aftertreatment via Active Flow Control – 174

Irwin, Ryan W.
Preliminary Design of a Manned Nuclear Electric Propulsion Vehicle Using Genetic Algorithms – 34

Ishii, Nobuo
Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

Itazoqui-Pastor, P.
An Analysis and Design Tool for Evaluation of Integrated Antenna Diversity Systems in Portable Wireless Devices – 90

Ito, Koichi
Numerical Analysis of Thin Coaxial Antennas for Microwave Coagulation Therapy – 112

Itoh, Kiyohiko
A Resonant Type Leaky-Wave Antenna Using an Image NRD Guide – 122

Itoh, Tatsuo
A Novel Phase Conjugator for Retrodirective Array Application – 84

A Uniplanar Quasi-yagi Antenna with Wide Bandwidth and Low Mutual Coupling Characteristics – 71

Itoh, T.
Active Integrated Antennas for New RF Architectures – 64

PBG-Assisted Gain Enhancement of Patch Antennas on High-dielectric Constant Substrate – 109

Izutsu, M.
Millimeter-wave Photodetection and Direct Integration with Microstrip Slot Antenna Array – 91

Jackson, David R.
An Annular-Ring Reduced Surface Wave Microstrip Antenna – 114

Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas – 122

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas – 150

Jaggard, Dwight L.
Chaotic Wave Scattering and Synchronization – 75

Jameson, Anthony
Computational Algorithms for High-Fidelity Multidisciplinary Design of Complex Aerospace Systems – 3

Janes, D.
Hybrid Molecular and Spin-Semiconductor Based Research – 168

Jarrett, David
Lessons Learned: The 'Pale Horse' Bioterrorism Response Exercise – 214

Jefferson, N. P.
Black Tie Optional: Modeling Programming Language Concepts – 235

Jenekhe, S. A.
Tunable Optical Polymer Systems – 53

Jenney, Tim
Research and Development (R&D) on Advanced Nonstructural Materials. Delivery Order 0001: Study of Hydraulic System Component Storage With Operational and Rust-Inhibited Hydraulic Fluids – 53

Jensen, Jack
SJFHQ Simulation – 81

Jesneck, Jonathan
Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer – 217

Jessup, Stuart D.
Performance of Propeller 4381 in Crashback – 160

Jeter, L.
The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

Jezek, K. C.
Coupled Gravity and Elevation Measurement of Ice Sheet Mass Change – 195

Jiang, Guo-Zhong
Review on the Layered Fresnel Zone Lens Antenna – 119

Jiang, Ming-Ming
Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components – 153

Jiao, Dan
Efficient Electromagnetic Modeling of Microstrip Structures in Multilayer Media – 113

Jin, J. M.
Higher-Order MoM Implementation to Solve Integral Equations – 268

Jin, Jian--Ming
Efficient Electromagnetic Modeling of Microstrip Structures in Multilayer Media – 113

Jin, Pan
The General NMM Solution for 2-D EMF Problems with Arbitrary Excitations under General Coordinates – 205

Jin, Ya-Qiu
Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62

Jinn, Guo-Woei
China's Development of Asymmetric Warfare and the Security of Taiwan, Republic of China – 301

Jo, Young-Min
Broad Band Patch Antennas Using a Wedge-shaped Air Dielectric Substrate – 124

Joachimowicz, N.
Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Johannisson, B.
Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface – 66

Johansen, Peter M.
A 2.5-D Diffraction Tomography Inversion Scheme for Ground Penetrating Radar – 97

Johansson, P.
Demonstration of Adaptive Radio Node – 63

Johnk, Robert
The Co-conical Field Generation System - A 40 GHz Antenna Calibration Cell – 120

Johnson, J. P.
Gasoline Vehicle Exhaust Particle Sampling Study – 179

Johnson, Joel A.
Development of Improved Thermal Control Coatings for Space Assets – 20

Johnson, Les
A Strategic Roadmap to Centauri – 19

Johnson, T.
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 174

Johnson, Thomas J.
Possible Role of the Oceans in the Variations of Length of Day at High Frequencies – 310

Johnson, W. A.
Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

Johnston, J. Chris
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Johnston, N. A. S.
X-Ray Calibration Facility/Advanced Video Guidance Sensor Test – 32

Johnston, Ronald H.
Small Antenna Efficiency by the Reflection and the Q Measurement Methods – 145

Joisel, A.
Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Jones, Bruce H.
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

Jones, C. B.
Black Tie Optional: Modeling Programming Language Concepts – 235

Jones, C.
Dependable Pervasive Systems – 236

Extending the Horizons of DSE (GC6) – 234

Jones, D. R.
Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings – 55

Jones, Dennis P.
Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Jones, J.
Internet Access in US Public Schools and Classrooms: 1994-2003 – 83

Jones, S. L.
Oak Ridge National Laboratory Radiation Control Program-Partners in Site Restoration – 278

Jones, Scott M.
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

Jones, T.
Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

Jones, W. Linwood
Normalization of NEXRAD Antenna Gain for Overlapping Radars – 127

On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

Jorgensen, R.
Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92

Jorgenson, R. M.
Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

Josefsson, Lars
Calculating The Mutual Coupling Between Apertures on Convex Cylinders Using a Hybrid UTD-MoM Method – 66

Joubert, P. N.
Flow Over a Body of Revolution in a Steady Turn – 10

Jouny, I.
Beamspace STAP for Circular Arrays – 120

Juedes, David
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Jun, Tang
Application of Conjugate Gradient Algorithm to Adaptive Beamforming – 255

Junttila, T.
New Canonical Representative Marking Algorithms for Place/Transition-Nets – 238

Juntunen, J. S.
An Enhanced Higher-Order FDTD Technique for the Construction of Efficient Reflectionless PMLs in 3-D Generalized Curvilinear Coordinate Systems – 274

Justus, C. G.
GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

Kabacik, Pawel
Planar Handset Antennas with Electronically Steerable Parameters – 105

Uni-polar Scanning Method for Near-field Measurements of Antennas – 154

Kabashima, Shigenori
Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems – 91

Kacarska, M.
Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

Kaercher, Hans J.
Design Features of the Large Millimeter Telescope (LMT) – 101

Kakinuma, Hiroyuki
Development and Evaluation Test of DBF Equipment for Transmitting – 72

Kaklamani, D. I.
The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

Kalinski, Michael E.
Hypervelocity Impact Analysis of International Space Station Whipple and Enhanced Stuffed Whipple Shields – 23

Kalkstein, M.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Kamdar, Nilesh
An Inexpensive Distance Measuring System for Location of Robotic Vehicles – 93

Kaneda, Noriaki
A Uniplanar Quasi-yagi Antenna with Wide Bandwidth and Low Mutual Coupling Characteristics – 71

Kang, Dal M.
Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

Kantartzis, N. V.
An Enhanced Higher-Order FDTD Technique for the Construction of Efficient Reflectionless PMLs in 3-D Generalized Curvilinear Coordinate Systems – 274

Kaper, L.
Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Kappus, K.
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

Karaoglu, Bulent
A Comparison of Frequency Offset Estimation Methods in Orthogonal Frequency Division Multiplexing (OFDM) Systems – 273

Kariis, H.
Pigments With Potential for Adaptable Optical Properties – 51

Karlsson, E. H.
Pigments With Potential for Adaptable Optical Properties – 51

Karri, M. A.
Thermoelectrical Energy Recovery from the Exhaust of a Light Truck – 173

Karthaus, U.
Significant RX Antenna Diversity Gain in 30 GHz Broadband Radio Channels Subject to Fading – 85

Kasami, H.
An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

Kashti, T.
New Ways to Soft Leptogenesis – 277

Kasparis, Takis
Normalization of NEXRAD Antenna Gain for Overlapping Radars – 127

Kassem, Wafaa I.
On the Performance of the VESPA Algorithm for Blind Beamforming and Signal Detection of Multi-source Multipath Signals – 73

Kaste, Richard C.
A Model-Based Approach to Battle Execution Monitoring – 302

Kastner, R.
Electromagnetic Analysis of an Antenna Buried in a Composite Environment – 73

Error Control in the Reduced Expansion and Field Testing (REFT) Method for MoM Matrix Thinning – 233

Katehi, Linda P. B.
Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Kathehi, Linda P.
A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies – 78

Katovic, Vladimir
Scholarly Research Program. Delivery Order 0007: Characterization of Ionic Liquids as Fuel Cell Electrolytes – 37

Kawakami, H.
Characteristics of Digital Terrestrial Broadcasting Antennas – 105

Kawano, T.
A Conformal Spiral Array Antenna Radiating an Omnidirectional Circularly-Polarized Wave – 70

Kawecki, Edwin J.
Nozzle Aerodynamic Stability During a Throat Shift – 1

Kaye, Grant D.
Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

Kazanas, D.
Long-Lag, Wide-pulse Gamma-Ray Bursts – 312

Kazanas, Demosthenes
Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content – 313

Keeney, M.
Insider Threat Study: Illicit Cyber Activity in the Banking and Finance Sector – 232

Keitz, Thomas L.
Scholarly Research Program. Delivery Order 0007: Characterization of Ionic Liquids as Fuel Cell Electrolytes – 37

Keizer, W. P. M. N.
Array Configurations and Wideband Radiators Suitable for Shared Apertures – 83

Keller, Vernon W.
GRAM Series of Atmospheric Models for Aeroentry and Aeroassist – 307

Kennedy, Joshua S.
Human Factors Assessment of the UH-60M Crew Station During the Early User Demonstration Number 2 (EUD2) – 12

Kenneth, K. O.
Integrated Dipole Antennas on Silicon Substrates for Intra-chip Communication – 102

Kenny, Michael T.
Development of Improved Thermal Control Coatings for Space Assets – 20

Kenny, Sean P.
Robust Control Design for Systems With Probabilistic Uncertainty – 18

Kergall, J.
Complex Natural Resonances Extracted from Radar Signatures Measured in Time Domain with UWB Laboratory System – 65

Khair, M. K.
Demonstration of Potential for Selective Catalytic Reduction and Diesel Particulate Filters – 184

Khalil, Ahmed I.
Analysis of Shielded CPW Spatial Power Combiners – 151

Khayat, Michael A.
Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas – 122

Khomenko, V.
Computing Shortest Violation Traces in Model Checking Based on Petri Net Unfoldings and SAT – 236

Khoshnevis, Behrokh
Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Kiang, Jean-Fu
Channel Simulation of Leo Satellites – 92

Kijesky, J.
Design and Development of Co-Polarized Ku-band Ground Terminal System for Very Small Aperture Terminal (VSAT) Application – 94

Kildal, Per-Simon
Analysis of Reflection from Multilayer Cylinder by Using a Black-hole Approach – 315

Asymptotic Boundary Conditions for Strip-loaded Surfaces of Cylindrical Structures with Arbitrarily Shaped Cross-section – 123

Kilic, O.
Distributed Aperture Design for Low Profile Earth Station Antennas – 101

Killion, M.
Economic Contribution of the California Air Pollution Control Industry – 190

Kim, C. W.
Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

Kim, H. J.
Low-cost Adaptive Arrays for Analysis of Wireless Systems – 117

Kim, J.
Relationship of Magnetocrystalline Anisotropy and Stoichiometry in Epitaxial L1(sup 0) CoPt(001) and FePT (001) Thin Films – 297

Kim, Kiho
Development of a Tri-plate Ring-Slot Antenna for mm-Wave Frequency Band – 99

Kim, Kihong
Integrated Dipole Antennas on Silicon Substrates for Intra-chip Communication – 102

Kim, S. H.
Global Climate Change and the Transportation Sector: An Update on Issues and Mitigation Options – 185

Kim, Won
Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

King, L.
An Overview of the Green Bank Telescope – 311

Kinkade, Rebecca
The Role of the Prohibition Gene in Apoptosis of Breast Cancer Cells – 215

Kioussis, Nicholas
Electronic Structure and Mechanical Properties of Metals and Intermetallics – 42

Kishk, Ahmed A.
Asymptotic Boundary Conditions for Strip-loaded Surfaces of Cylindrical Structures with Arbitrarily Shaped Cross-section – 123

Kitchener, D.
Multi-band Antennas – 65

Kittelson, D. B.
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 174

Gasoline Vehicle Exhaust Particle Sampling Study – 179

Kleinstreuer, Clement
Computational Analysis and Simulation of Toxic Particle Deposition in the Human Respiratory System – 56

Klemradt, U.
Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

Klinkenbusch, Ludger
Spherical-multipole Analysis of the Field within a Canonical GTEM-cell – 257

Klose, S.
Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Knapp, D. A.
Gamma-Ray Identification of Nuclear Weapon Materials – 46

Knott, E. F.
Wideband Radar Echoes from Cylindrical Rods – 74

Knott, Eugene F.
The World's First Comparison of Outdoor RCS Test Ranges – 143

Knowlton, Kelly
Laboratory Measurement of Bidirectional Reflectance of Radiometric Tarps – 169

Ko, Y.-K.
Current Sheet Evolution in the Aftermath of a CME Event – 324

Kodanda, R. T. M.
Demonstration and Evaluation of Potential High Level Waste Melter Decontamination Technologies for Savannah River Site – 185

Koehler, Chris
Student Hands-On Training (SHOT) Workshop Summer 2003 and 2004 – 24

Koelmans, A.
Applying Petri Nets to Systems Biology using XML Technologies – 237

Koenig, John R.
Lightweight Nonmetallic Thermal Protection Materials Technology – 51

Koenig, Z. M.
Gamma-Ray Identification of Nuclear Weapon Materials – 46

Kogiso, S.
Characteristics of Digital Terrestrial Broadcasting Antennas – 105

Koh, Il-Suek
Effect of Canopy-Air Interface Roughness on HF-VHF Wave Propagation in Forest – 86

Kolundzija, B.
Efficient and Accurate Inclusion of Radomes into Antenna Analysis – 71

Kolundzija, Branko M.
A New Approach for Accurate Analysis of Antennas Above Real Ground – 152

Konishi, Yoshihiko
Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems – 91

Konoske, Paula J.
The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

Konoske, Paula
Estimating Supplies Program: Evaluation Report – 245

Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

Review of Marine Corps Expeditionary Force Preventive Medicine Materiel Requirements – 219

Koontz, Steve
Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

Koppen, Sandra V.
Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

Korzennik, Sylvain G.
Seismic Study of the Solar Interior: Inferences from SOI/MDI Observations During Solar Activity – 325

Kota, Arun
Residual Gas Effects on Detached Solidification in Microgravity – 297

Kotulski, J. D.
Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

Koutny, M.
Modelling Opacity using Petri Nets – 236

Kouveliotou, C.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Kouveliotou, Chryssa
Observations of Soft Gamma Repeaters – 314

Kovalenko, V.
Probe Pulse Shape Estimation in Synthetic Aperture Method – 88

Kowalski, E.
Insider Threat Study: Illicit Cyber Activity in the Banking and Finance Sector – 232

Kraft, Ulrich R.
EIRP and Power Efficiency of Reconfigurable Active Transmit Antennas – 77

Krajacich, Christopher A.
Designing a Forcenet Information Topology – 248

Kraszewski, Andrzej W.
Density- and Structure-independent Calibration Method for Microwave Moisture Determination in Granular Materials – 157

Krause, Silva
Promotion of Epithelial to Mesenchymal Transformation by Hyaluronan – 211

Krawczynski, Henric
Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

Krok, Franciszek
International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004 – 54

Kronberger, R.
Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems – 90

Krop, Cathy
California's K-12 Public Schools. How Are They Doing? – 301

Krull, Andrea R.
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

Ksendzov, A.
Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Ku, Jentung
Miniature Heat Transport System for Spacecraft Thermal Control – 162

Kubicek, C.
Dynamic Allocation of Servers in a Grid Hosting Environment – 237

Kucharski, Andrzej
Planar Handset Antennas with Electronically Steerable Parameters – 105

Kulick, Wayne J.
Development Of A Control Moment Gyroscope Controlled, Three Axis Satellite Simulator, With Active Balancing For The Bifocal Relay Mirror Initiative – 24

Kumar, B. Preetham
Design of Low Sidelobe Circular Ring Arrays by Element Radius Optimization – 109

Optimization of Linear Array Antenna Performance – 104

Kumosa, M. S.
Fundamental Issues Regarding the High Temperature Failure Properties of Graphite/Polyimide Fabric Composites – 40

Kuntz, K. D.
The Optical Counterpart of M101 ULX-1 – 313

Kuperman, Gilbert G.
An Assessment of Alternative SAR Display Formats: Orientation and Situational Awareness – 302

Kurani, K.
Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB-1493 Rulemarking – 186

Kuwahara, Y.
3D Super Resolution Algorithm for Analysis of Multi-path Propagation Structure – 148

Kuwahara, Yoshihiko
Development and Evaluation Test of DBF Equipment for Transmitting – 72

Kuzuoglu, Mustafa
Reciprocity in Perfectly Matched Absorbers – 278

Kuzyk, Mark
Three Dimensional Optical Fiber Simulation – 117

Kwan, J. W.
Experimental Evaluation of a Negative Ion Source for a Heavy Ion Fusion Negative Ion Driver – 281

Kwoka, D.
Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Kwon, C.
Demonstration of Silicon Carbide Power Devices in Practical Power Conversion Systems – 46

Kyriazidou, Chryssoula A.
Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials – 146

Kyriazidou, Chryssoula
Filtering Characteristics of Thin, Planar 3D Printed Element Arrays – 153

Physical Realization of Magnetic Walls Using Finite-thickness 3D Printed Arrays – 108

The Field Transmitted into a PBG Crystal due to an Electric Line Source – 108

LaBarre, R.
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

LaBaw, Clayton C.
Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

LaBombard, B.
Three-Dimensional Simulation of Gas Conductance Measurement Experiments on Alcator C-Mod – 284

Ladner, S.
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264

Lakshminarayanan, B.
FDTD Modeling of Ceramic Multi-layer Capacitors Using Lumped Equivalent Models – 253

LaLaurie, J.
Interconnect and Packaging Electrical Circuits Network – 124

Lamartiniere, Coral A.
Interdisciplinary Breast Cancer Training Program – 225

Lamb, Christopher J.
Information Operations as a Core Competency (Joint Force Quarterly) – 303

Lampariello, P.
Improvements of the Radiation Performance in Leaky-wave Antennas with Gyrotropic Media – 115

Lan, K.
A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

Landesa, L.
The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces – 253

Langenberg, K. J.
Identification Versus Imaging – 149

Larsen, Tom
Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

Larson, Adam D.
The Impact of Computer Decision Support on Military Decision Making – 246

Lau, Jack
2.4GHz ISM Band Antenna for PC Cards – 241

Law, P. H.
Shaped Reflector and Multi-feed Paraboloid: A Comparison – 60

Lawrence, Kenneth
Limited Evaluation of Automated Aerial Refueling Algorithm (Project Self Serve) – 7

Lawrence, Timothy W.
Lightweight Nonmetallic Thermal Protection Materials Technology – 51

Lazarus, S. C.
Health Impact of Nitric Oxide: Effects on Lung Function and Cellular and Biochemical Processes in Healthy Humans – 179

Lazzi, Gianluca
Extension and Validation of the Equivalent Sources Helical Antenna Modeling with the FDTD Code – 130

Leach, S. M.
Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna – 205

Lear, W. E.
A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow – 16

LeClair, A.
Experiments on Dust Grain Charging – 315

Lederberg, Joshua
Interim Report of the Defense Science Board Task Force on SARS Quarantine – 226

Lee, Andre
Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes – 37

Lee, Bryan S.
An Analysis of a Dual Gridded Reflector Antenna – 67

Lee, Byungje
FDTD Analysis of Mutual Coupling between Microstrip Patch Antennas on Curved Surfaces – 71

Lee, Charles
Two Trees: Migrating Fault Trees to Decision Trees for Real Time Fault Detection on International Space Station – 306

Lee, Cheol Hoon
Surface Wave Scattering by Finite Periodic Structure of Arbitrary Profile in a Ground Plane: TE case – 84

Lee, Cheol
Revisited Generalized Wood Anomalies – 239

Lee, Ching Kwang
Shape Reconstruction of a Perfectly Conducting Cylinder Using Real-coded Genetic Algorithm – 266

Lee, Choon Sae
Bandwidth Enhancement of Microstrip Antenna with Leaky-wave Excitation – 79

Tapered Leaky-wave Ultra Wide-band Microstrip Antenna – 112

Lee, Chun M.
Design of Two-Axis Capacitive Accelerater Using MEMS – 262

Lee, E.
Multi-band Antennas – 65

Lee, Jonathan A.
Feasibility Assessment for Pressure Casting of Ceramic-Aluminum Composites for NASA's Propulsion Applications – 39

Lee, K. F.
Wideband L-strip Fed Microstrip Antenna – 68

Lee, Moon Gul
New Fictitious Play Procedure For Solving Blotto Games – 271

Lee, P. A.
Visual Language for Parallel, Object-Oriented Programming – 237

Lee, Robert
Matrix Pade Via Lanczos for FEM Problems – 142

Transient Plane Wave Scattering from Objects Near Lossy Ground with FDTD – 150

Lee, Sy-Teck
A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions – 72

Lee, Young-Ching
Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

Leeman, C.
Lattices. Subgroup Summary Report – 275

Legg, Jonathan A.
Tracking and Sensor Fusion Issues in the Tactical Land Environment – 304

Legoff, M.
Complex Natural Resonances Extracted from Radar Signatures Measured in Time Domain with UWB Laboratory System – 65

Lehner, G.
2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

Lehoczky, S. L.
Electrical Conductivity of HgTe at High Temperatures – 133

Lehto, Arto
Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna – 79

Leong, Mook-Seng
A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions – 72

Electromagnetic Radiation of Antennas in the Presence of an Arbitrarily Shaped Dielectric Object: Green Dyadics and Their Applications – 132

Leptoukh, Gregory
NASA GES DISC DAAC Satellite Data for GIS – 308

Leung, K. N.
Experimental Evaluation of a Negative Ion Source for a Heavy Ion Fusion Negative Ion Driver – 281

Levadoux, David
An Efficient High-frequency Boundary Integral Equation – 260

Leventis, Nicholas
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Levi, A. F. J.
Integrated Microphotonic Receiver for Ka-Band – 140

Levine, Murray D.
DRI internal Wave Simulations – 289

Levine, Stanley R.
Lightweight Nonmetallic Thermal Protection Materials Technology – 51

Lewis, B. J.
Estimation of Radiolytic Gas Generation Rate for Cylindrical Radioactive Waste Packages - Application to Spent Ion Exchange Resin Containers – 41

Lewis, L. H.
Relationship of Magnetocrystalline Anisotropy and Stoichiometry in Epitaxial L1(sup 0) CoPt(001) and FePT (001) Thin Films – 297

Lewis, Raymond A.
RF Stabilization for Storage of Antiprotons – 292

Leyendecker, Albert J.
Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

Li, C.
Electrical Conductivity of HgTe at High Temperatures – 133

Li, Eric S.
Polarimetric Backscatter Characterization of Road Surface Faults at Millimeter-wave Frequencies – 80

Polarimetric Radar Measurements for Vehicle Control and Warning Applications – 305

Li, \hLe-Wei
Electromagnetic Radiation of Antennas in the Presence of an Arbitrarily Shaped Dielectric Object: Green Dyadics and Their Applications – 132

Li, K.
Millimeter-wave Photodetection and Direct Integration with Microstrip Slot Antenna Array – 91

Li, Keren
3-D Spectral Domain Green's Function for Arbitrarily Multilayered Dielectric Structure – 118

Li, L. Y.
Reduced-Order Models for the Field Analysis of Hybrid Systems – 152

Li, Le-Wei
A 3-D Discrete Analysis of Cylindrical Radomes Using Dyadic Green's Functions – 72

Li, Zhifang
Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

Liang, Jian
S-Parameter Extraction of 3-D Microwave Structures by Using 3D-FDFD Method in Conjunction with Asymptotic Waveform Evaluation Technique – 106

Lieberman, M.
Distributed Aperture Design for Low Profile Earth Station Antennas – 101

Liepa, Valdis V.
Measured Back Scattering Cross Section of Thin Wires – 156

Ligeti, Z.
Comments on Extracting alpha from B to rho rho – 285

Ligthart, L. P.
Design of a Focal Plane Dielectric Rod Array for Feeding a Multiple Beams Reflector Antenna – 76

Lillie, B.
Signatures of Long-lived Gluinos in Split Supersymmetry – 284

Lim, Kyutae
Development of a Tri-plate Ring-Slot Antenna for mm-Wave Frequency Band – 99

Lin, Hsin-Piao
Multi-state Markov Model for Satellite Propagation Channels – 92

Lin, Shi-Ming
Synthesis of Shaped-Beam Pattern for Mobile Antenna – 143

Lin, Y.
Cryo Power and Heat Transfer – 171

Lin, Zi-Wei
Effects of Nuclear Interactions in Space Radiation Transport – 229

The Human Exploration Initative: Space Radiation Measurement Needs – 306

Lindenmeier, H.
Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems – 90

Linder, S.
Demonstration of Adaptive Radio Node – 63

Lindholm, Jeffery L.
Utilizing IXP1200 Hardware and Software for Packet Filtering – 243

Lindmark, Bjorn
Downlink Propagation Measurements in the GSM 900 and 1800 MHz Bands – 93

Ling, Feng
Efficient Electromagnetic Modeling of Microstrip Structures in Multilayer Media – 113

Ling, Hao
Clutter Reduction for Synthetic Aperture Radar Images Using Adaptive Wavelet Packet Transform – 103

Linkenkaer-Hansen, K.
Self-Organized Criticality and Stochastic Resonance in the Human Brain – 281

Liou, L. L.
Numerical Amplification of the Excitation Source in Waveguide Structure – 266

Litsuka, Y.
Characteristics of Digital Terrestrial Broadcasting Antennas – 105

Liu, Dui-Xian
A Multi-Branch Monopole Antenna for Dual-Band Cellular Applications – 105

Liu, Feng
Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129

Liu, Jeng-Shiung
Improvement of an Acoustic Sounder Device Used to Measure Atmospheric Turbulence – 194

Liu, Jun
Three Dimensional Optical Fiber Simulation – 117

Liu, P.K.
Hydrogen Production via a Commercially Ready Inorganic Membrane Reactor – 49

Liu, Qing Huo
PML and PSTD Algorithm for Arbitrary Lossy Bianisotropic Media – 259

PML-FDTD Method for Elastic Waves in Cylindrical and Spherical Coordinates – 257

Liu, Qing-Huo
3-D Numerical Mode-Matching (NMM) Method for Inhomogeneous Media – 254

Liu, Y. W.
A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

Liu, Zhijun
Moment Method Based Analysis of Dielectric-resonator Antennas – 122

Livesey, N. J.
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

Lizotte, Andrew
Twist Model Development and Results From the Active Aeroelastic Wing F/A-18 Aircraft – 15

Lloyd-Davies, Ed
Galactic Winds and Intragroup Medium Energetics – 317

Lo, Joseph
Modular Machine Learning Methods for Computer-Aided Diagnosis of Breast Cancer – 217

Lo, Wenso
Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

Loeffler, D.
Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface – 66

Lofts, Loreen A.
Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

Lohmann, R. P.
Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Lohrenz, Maura C.
Moving-Map Composers System Version 3.4P Acceptance Test Procedures Developed for the Finnish Air Force Modification for FIAF MMC System Without DMUI/DMU – 177

Long, Stuart A.
An Annular-Ring Reduced Surface Wave Microstrip Antenna – 114

Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas – 122

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas – 150

Looney, John
SJFHQ Simulation – 81

Lorenzo, Jerome
Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar – 151

Loskovska, S.
Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

Love, B. M.
Localization of Deformation in Heterogeneous Solids Deformed at High Strain Rates – 279

Loveland, K.
Envirocare of Utah: Expanding Waste Acceptance Criteria to Provide Low-Level and Mixed Waste Disposal Options – 187

Lowell, D. M.
Comparison of Clean Diesel Buses to CNG Buses – 188

Lowrance, John
Silicon-Based Visible/Near-Infrared Affordable Missile Warning – 292

Lozano, M. V.
Recalculating Linear Array Antennas to Compensate for Failed Elements While Maintaining Fixed Nulls – 102

Lu, Jui-Han
Dual-frequency Operation of Single-feed Triangular Microstrip Antennas – 96

Lu, L.
Photonic Analog-to-Digital Conversion Technology – 133

Lu, M.
A Diagonal Translation Operator for the Fast Evaluation of Two-dimensional Transient Wave Fields – 260

Lu, Ming-Yu
A 2.5-D PSTD Algorithm in Cylindrical Coordinates – 259

Acceleration of Two-dimensional Time Domain Integral Equation Solvers Using a Hilbert Transform – 261

Lu, Yuyuan
Study of Micromachined Microstrip Lines Using FDTD – 117

Lucke, Robert L.
Improved Approximations for Wave Structure Functions in a Turbulent Atmosphere – 195

Luff, J. D.
The 1-MW Radiatively Driven Hypersonic Wind Tunnel Experiments – 60

Lugaz, Noe
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Luh, Howard
A Confocal Reflector System – 77

An Analysis of a Dual Gridded Reflector Antenna – 67

Luk, K. M.
Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section – 118

Wideband L-strip Fed Microstrip Antenna – 68

Lukens, Scott
Concepts to Automate Fluid Transfer Capability of Low Impact Docking System (LIDS) – 27

Luong, Bruno
Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

Luz, P.
The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

Lyman, Raphael
Research Supporting Satellite Communications Technology – 110

Lyman, Ray
Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments – 62

Lynch, James A.
Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

Lynch, William A.
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

Lyubarsky, Y. E.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Mackin, Stephen
The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

MacPhie, Robert H.
Generalized Coincident Arrays for the Direct Measurement of the Principal Solution in Radio Astronomy – 127

MacReynolds, Katie
Far-field Antenna Patterns Determined from Infrared Holograms – 89

Madaras, Eric I.
Application of Hilbert-Huang Transform for Improved Defect Detection in Terahertz NDE of Shuttle Tiles – 30

Mahanta, Kamala
Polymer Waveguides for Quantum Information – 55

Mahdjoubi, K.
Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials – 132

Mixed Metallic Photonic Band-gap Material and Bragg Mirror – 298

Mait, Joseph N.
Shedding Light on the Battlefield: Tactical Applications of Photonic Technology – 167

Majjigi, R. K.
Low Noise Exhaust Nozzle Technology Development – 2

Majjigi, R.
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Mak, C. L.
Wideband L-strip Fed Microstrip Antenna – 68

Maker, Paul D.
Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Makino, Shigeru
Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems – 91

Malesani, D.
Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Mallik, Ranjan K.
Closed Form Expression For Mutual Partial Inductance Between Two Skewed Linear Current Segments – 113

Mallorqui, J. J.
Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Mallorqui, Jordi, J.
Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

Mallorqui, Jordi J.
Vectorial Waveguide Reflectometer for Dielectric Characterization of Materials Under Power Microwaves – 147

Malone, Roy W., Jr.
Development of Risk Assessment Matrix for NASA Engineering and Safety Center – 304

Manara, G.
A New Genetic-Algorithm-based Frequency Selective Surface Design for Dual Frequency Applications – 145

Mangenot, Cyril
Dual Band Dual Polarized Radiating Subarray for Synthetic Aperture Radar – 151

Mani, Mori
High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

Mankbadi, R. R.
Validation of a High-Order Prefactored Compact Code on Nonlinear Flows with Complex Geometries – 4

Manke, Gerald C.
The Measurement of Gain in a Supersonic, Combustion-Driven Generator for NCl(a1Delta) – 171

Manney, G. L.
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

Mansfle1d, D. K.
The 1-MW Radiatively Driven Hypersonic Wind Tunnel Experiments – 60

Marburger, John M.
Estimation of Geoacoustic Properties in the South China Sea Shelf Using a Towed Source and Vertical Line Hydrophone Array – 288

Marchuk, L. A.
A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

Marcus, Sharman W.
Parabolic Equation-Based Propagation Fields Near Surface Irregularities Including Backscatter – 266

Marin, C.
Reproducible Crystal Growth Experiments in Microgravity Science Glovebox at the International Space Station (SUBSA Investigation) – 57

Markley, D. J.
Siemens Programmable Variable Speed DC Drives Applied to Wet and Dry Expansion Engines – 277

Marti-Canales, Javier
Large 2-D Thinned Array for the Microwave Imaging Radiometer with Synthetic Aperture (MIRAS) – 100

Martin, James
Hardware Progress Made in the Early Flight Fission Test Facilities (EFF-TF) To Support Near-Term Space Fission Systems – 29

Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module – 33

Martin, Joseph S.
Aerosol Optical Depth Model Assessment With High Resolution Multiple Angle Sensors – 23

Martin-Cuerdo, R.
Minimization of Mutual Coupling Effects in Eigenstructure Algorithms Based on Modal Analysis – 94

Martin-Neira, Manuel
Large 2-D Thinned Array for the Microwave Imaging Radiometer with Synthetic Aperture (MIRAS) – 100

Martins, G.
Interconnect and Packaging Electrical Circuits Network – 124

Martire, V.
A Broadband Microstrip Antenna for SAR Applications – 75

Martone, Patrick
Deployment and Evaluation of the Helicopter In-Flight Tracking System (HITS) – 8

Marvin, A. C.
A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves – 269

Marx, Egon
Extensions of the Single-integral-equation Method – 258

Masetti, N.
Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Masip, M.
Signatures of Long-lived Gluinos in Split Supersymmetry – 284

Maskarinec, Gertraud
A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer – 223

Massengill, Lloyd
Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digital Converter – 140

Matloff, Gregory L.
A Strategic Roadmap to Centauri – 19

Matsui, T.
Millimeter-wave Photodetection and Direct Integration with Microstrip Slot Antenna Array – 91

Matsui, Toshiaki
Development of a Tri-plate Ring-Slot Antenna for mm-Wave Frequency Band – 99

Matsuyoshi, Toshimitsu
An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz – 76

Mattocco, Gaetano
Time-Domain Analysis of the Electromagnetic Coupling in Satellite Environments – 31

Matveev, Konstantin I.
Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

Maurer, B.
SCR Systems for Heavy Duty Trucks: Process Towards Meeting EURO 4 Emission Standards in 2005 – 172

Maurer, Mark
Hierarchical CAD Tools for Radiation Hardened Mixed Signal Electronic Circuits – 135

Maxson, J. A.
On-Line Integrated Control System for Reducing Coal Costs and Coal-Related Emissions: Coal Blend Automation System (CBAS) – 187

Mays, Jimmy W.
Morphology and Properties of Model Block and Graft Copolymers – 54

Mazumdar, A.
Demonstration and Evaluation of Potential High Level Waste Melter Decontamination Technologies for Savannah River Site – 185

McCarthy, Dennis D.
IERS Conventions (2003) – 310

McCormick, Frank
Identification of Functions of Neurofibromin Distinct from the RASGAP domain – 216

McGee, P.
Dynamic Allocation of Servers in a Grid Hosting Environment – 237

McGhee, David S.
Vehicle Integrated Performance Analysis, the VIPA Experience: Reconnecting with Technical Integration – 175

McGill, R.
Demonstration of Potential for Selective Catalytic Reduction and Diesel Particulate Filters – 184

McGinnis, Patrick J.
Assessment of Advanced Logistics Delivery System (ALDS) Launch Systems Concepts – 7

McGinnis, Scott J.
Nuclear Power Systems for Manned Mission to Mars – 20

McGregor, Andrew
Patient Warming Device for Casualty Care – 222

McGregor, Walter
In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19

McGregory, Walter
In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

McIlroy, David
Two-Dimensional Photonic Crystals for Near IR and Visible Optoelectronics Applications – 294

McKay, David T.
Civil Works Operations & Maintenance Management Tools Research Program: Program Summary FY 2000 - FY 2002 – 272

McKenna, Paul
Reflection and Transmission Properties of Reinforced Concrete Walls – 93

McLaren, D.
Design Concepts for the Radarsat-2 SAR Antenna – 88

McLean, James
Broadband, Robust, Low-profile Monopole Incorporating Top Loading, Dielectric Loading, and a Distributed Capacitive Feed Mechanism – 104

McLemore, Donald
Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

McMorrow, Dale
Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digital Converter – 140

McRory, John G.
Small Antenna Efficiency by the Reflection and the Q Measurement Methods – 145

McSpadden, James O.
Ka-Band Beam Steering Reflectarray Study – 86

Meador, Mary Ann B.
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Meador, Mary Ann
Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

Meador, Michael A.
Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

Mecking, B. A.
First Results from the CEBAF CLAS Spectrometer – 274

Medeiros, Maria G.
A Bipolar Electrode for Use in a Semi Fuel Cell – 139

Meguro, Akira
The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII – 104

Mehrotra, Amit R.
An Annular-Ring Reduced Surface Wave Microstrip Antenna – 114

Mei, K. K.
A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

Meigs, Andrew
Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

Mellquist-Riemenschneider, Jenny L.
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

Melnitchouk, W.
Jefferson Lab Phenomenology: An Overview – 277

Mendy Jr, Paul B.
Multiple Satellite Trajectory Optimization – 25

Mengle, V.
Low Noise Exhaust Nozzle Technology Development – 2

Mennitto, J.
Design Concepts for the Radarsat-2 SAR Antenna – 88

Merrill, William M.
Effective Permittivity and Permeability Functions of Metalo-dielectric Photonic Band Gap Materials – 146

The Field Transmitted into a PBG Crystal due to an Electric Line Source – 108

Merrill, William
Filtering Characteristics of Thin, Planar 3D Printed Element Arrays – 153

Physical Realization of Magnetic Walls Using Finite-thickness 3D Printed Arrays – 108

Meyn, Larry A.
A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic – 6

Michels, Karin B.
Severe Caloric Restriction in Adolescence and Incidence of Breast Cancer – 210

Michielsen, Bas
An Efficient High-frequency Boundary Integral Equation – 260

Michielssen, E.
A Diagonal Translation Operator for the Fast Evaluation of Two-dimensional Transient Wave Fields – 260

A Fast Time Domain Integral Equation Technique for Analyzing EMC/EMI Problems – 258

Rational Krylov Reduced Order Modeling of Frequency Selective Surfaces Through the Blazing Onset Using Woodbury Singularity Extraction – 265

Michielssen, Eric
A 2.5-D PSTD Algorithm in Cylindrical Coordinates – 259

Acceleration of Two-dimensional Time Domain Integral Equation Solvers Using a Hilbert Transform – 261

Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268

Moment Method Based Analysis of Dielectric-resonator Antennas – 122

The Multilevel Plane Wave Time Domain Algorithm for the Fast Analysis of Transient Scattering Phenomena – 254

Mickiewicz, Rafal
Bio-Derived Photonic Assemblies – 45

Midea, Anthony C.
High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

Miernik, Janie H.
Concepts to Automate Fluid Transfer Capability of Low Impact Docking System (LIDS) – 27

Miernik, Janie
Reuse International Space Station (ISS) Modules as Lunar Habitat – 318

Mikatarian, Ron
Simulated Space Environment Effects on the Blocking Force of Silicone Adhesive – 55

Milanowski, Randall
Hierarchical CAD Tools for Radiation Hardened Mixed Signal Electronic Circuits – 135

Milburn, G. J.
Experimental Implementation of Efficient Linear Optics Quantum Computation – 138

Miles, R. B.
The 1-MW Radiatively Driven Hypersonic Wind Tunnel Experiments – 60

Miles, Richard
Silicon-Based Visible/Near-Infrared Affordable Missile Warning – 292

Miller, Edmund K.
A Comparison of Solution Accuracy Resulting from Factoring and Inverting Ill-conditioned Matrices – 233

Developing Adaptive Models and Estimating the Uncertainty of Presampled Spectral Data – 241

Far Field Analysis of Radiation Sources – 110

Miller, Robert N.
Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES) – 289

Miller, S.
Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000 – 180

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, June 2000 – 180

Miller, Scott D.
The Reliability and Validity of the Outcome Rating Scale: A Replication Study of a Brief Clinical Measure – 214

Miller, Sharon K. R.
Atomic Oxygen Treatment and Its Effect on a Variety of Artist's Media – 38

Milman, Andrew S.
An Optimal Algorithm for Radar Imaging – 84

Milos, Frank S.
Lightweight Nonmetallic Thermal Protection Materials Technology – 51

Mingo, C.
The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

Minin, I. V.
New Class Microwave Antennas Based on the Elements of the Diffraction Quasioptics: Advantages and Applications – 65

Minin, O. V.
New Class Microwave Antennas Based on the Elements of the Diffraction Quasioptics: Advantages and Applications – 65

Minow, Joseph I.
Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

Mireles, Omar
Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module – 33

Mirme, A.
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 174

Mitchel, Brian
Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment – 69

Mitrani, I.
Design and Evaluation of a QoS-Adaptive System for Reliable Multicasting – 82

Dynamic Allocation of Servers in a Grid Hosting Environment – 237

Mitrovica, J. X.
Climate-Driven Deformation of the Solid Earth from GRACE and GPS – 196

Regional Deformation Studies with GRACE and GPS – 253

Mittra, Raj
An Anisotropic Perfectly Matched Layer (APML) Absorber for Mesh Truncation in the Context of a Multiresolution Time Domain Scheme – 89

An Aperture-coupled Small Microstrip Antenna with Enhanced Bandwidth – 67

FDTD Modeling of an Artificially-synthesized Absorbing Medium – 155

Reciprocity in Perfectly Matched Absorbers – 278

Mittra, R.
A New Genetic-Algorithm-based Frequency Selective Surface Design for Dual Frequency Applications – 145

Efficient MoM Analysis of Polarization Selective Surfaces Using Trefoil Knot Arrays – 293

Miura, Ryu
A Remote Calibration for DBF Transmitting Array Antennas by Using Synchronous Orthogonal Codes – 69

Miyamoto, Ryan Y.
A Novel Phase Conjugator for Retrodirective Array Application – 84

Mizuguchi, Yoshihiko
Performance Estimation of Space-Time Adaptive Processing via Subband Processing in Mobile Communications – 69

Mobley, Curtis D.
Collaborative Investigations of Shallow Water Optics Problems – 270

Moeckly, Brian
Frequency Agile Materials for Electronics (FAME) – 136

Moffat, James
Information Sharing Among Military Headquarters. The Effects on Decision-making – 300

Moffeit, K. C.
Design Studies for Flux and Polarization Measurements of Photons and Positrons for SLAC Proposal E166: An Experiment to Test Polarized Positron Production in the FFTB – 286

Moheb, H.
Design and Development of Co-Polarized Ku-band Ground Terminal System for Very Small Aperture Terminal (VSAT) Application – 94

Moini, R.
A New Time Domain Analysis of Vertical Dipole in the Vicinity of a Planar Dielectric Interface – 114

Mokhtari, M.
Photonic Analog-to-Digital Conversion Technology – 133

Molina-Jimenez, C.
Monitoring of Contractual Service Level Agreement – 232

Molitoris, J. D.
Pre/Post-Strike Atmospheric Assessment System (PAAS) – 182

Monfore, Kenneth
OR Modeling of a Conceptual System of Systems for Maritime Littoral Dominance in 2020 – 272

Monich, G.
Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

Monma, Kenji
An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz – 76

Monorchio, A.
A New Genetic-Algorithm-based Frequency Selective Surface Design for Dual Frequency Applications – 145

Design and Simulation of Active Spiral Inductors for RF Integrated Circuits – 145

Monti, Massimiliano
Time-Domain Analysis of the Electromagnetic Coupling in Satellite Environments – 31

Moore, A.
Insider Threat Study: Illicit Cyber Activity in the Banking and Finance Sector – 232

Moore, R. C.
Rail Access to Yucca Mountain: Critical Issues – 191

Moore, Ronald L.
Slow-rise and Fast-rise Phases of an Erupting Solar Filament and Flare Emission Onset – 325

Moore, Ronald
Compact Flares and CMEs – 309

Moore, T. E.
Thermal N+ in the Inner Magnetosphere – 295

Moore, Thomas E.
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Morahan, Michael
NASA GES DISC DAAC Satellite Data for GIS – 308

Moran, J. M.
X-ray Luminosity and Absorption Column Fluctuations in the H2O Maser Galaxy NGC 4258 from Weeks to Years – 316

Morgan, Bill
An Integrated Procedure for Measuring the Spatial and Temporal Resolution of Visual Displays – 138

Morris, Cohen
Bio-Derived Photonic Assemblies – 45

Morrison, Peter A.
California's K-12 Public Schools. How Are They Doing? – 301

Mortazawi, A.
An Inhomogeneous Waveguide Transformer with Hard Walls for the Excitation of Quasi-optical Amplifiers – 115

Moses, Kelly
Development of Risk Assessment Matrix for NASA Engineering and Safety Center – 304

Moss, S. C.
Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

Moumen, A.
Design of a Focal Plane Dielectric Rod Array for Feeding a Multiple Beams Reflector Antenna – 76

Mountain, R. D.
Transport Coefficients and Molecular Dynamics: Alternatives – 161

Moyeda, D.
Achieving New Source Performance Standards (NSPS) Emission Standards Through Integration of Low-No(x) Burners with an Optimization Plan for Boiler Combustion. Quarterly Technical Progress Report for January 2003 - March 2003 – 183

Mpoeleng, D.
From Crash Tolerance to Authenticated Byzantine Tolerance: A Structured Approach, the Cost and Benefits – 82

Mui, Whye K.
An Architecture for Network Centric Operations in Unconventional Crisis: Lessons Learnt from Singapore's SARS Experience – 303

Mukai, Koji
The Optical Counterpart of M101 ULX-1 – 313

Muller, Richard E.
Multi-Bandwidth Frequency Selective Surfaces for Near Infrared Filtering: Design and Optimization – 152

Muncill, Gregory
Using Adaptive Simulated Annealing to Estimate Ocean Bottom Acoustic Properties from Acoustic Data – 288

Munir, Arshad
Wide Band Modeling and Electromagnetic Pulse Propagation through HF Channel – 68

Murch, Ross D.
2.4GHz ISM Band Antenna for PC Cards – 241

Murdoch, Karen
Sabatier Methanation Reactor for Space Exploration – 321

Murphy, A. J.
Spent Fuel Transportation Package Performance Study Experimental Design Challenges – 56

Murphy, L.
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

Mushotzky, Richard
Recent Results on Ultra-Luminous X-ray Sources – 313

Musuotzky, Richard F.
The Optical Counterpart of M101 ULX-1 – 313

Muza, Stephen R.
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

Myers, S. C.
Practical Gamma Spectroscopy Assay Techniques for Large Volume Low-Level Waste Boxes – 231

Myrick, Michael L.
University of South Carolina CB Support, Basic Research in Materials and Techniques for Optical Computing Standoff Sensors – 271

Myrick, Stephanie A.
Moving-Map Composers System Version 3.4P Acceptance Test Procedures Developed for the Finnish Air Force Modification for FIAF MMC System Without DMUI/DMU – 177

Na, Zai-Ping
The General NMM Solution for 2-D EMF Problems with Arbitrary Excitations under General Coordinates – 205

Nabulsi, Khalid A.
A Viable Model for Power Focussing in a Lossy Cylinder – 142

Nadler, Itzhak
An Assessment of Alternative SAR Display Formats: Orientation and Situational Awareness – 302

Nadobny, J.
Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

Najafabadi, Reza M.
Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment – 69

Nakano, H.
A Conformal Spiral Array Antenna Radiating an Omnidirectional Circularly-Polarized Wave – 70

Nakano, Hisamatsu
Theoretical and Experimental Investigations on Focusing Properties of the Fresnel Zone Lens and Plate – 294

Nakayama, K.
A Conformal Spiral Array Antenna Radiating an Omnidirectional Circularly-Polarized Wave – 70

Nakayama, Ken
Implicit Memory, Perception and the Rapid Deployment of Visual Attention and Action – 241

Nalbandian, Vahakn
Bandwidth Enhancement of Microstrip Antenna with Leaky-wave Excitation – 79

Tapered Leaky-wave Ultra Wide-band Microstrip Antenna – 112

Nalca, Aysegul
Vaccines and Animal Models for Arboviral Encephalitides – 222

Naldini, A.
A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108

Nall, Mark
Strategic Research Partnerships for Exploration – 319

Nam, Sangmin
Development of a Tri-plate Ring-Slot Antenna for mm-Wave Frequency Band – 99

Namani, Madhu
Morphology and Viscoelastic Properties of Polystyrene Blended with Fully Condensed Polyhedral Oligomeric Silsesquioxanes – 37

Nami, Ziba
Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment – 69

Nantista, C.
Low Field Accelertor Structure Couplers and Design Techniques – 284

Narayanan, Ram M.
ISAR Turntable Experiments Using a Coherent Ultrawideband Random Noise Radar – 84

Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements – 156

Ultrawide-band Noise Synthetic Aperture Radar: Theory and Experiment – 87

Nardi, Daniele
Situation Assessment and Information Fusion: An Experimental Framework for Performance Evaluation – 302

Nash, L.
An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

Nashashibi, A.
A Novel Design of an Ultra-Fast Wideband Polarimetric Radar – 107

Navarro, M.
Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms – 85

NeergaardParker, Linda
Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

Nelson, Edward L.
Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

Nelson, Herbert H.
Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

Nelson, Karl W.
Technology Challenges for Deep-Throttle Cryogenic Engines for Space Exploration – 33

Nelson, Mark D.
Integrated Network Application Management (INAM) – 249

Nelson, Stuart O.
Density- and Structure-independent Calibration Method for Microwave Moisture Determination in Granular Materials – 157

Nelsson, C.
Database of Material Properties for Optical Signature Modelling – 293

Neri, B.
Design and Simulation of Active Spiral Inductors for RF Integrated Circuits – 145

Nerukh, A. G.
Numerical Calculation of the Volterra Integral Equation for a Time-varying Medium – 109

Neuman, Frank
A Fast-Time Simulation Tool for Analysis of Airport Arrival Traffic – 6

Neumann, Peter D.
Using Adaptive Simulated Annealing to Estimate Ocean Bottom Acoustic Properties from Acoustic Data – 288

Ng, Anvil K. P.
2.4GHz ISM Band Antenna for PC Cards – 241

Ng, W.
Photonic Analog-to-Digital Conversion Technology – 133

Ngongo, R. S.
A New Approach for Microstrip Active Antennas Using Modal FFT-algorithm – 98

NGongo, R. S.
Interconnect and Packaging Electrical Circuits Network – 124

Nguyen, Christine
Metallic Zone Plates for Sectoral Horns – 119

Nguyen, D. T.
Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics – 291

Parallel Domain Decomposition Formulation and Software for Large-Scale Sparse Symmetrical/Unsymmetrical Aeroacoustic Applications – 239

Nguyen, Duc T.
Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

Nguyen, K.
Energy Efficient Thermal Management for Natural Gas Engine Aftertreatment via Active Flow Control – 174

Nguyen, Truong X.
Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

Nicklaw, Christopher
Hierarchical CAD Tools for Radiation Hardened Mixed Signal Electronic Circuits – 135

Nickless, Darryl
NASA GES DISC DAAC Satellite Data for GIS – 308

Nielsen, D.
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

Nikita, Konstantina S.
Radiation Properties of Two Cylindrical Conformal Arrays Isolated by a Space Filter – 59

Nilsson, C.
Pigments With Potential for Adaptable Optical Properties – 51

Nir, Y.
Comments on Extracting alpha from B to rho rho – 285

New Ways to Soft Leptogenesis – 277

Nishikawa, K. I.
3-D GRMHD Simulations of Disk-Jet Coupling and Associated Variabilities and Emission – 316

Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

Nishimori, Kentaro
A New Calibration Method of Adaptive Array for TDD Systems – 74

Nix, Ralph E.
The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

Noe, R.
Significant RX Antenna Diversity Gain in 30 GHz Broadband Radio Channels Subject to Fading – 85

Noel, B. W.
Development of On-Line Temperature Measurement Instrumentation for Gasification Process Control – 36

Noordally, E.
Porous Media Combustors for Clean Gas Turbine Engines – 42

Norbeck, J. M.
Internal Combustion Engine (ICE) Air Toxic Emissions – 173

Norbraten, Terry D.
Utilization of Forward Error Correction (FEC) Techniques With Extensible Markup Language (XML) Schema-Based Binary Compression (XSBC) Technology – 243

Norgard, John D.
Far-field Antenna Patterns Determined from Infrared Holograms – 89

Norris, J. P.
Long-Lag, Wide-pulse Gamma-Ray Bursts – 312

Norrod, R.
An Overview of the Green Bank Telescope – 311

Nossek, Josef A.
Low Complexity Space-frequency Rake Receivers for WCDMA – 131

Novotny, David R.
The Co-conical Field Generation System - A 40 GHz Antenna Calibration Cell – 120

Nunes, Arthur C., Jr.
Unraveling the Material Processing Conditions for Optimizing FSW Process – 175

Obayashi, S.
An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

Obeidat, Khaled
Quasi-static Analysis of Asymmetric Cylindrical Coplanar Waveguide – 151

Obelleiro, F.
Fast Generalized Forward-backward Method by Using a Spectral Acceleration – 255

The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces – 253

Oberle, William F.
Toward High Resolution, Ladar-Quality 3-D World Models Using Ladar-Stereo Data Integration and Fusion – 167

Ochterbeck, Jay M.
Miniature Heat Transport System for Spacecraft Thermal Control – 162

O'Connell, Peter
MTA1-Regulated Gene Expression: New Markers of Breast Cancer Metastasis – 228

ODell, S.
A Viable Scheme for Elemental Extraction and Purification Using In-Situ Planetary Resources – 318

Oehgren, J.
Retrocommunication – 63

Oelke, Mathis
Development of Artificial Antigen Presenting Cells for Prostate Cancer Immunotherapy – 207

Oelrich, Brian
The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

Ogawa, Koichi
An Analysis of the Performance of a Handset Diversity Antenna Influenced by Head, Hand and Shoulder Effects at 900 MHz – 76

Ogawa, Satoshi
Development and Evaluation Test of DBF Equipment for Transmitting – 72

Ogle, J. A.
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

Oguz, Ugur
Employing PML Absorbers in the Design and Simulation of Ground Penetrating Radars – 266

Ohlhorst, Craig W.
Lightweight Nonmetallic Thermal Protection Materials Technology – 51

Ohmi, K.
Beam-beam Simulation Studies for PEP-II and KEKB – 284

Ojiro, Y.
Characteristics of Digital Terrestrial Broadcasting Antennas – 105

Okhmatovsky, Vladimir I.
Radiation Properties of Two Cylindrical Conformal Arrays Isolated by a Space Filter – 59

Oland, C. B.
Guide to Low-Emission Boiler and Combustion Equipment Selection – 186

Oldigs, Richard
Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

Oliversen, Ronald J.
Chemical Compositions and Anomalies in Stellar Coronae ADP99 – 315

Ololoska-Gagoska, L.
Visualization of Induced Currents and SAR in Human's Head in Cellular Telecommunications – 126

Olyslager, F.
Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports – 130

Olyslager, Frank
Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques – 253

Omar, A. S.
An Improved Renormalization Technique for Profile Inversion – 267

Omar, Amjad A.
A New Broad-band, Dual-frequency Coplanar Waveguide Fed Slot-Antenna – 66

Ondrejka, Arthur
The Co-conical Field Generation System - A 40 GHz Antenna Calibration Cell – 120

ONeil, Daniel A.
Advanced Technology Lifecycle Analysis System (ATLAS) Technology Tool Box (TTB) – 300

Ong, Chin S.
Digital Phased Array Architectures for Radar and Communications Based on Off-the-Shelf Wireless Technologies – 134

Ono, Mitsuhiro
Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

Onodera, Toshio
A Design Method of Offset Fresnel Zone Plate Reflector as Receiving Antenna – 119

Onofrio, Kathleen
The Air Force Mobile Forward Surgical Team (MFST): Using the Estimating Supplies Program to Validate Clinical Requirement – 247

Oodo, Masayuki
A Remote Calibration for DBF Transmitting Array Antennas by Using Synchronous Orthogonal Codes – 69

Orefice, M.
Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas – 112

Orlando, Terry P.
Student Support for Quantum Computation With Superconducting Quantum Devices – 280

Ostrogorsky, A.
Reproducible Crystal Growth Experiments in Microgravity Science Glovebox at the International Space Station (SUBSA Investigation) – 57

Otaka, S.
An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

Ouelette, Thomas
Production and Purification of Refolded Recombinant Human IL-7 From Inclusion Bodies – 227

Ouelette, Timothy
Production and Purification of Refolded Recombinant Human IL-7 From Inclusion Bodies – 227

Overcash, Michael
Environmental Life Cycle Techniques for New Weapons Acquisition Systems – 45

Owens, James E.
Reuse International Space Station (ISS) Modules as Lunar Habitat – 318

Owrutsky, Jeffrey C.
Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

Ozaki, Tsuyoshi
Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems – 91

Ozkar, M.
An Inhomogeneous Waveguide Transformer with Hard Walls for the Excitation of Quasi-optical Amplifiers – 115

Ozzaim, Cengiz
Analysis of a Charge Probe and its Response near Metallic and Dielectric Interface – 151

Coupling to a Probe in a Metal Can by an Electric Dipole – 240

Padget, F. C.
Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Paeaejaervi, L.
Demonstration of Adaptive Radio Node – 63

Pages, Roma
Application of the Conjugate Gradient Method to a Self-matching Network for Industrial Microwave Heating Antennas – 115

Pagnutti, Mary
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

Paik, Dr. Namwoong
Ultra-Smooth As-Deposited Optical Films – 137

Palacios, Helena
Large 2-D Thinned Array for the Microwave Imaging Radiometer with Synthetic Aperture (MIRAS) – 100

Palano, A.
Study of e(sup +)e(sup -) --\g (pi)(sup +)(pi)(sup -)(pi)(sup 0) Process Using Initial State Radiation with BaBar – 283

Palazzi, E.
Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Paley, Mark S.
Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

Palisoc, Arthur
On Inflatable Antenna State of the Art Precision – 100

Palmer, D. J.
Distributed Enactment of Composite Web Services – 82

Notations for the Specification and Verification of Composite Web Services – 304

Palmer, J.
Dynamic Allocation of Servers in a Grid Hosting Environment – 237

Pan, Shan-Cheng
Single-feed Dual-frequency Microstrip Antenna with Two Patches – 95

Panariello, G.
A New Method to Compute the Fundamental Mode Resonant Frequencies of Microstrip Annular Rings – 121

Panchal, Rekha G.
Molecular Mechanisms of Filovirus Cellular Trafficking – 222

Pang, Gerald
Estimating Supplies Program: Evaluation Report – 245

Pang, Gerry
Marine Corps Operational Medicine: An Analysis of Medical Supply Requirements for the Surgical Company Operating Room – 220

Pao, Hsueh-Yuan
Design of a TEM Waveguide for Ultra-wideband Applications – 154

Pao, S. Paul
High Speed Civil Transport (HSCT) Isolated Nacelle Transonic Boattail Drag Study and Results Using Computational Fluid Dynamics (CFD) – 3

Papalambros, panos Y.
Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

Papaliakos, Vasilios
Content Repurposing of Electrical Diagrams for Presentation in Handheld Devices – 241

Papatsoris, A. D.
A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves – 269

Parastatidis, S.
Assessing the Risk and Valie of Adopting Emerging and Unstable Web Services Specifications – 234

Using Web Services to Build Grid Applications-The No Risk WSGAF Profile – 235

Visual Language for Parallel, Object-Oriented Programming – 237

Parini, C.
Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60

Paris, Deidre
IVHM Framework for Intelligent Integration for Vehicle Health Management – 250

Park, Ikmo
An Aperture-coupled Small Microstrip Antenna with Enhanced Bandwidth – 67

Park, Joel T.
Performance of Propeller 4381 in Crashback – 160

Parker, D.
An Overview of the Green Bank Telescope – 311

Parks, Jeffery M.
Scattering from Dielectric Bodies – 69

Parks, R.
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

Parmantier, Jean-Philippe
Development of the CRIPTE Code for Electromagnetic Coupling – 246

Parris, F.
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

Parrish, John A.
Center for Innovative Minimally Invasive Therapy (CIMIT) – 205

Parrott, David
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Parsad, B.
Internet Access in US Public Schools and Classrooms: 1994-2003 – 83

Parsells, R.
Diamond Wire Cutting of the Tokamak Fusion Test Reactor – 295

Parsley, W.
Comparison of Clean Diesel Buses to CNG Buses – 188

Parsons, R.
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264

Pasvolsky, J.
Electromagnetic Analysis of an Antenna Buried in a Composite Environment – 73

Patel, Rishi
Multiple Strategy Bio-Detection Sensor Platforms Made from Carbon and Polymer Materials – 166

Patra, Abani K.
Fracture Toughness Improvement of Composites Reinforced with Optimally Shaped Short Ductile Fibers – 40

Patrick, Clinton
A Concept for the Inclusion of Analytical and Computational Capability in Existing Systems for Measurement of Neutron Flux – 164

Patrissi, Charles J.
A Bipolar Electrode for Use in a Semi Fuel Cell – 139

Patteri, P.
Lattices. Subgroup Summary Report – 275

Paul, J.
Time-Domain Modelling of Propagation in Nonlinear Dielectrics Using TLM – 258

Pauley, R. L.
The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

Pawson, S.
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

Pearson, J. Boise
RF Stabilization for Storage of Antiprotons – 292

Pearson, Kristen A.
Circadian Rhythms, Fatigue, and Manpower Scheduling – 229

Peden, C. H. F.
Dynamometer Evaluation of Plasma-Catalyst for Diesel NOX Reduction – 171

Peglow, S. G.
Pre/Post-Strike Atmospheric Assessment System (PAAS) – 182

Peixeiro, Custodio
Microstrip Patch Antenna for GSM 1800 Handsets – 90

Pelletier, Keith N.
Influence of Stress Relaxation in Hybrid Composite/Metal Bolted Connections – 175

Pelosi, G.
A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108

Penaranda-Foix, F.
Precise Dielectric Properties Determination of Laminar-shaped Materials in a Partially-filled Waveguide – 146

Penaranda-Foix, Felipe
Circuital Analysis of a Two-port Angular Sector – 143

Peng, S. T.
Scattering of Plane Waves by Two-Dimensional Periodic Impedance Surface – 85

Penrod, W.
Achieving New Source Performance Standards (NSPS) Emission Standards Through Integration of Low-No(x) Burners with an Optimization Plan for Boiler Combustion. Quarterly Technical Progress Report for January 2003 - March 2003 – 183

Perera, Janaka P.
A Low-Cost, Man-Portable, Free-Space Optics Communications Device for Ethernet Applications – 170

Perevodchikov, Vladimir
Investigation of Characteristics of High-Power Wide-Band Plasma-Filled Traveling Wave Tubes (TWT) – 295

Perez-Moreno, Mirna
Role of E-Cadherin Homophilic Contacts in the Inhibition of Cell Growth of Primary Breast Cells – 218

Perlman, Eric
Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content – 313

Perry, E.
Diamond Wire Cutting of the Tokamak Fusion Test Reactor – 295

Perry, Walter L.
Information Sharing Among Military Headquarters. The Effects on Decision-making – 300

Persson, Patrik
Calculating The Mutual Coupling Between Apertures on Convex Cylinders Using a Hybrid UTD-MoM Method – 66

Petersen, W. A.
Lightning Contribution to Improvement of Passive Microwave Vertical Structure and Rainfall Estimation – 196

Peterson, Andrew F.
Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

Petit, Gerard
IERS Conventions (2003) – 310

Petrenko, Velery A.
Phage Landscape Libraries as a Source of Substitute Antibodies for Detection Platforms – 212

Petrovic, Vladimir V.
A New Approach for Accurate Analysis of Antennas Above Real Ground – 152

Pfarr, Barbara
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Pharn, V. D.
Computer Simulated and Analytical Results of MSE in Adaptive Integrated Reduced-complexity Receiver for Multipath DS/CDMA Systems – 73

Phillip, DeLeon
Effective Utilization of Commercial Wireless Networking Technology in Planetary Environments – 62

Phoha, Shashi
Mobile Ubiquitous Security Environment (MUSE) – 250

Pian, E.
Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Pierce, Byron J.
An Integrated Procedure for Measuring the Spatial and Temporal Resolution of Visual Displays – 138

Pinho, Silvestre T.
Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

Pink, John J.
The Role of Calgranulin Overexpression in Breast Cancer Progression – 220

Pino, Antonio G.
Antennas Feasibility Study for a LMDS Communication System – 91

Pino, M. R.
Fast Generalized Forward-backward Method by Using a Spectral Acceleration – 255

The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces – 253

Pinto, Innocenzo M,.
Higher-order Impedance Boundary Conditions for Complex Layered Planar Coatings – 130

Pirinoli, P.
Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas – 112

Plaia, James
Bond Testing for Effects of Silicone Contamination – 173

Plassat, G.
Comparative Study on Exhaust Emissions from Diesel- and CNG-Powered Urban Buses – 189

Plocharski, Janusz
International Symposium on Polymer Electrolytes (9th) Held in Mragowo, Poland, on August 22-27, 2004 – 54

Pocher, A.
Engine Exhaust Particle Sizer (Trademark) Spectrometer for Transient Emission Particle Measurements – 174

Pochini, C.
A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108

Poggio, Andrew J.
Design of a TEM Waveguide for Ultra-wideband Applications – 154

Poh, Seng Cheong Telly
Simulations of Diversity Techniques for Urban UAV Data Links – 11

Poilasne, G.
Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials – 132

Mixed Metallic Photonic Band-gap Material and Bragg Mirror – 298

Polcawich, Ronald
UV Baked/Cured Photoresist Used as a Sacrificial Layer in MEMS Fabrication – 280

Poletto, G.
A Detection of the Same Hot Plasma in the Corona: During a CME and Later at Ulysses – 192

Current Sheet Evolution in the Aftermath of a CME Event – 324

Pollack, Nathan
NASA GES DISC DAAC Satellite Data for GIS – 308

Polsgrove, T.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Polycarpou, Anastasis C.
Full-wave Analysis of HF Antennas on Helicopters Using the FDTD, FEM and NEC – 128

Ponliguen, P.
Mixed Metallic Photonic Band-gap Material and Bragg Mirror – 298

Pope, Regina D.
In Situ Resource-Based Lunar and Martian Habitat Structures Development at NASA/MSFC – 323

Post, David L.
Helmet-Mounted Display Targeting Symbology Color Coding: An Air-to-Air Scenario Evaluation – 231

Pouliguen, P.
Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials – 132

Complex Natural Resonances Extracted from Radar Signatures Measured in Time Domain with UWB Laboratory System – 65

Povirk, Lawrence F.
Role of Brca1 in Nonhomologous DNA End Joining – 212

Powers, W. T.
A Concept for the Inclusion of Analytical and Computational Capability in Existing Systems for Measurement of Neutron Flux – 164

Prados, Don
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

Prata, A., Jr.
A Design Procedure for Classical Offset Dragonian Antennas with Circular Apertures – 77

Prata, Aluizio, Jr.
Archimedean Spiral-mode Microstrip Antenna with Improved Axial Ratio – 79

Electromagnetic Parallel Processing Using the Personal Computers of a Local Area Network – 242

Rigorous Analysis of Practical Reflector Antennas – 80

Prather, Dennis W.
Experimental Characterization of Photonic Band Crystals for Tera Hertz Devices – 134

Prechtl, E.
Dismantling of the Upper RPV Components of the Karlsruhe Multi-Purpose Research Reactor (MZFR), Germany – 291

Preece, R.
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

Preger, M.
Lattices. Subgroup Summary Report – 275

Prieto, Darue
Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

Prieto, Raphael Garcia
Nickel Sandwich Technology for High Precision Reflector Antennas – 97

Przybylski, J. M.
Porous Media Combustors for Clean Gas Turbine Engines – 42

Puente, Carles
A Procedure to Design Wide-Band Electromagnetically-coupled Stacked Microstrip Antennas Based on a Simple Network Model – 114

Puente, C.
Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms – 85

Pulskamp, Jeff
UV Baked/Cured Photoresist Used as a Sacrificial Layer in MEMS Fabrication – 280

Pumphrey, H. C.
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

Pun, Winston
Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

Pusey, Marc L.
Fluorescent Approaches to High Throughput Crystallography – 296

Pushko, Peter
Venezuelan Equine Encephalitis Replicon Immunization Overcomes Intrinsic Tolerance and Elicits Effective Anti-Tumor Immunity to the 'Self' Tumor-Associated Antigen, neu in a Rat Mammary Tumor Model – 224

Qi, Zhu
Improved Smokescreen For MM Wave And IR – 116

Qian, Y.
Active Integrated Antennas for New RF Architectures – 64

PBG-Assisted Gain Enhancement of Patch Antennas on High-dielectric Constant Substrate – 109

Qian, Yong-Xi
A Novel Phase Conjugator for Retrodirective Array Application – 84

Qian, Yongxi
A Uniplanar Quasi-yagi Antenna with Wide Bandwidth and Low Mutual Coupling Characteristics – 71

Qiang, J.
Beam-beam Simulation Studies for PEP-II and KEKB – 284

Qing, Anyong
Shape Reconstruction of a Perfectly Conducting Cylinder Using Real-coded Genetic Algorithm – 266

Quach, Cuong C.
Comparison of Fiber Optic Strain Demodulation Implementations – 168

Quade, U.
Release of Residues from Melting Norm-Contaminated Steel Scrap. A German Approach – 50

Quek, Yew S.
Characterization of 3 to 5 Micron Thermal Imagers and Analysis of Narrow Band Images – 252

Quigg, C.
Lost Tribes of Charmonium – 276

Quinn, H.
Comments on Extracting alpha from B to rho rho – 285

Quintenz, J. P.
Pulsed Power Fusion – 149

Raeisaenen, Antti V.
Simple Broadband Dual-polarized Aperture-coupled Microstrip Antenna – 79

Rafi, Gh. Z.
A New Time Domain Analysis of Vertical Dipole in the Vicinity of a Planar Dielectric Interface – 114

Rahmat-Samii, Yahya
A Fractal Based FSS with Dual Band Characteristics – 87

ARISE: A Challenging 25-m Space Antenna Design – 88

Design and Characterization of Diagonal Horn Antennas Using UCLA Bi-Polar Near-Field Measurement and Imaging Facilities – 155

Rahmat-Samii, Y.
External Substrate Perforation Applied to Patch Antennas for Mitigating Surface Wave Effects – 110

Raisanen, Antti V.
On the Planarity Errors of the Hologram of the CATR – 92

Rajabi, Hasan N.
The Mechanism of Retinoblastoma Protein-Mediated Terminal Cell Cycle Arrest – 218

Rajan, Subramaniam D.
Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

Ralph, T. C.
Experimental Implementation of Efficient Linear Optics Quantum Computation – 138

Ramachandran, Narayanan
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 323

Ramachandran, N.
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193

Ramakrishnan
Residual Gas Effects on Detached Solidification in Microgravity – 297

Ramanujam, P.
Shaped Reflector and Multi-feed Paraboloid: A Comparison – 60

Ramirez, Raul R.
Dual Band Dual Linear Polarization Elliptical Microstrip Ring Antenna – 145

Ramirez-Ruiz, E.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Ramsay, Gavin
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Randazzo, M. R.
Insider Threat Study: Illicit Cyber Activity in the Banking and Finance Sector – 232

Randell, B.
Dependable Pervasive Systems – 236
Extending the Horizons of DSE (GC6) – 234
Wrapping the Future – 234

Randhawa, B. S.
A Hybrid Uniform Theory of Diffraction Finite-difference Time-domain Method for Scattered Waves – 269

Rantakokko, J.
Demonstration of Adaptive Radio Node – 63

Rao, S. I.
Ab-Initio Simulation of a/2\h110\g Screw Dislocations Gamma-TiAl – 49

Rashidnia, Nasser
Novel Optical Diagnostic Techniques for Studying Particle Contact and Deposition Upon a Large Cylinder in a Sheared Suspension – 163

Raskin, Jean-Pierre
A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies – 78

Ratner, Albert
Measurements and Modeling of Combustion Dynamics for Control of Combustion Instabilities – 44

Rau, A.
Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Rausch, Ekkehart O.
Numerical Techniques for the Analysis of Microstrip, Stripline, and Waveguide Rotman Lenses – 157

Ravindranath, Mepur H.
Gangliosides During Tumor Progression in Patients With Prostate Cancer – 209

Ray, C. S.
A Viable Scheme for Elemental Extraction and Purification Using In-Situ Planetary Resources – 318
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193
Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

Ray, Chandra
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 323

Ray, Saikat
Closed Form Expression For Mutual Partial Inductance Between Two Skewed Linear Current Segments – 113

Raymond, J. C.
Current Sheet Evolution in the Aftermath of a CME Event – 324

Read, W. G.
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

Rebeiz, Gabriel M.
A Wideband CPW-fed Microstrip Antenna at Millimeter-wave Frequencies – 78

Rebollar, J. M.
Dual-band Compact Square Waveguide Corrugated Polarizer – 112

Reddy, C. J.
Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics – 291

Redondo, R.
Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Reed, A. W.
Wideband Radar Echoes from Cylindrical Rods – 74

Reed, Douglas S.
Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

Regel, Liya L.
Residual Gas Effects on Detached Solidification in Microgravity – 297

Reid, Robert S.
Transient Approximation of SAFE-100 Heat Pipe Operation – 32

Reid, Robert
Multiple Restart Testing of a Stainless Steel Sodium Heat Pipe Module – 33

Reifenberger, R.
Hybrid Molecular and Spin-Semiconductor Based Research – 168

Reis, S. T.
Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

Reiter, L.
Optimization of the Antenna-diversity-effectiveness of Complex FM-car-antenna Systems – 90

Reponen, T.
Microbiological Air Contamination from Machining Fluids – 181

Reynolds, Stephen A.
DRI internal Wave Simulations – 289

Rezvanov, A. G.
Beamforming by Magnetostatic Wave Microstrip Antennas – 98

Ribeiro, Gregg L.
Nozzle Aerodynamic Stability During a Throat Shift – 1

Ribo, Serni
Vectorial Waveguide Reflectometer for Dielectric Characterization of Materials Under Power Microwaves – 147

Richardson, C.
Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000 – 180
Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, June 2000 – 180

Richardson, G.
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

Rieger, W.
2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

Ries, C.
Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Rigali, M. J.
Fibrous Monolith Wear Resistant Components for the Mining Industry. Semi-Annual Report No. 4 – 51

Riley, V.
Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs) – 231

Rimm, David
Outcome Based Screening for Prognostic Phospho-RTK (Receptor Tyrosine Kinase) Antibodies Using Tissue Microarrays) – 227

Rinard, Martin
Component Composition for Embedded Systems Using Semantic Aspect-Oriented Programming – 245

Rivera Parga, Jose R.
Wind Tunnel Investigation of the Static Stability and Control Effectiveness of a Rotary Tail in a Portable UAV – 4

Rizzi, Stephen A.
High Speed Research Program Structural Acoustics Multi-Year Summary Report – 290

Rizzo, T. G.
Signatures of Long-lived Gluinos in Split Supersymmetry – 284

Roach, John M.
Production and Purification of Refolded Recombinant Human IL-7 From Inclusion Bodies – 227

Roberts,
Novel Techniques for the Production of Gamma Rays – 293

Robertson, Jeff
Concepts to Automate Fluid Transfer Capability of Low Impact Docking System (LIDS) – 27

Robinson, Allan
Uncertainties and Interdisciplinary Transfers through the End-to-End System (UNITES) – 289

Robinson, C.
Design and Development of Co-Polarized Ku-band Ground Terminal System for Very Small Aperture Terminal (VSAT) Application – 94

Robinson, Daryl C.
Dual Purpose Simulation: New Data Link Test and Comparison With VDL-2 – 2

Robinson, Esther R.
Iraq and Failures in U.S. Compellence Policy 1990-2003 – 279

Robinson, P.
Component Middleware to Support Non-repudiable Service Interactions – 82

Failure Models and Criteria for FRP Under In-Plane or Three-Dimensional Stress States Including Shear Non-Linearity – 40

Robinson, Peter
Two Trees: Migrating Fault Trees to Decision Trees for Real Time Fault Detection on International Space Station – 306

Robson, Mark E.
Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women with Hereditary Breast Cancer – 220

Rodriquez, J. A.
Recalculating Linear Array Antennas to Compensate for Failed Elements While Maintaining Fixed Nulls – 102

Rodriquez, J. L.
The Generalized Forward-backward Method for Analyzing the Scattering from Targets on Ocean-like Rough Surfaces – 253

Rogers, B.
Envirocare of Utah: Expanding Waste Acceptance Criteria to Provide Low-Level and Mixed Waste Disposal Options – 187

Rogers, J. R.
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 193

Rogers, Jan
Developing Glassy Magnets from Simulated Composition of Martian Soil for Exploration Applications – 323

Rogers, Jason
Secure Distribution of Open Source Information – 302

Rogers, Shawn D.
The Sleeve-cage Monopole and Sleeve Helix for Wideband Operation – 80

Rogers, W. E.
Evaluations of Global Wind Prediction at Fleet Numerical Meteorology and Oceanography Center: from the Perspective of a Wave Modeler – 197

Rogier, Hendrik
Modelling Complex Structures by Combining the FE, FDTD and BIE Techniques – 253

Rol, E.
Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Romanovsky, A.
Wrapping the Future – 234

Romeu, J.
Self-similar Surface Current Distribution on Fractal Sierpinski Antenna Verified with Infra-red Thermograms – 85

Romeu, Jordi
A Fractal Based FSS with Dual Band Characteristics – 87

Roquemore, A. L.
Deposition Diagnostics for Next-Step Devices – 296

Ross, Daniel C.
Surface Integral Equations for Three Dimensional Surfaces Containing Circuit Analog Sheets – 143

Ross-Witkowski, Corrina
MORS Workshop. Operations Analysis Support to Network Centric Operations. Held in McLean, VA on 27-29 January 2004 – 271

Rotello, Vincent M.
Nanoparticle-Mediated Rescue of p53 Through Targeted Degradation of MDM2 – 215

Rothberg, L. J.
Tunable Optical Polymer Systems – 53

Rothschild, William J.
Shuttle-Derived Launch Vehicles' Capablities: An Overview – 22

Roulet, E.
New Ways to Soft Leptogenesis – 277

Rousseau, Paul R.
Elemental Probes for Planar Near-field Antenna Measurements – 103

Rubin, Ethel
HOXB7: An Oncogenic Gene in Breast Cancer Cells – 217

Rubinos, J. Oscar
Antennas Feasibility Study for a LMDS Communication System – 91

Rucker, W. M.
2D-TE Inverse Medium Scattering: An Improved Variable Metric Method – 265

Rule, K.
Diamond Wire Cutting of the Tokamak Fusion Test Reactor – 295

Russell, Christopher T.
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Russell, Jeff
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

Rustenburg, J. W.
Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

Ruthel, Gordon
Ebola and Marburg Viruses Replicate in Monocyle- Derived Dendritic Cells without Inducing the Production of Cytokines and Full Maturation – 221

Ryan, P. Y. A.
Modelling Opacity using Petri Nets – 236

Ryan, P.
Simplified Version of the Chaum Voting Scheme – 235

Ryan, Robert E.
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

Ryan, T.
Diesel Engine Alternatives – 172

Sabet, Kazem F.
Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Safavi-Nacini, S.
A Simple Theoretical Model for Polarization Diversity Reception in Wireless Mobile Environments – 68

Saglam, Halil D.
Simulation Performance of Multiple-Input Multiple-Output Systems Employing Single-Carrier Modulation and Orthogonal Frequency Division Multiplexing – 279

Saikh, Kamal U.
Comparison of the Protective Efficacy of DNA and Baculovirus-Derived Protein Vaccines for EBOLA Virus in Guinea Pigs – 221

Saito, Kazuyuki
Numerical Analysis of Thin Coaxial Antennas for Microwave Coagulation Therapy – 112

Salama, K.
Materials, Processing and Quality Control for High Performance Coated High Temperature Superconducting Conductors – 139

Saleeb, Adel A.
Design of a Smart Antenna for Reducing Co-Channel Interference in Cellular Mobile Communications – 144

Salikuddin, M.
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Salud, Maria Theresa P.
Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

Sanchez, Manuel Garcia
Measurement of Transmission Coefficients of Radiowaves through Building Materials in the 5.8 GHz Frequency Band – 142

Sanchez-Hernandez, D.
Precise Dielectric Properties Determination of Laminar-shaped Materials in a Partially-filled Waveguide – 146

Sanford, Joseph
Reuse International Space Station (ISS) Modules as Lunar Habitat – 318

Santee, M. L.
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

Sarabandi, Kamal
Compact Reconfigurable HF-UHF Antennas – 136

Effect of Canopy-Air Interface Roughness on HF-VHF Wave Propagation in Forest – 86

Efficient Printed Antenna Array Synthesis Including Coupling Effects Using Evolutionary Genetic Algorithms – 101

Modeling Surface Currents on Electrically Large Impedance Cylinders - 2D, TM Case – 120

Polarimetric Backscatter Characterization of Road Surface Faults at Millimeter-wave Frequencies – 80

Polarimetric Radar Measurements for Vehicle Control and Warning Applications – 305

Propagation of Electromagnetic Waves Near the Surface of a Half-space Dielectric with Rough Interface – 257

Sarabandi, K.
A Novel Design of an Ultra-Fast Wideband Polarimetric Radar – 107

Sargand, S. M.
Evaluation of HPC Pavement in Nelsonville, Ohio – 38

Sarkar, T.
Efficient and Accurate Inclusion of Radomes into Antenna Analysis – 71

Sarver, J.
Boiler Materials for Ultrasupercritical Coal Power Plants. Third Quarterly Report April 1 to June 30, 2004 – 48

Sato, G.
Characteristics of Digital Terrestrial Broadcasting Antennas – 105

Saunders, S. R.
Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna – 205

Saveliev, A. N.
A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

Savtchenko, Andrey
NASA GES DISC DAAC Satellite Data for GIS – 308

Sawaya, Kunio
Measurement of Radiation Efficiency of Antennas in the Vicinity of Human Head Model Proposed By COST 244 – 131

Saylor, Steven
SJFHQ Simulation – 81

Sazonov, Dimitry M.
Computer Aided Design of Holographic Antennas – 242

Scargle, . D.
Long-Lag, Wide-pulse Gamma-Ray Bursts – 312

Schacher, Gordon
SJFHQ Simulation – 81

Schantz, Hans Gregory
Electromagnetic Energy around Hertzian Dipoles – 81

Schaubert, Daniel H.
Scattering by Resistively Loaded, Multilayer Frequency Selective Surfaces over Two-octave Bandwidth – 98

Schauer, J. J.
Gasoline Vehicle Exhaust Particle Sampling Study – 179

Scherer, Axel
Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

Schettino, F.
A New Method to Compute the Fundamental Mode Resonant Frequencies of Microstrip Annular Rings – 121

Schiavon, G.
Improving Satellite Antenna Temperature Estimation by High-resolution Emission Model of the Earth – 92

Schiele, Tom
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Schihl, Peter
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Schittler, M.
State-of-the-Art and Emerging Truck Engine Technologies for Optimized Performance, Emissions and Life Cycle Costs – 172

Schlagheck, R.
The Status of Lunar Simulants: Conclusions and Recommendations from the 2005 Lunar Regolith Simulant Materials Workshop – 322

Schlagheck, Ronald A.
Research Opportunities Supporting the Vision for Space Exploration from the Transformation of the Former Microgravity Materials Science Program – 36

Schmaljohn, Alan
Molecular Mechanisms of Filovirus Cellular Trafficking – 222

Schmieg, S. J.
Dynamometer Evaluation of Plasma-Catalyst for Diesel NOX Reduction – 171

Schneck, Jonathan P.
Development of Artificial Antigen Presenting Cells for Prostate Cancer Immunotherapy – 207

Schneider, Judy
Unraveling the Material Processing Conditions for Optimizing FSW Process – 175

Schoenberg, J. S. H.
Beamforming in Time-Domain Arrays – 106

Schofield, E.
A Viable Scheme for Elemental Extraction and Purification Using In-Situ Planetary Resources – 318

Schuut-Aine, Jose E.
Full Wave Analysis of Transmission Lines via 2D-FDTD and Signal-processing Techniques – 129

Schwab, Robert W.
Assessment of the NASA AvSTAR Project Plan – 1

Schwadron, N. A.
Current Sheet Evolution in the Aftermath of a CME Event – 324

Schwarz, Ernie
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Schweiger, P.
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Scott, J. R.
Validation of a High-Order Prefactored Compact Code on Nonlinear Flows with Complex Geometries – 4

Scripa, R. N.
Electrical Conductivity of HgTe at High Temperatures – 133

Scudder, Jack D.
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Searcy, K.
Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, February 2000 – 180

Enhanced Control of Mercury by Wet Flue Gas Desulfurization Systems-Site 2 Results, June 2000 – 180

Segovia-Vargas, D.
Minimization of Mutual Coupling Effects in Eigenstructure Algorithms Based on Modal Analysis – 94

Sehgal, R.
On-Line Integrated Control System for Reducing Coal Costs and Coal-Related Emissions: Coal Blend Automation System (CBAS) – 187

Seidel, D. B.
Pulsed Power Fusion – 149

Seidel, Jonathan A.
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

Selkainaho, J.
Adaptive Autonomous Navigation of Mobile Robots in Unknown Environments – 238

Selleri, S.
A Time Domain Physical Optics Approach to Passive Intermodulation Scattering Problems – 108

Sen, S.
A Viable Scheme for Elemental Extraction and Purification Using In-Situ Planetary Resources – 318

Glass and Glass-Ceramic Materials from Simulated Composition of Lunar and Martian Soils: Selected Properties and Potential Applications – 58

Sengupta, Dipak L.
Electromagnetic Interference from Wind Turbines – 147

Senick, Paul F.
A Comparative Propulsion System Analysis for the High-Speed Civil Transport – 17

Senior, C.
Oxidation of Mercury Across SCR Catalysts in Coal-Fired Power Plants Burning Low Rank Fuels. Quarterly Progress Report April 1, 2004-June 30, 2004 – 185

Seow, Yoke W.
Survivability Enhancement in a Combat Environment – 9

Sergre, P. N.
The In-Space Soldering Investigation: Research Conducted on the International Space Station in Support of NASA's Exploration Initiative – 133

Sezginer, Apo
Analysis and Design of Magnet and Antenna for NMR Well-logging Tool – 70

Shafai, L.
Microstrip Patches for a Reflectarray – 96

Study of Micromachined Microstrip Lines Using FDTD – 117

Wideband Single Layer Microstrip Array at 28 GHz – 98

ShanJia, Xu
Improved Smokescreen For MM Wave And IR – 116

Shanker, B.
A Fast Time Domain Integral Equation Technique for Analyzing EMC/EMI Problems – 258

Sharma, Shashi K.
Military Aerospace Fluids and Lubricants Workshop Proceedings – 53

Research and Development (R&D) on Advanced Nonstructural Materials. Delivery Order 0001: Study of Hydraulic System Component Storage With Operational and Rust-Inhibited Hydraulic Fluids – 53

Sharp, C. A.
Demonstration of Potential for Selective Catalytic Reduction and Diesel Particulate Filters – 184

Shaw, O.
Applying Petri Nets to Systems Biology using XML Technologies – 237

Shea, S.
On-Line Integrated Control System for Reducing Coal Costs and Coal-Related Emissions: Coal Blend Automation System (CBAS) – 187

Sheffing, C. C.
Practical Gamma Spectroscopy Assay Techniques for Large Volume Low-Level Waste Boxes – 231

Shen, B. C.
Gas System Upgrade for the BaBar IFR Detector at SLAC – 283

Shepard, W. Steve, Jr.
Smart Structures for Vibration Control on Long-Term Space Exploration and Habitation Missions – 323

Shepherd, F. B.
Fundamentals of Combinatorial Optimization and Algorithms Design: December Report – 263

Sheppard, J. C.
Design Studies for Flux and Polarization Measurements of Photons and Positrons for SLAC Proposal E166: An Experiment to Test Polarized Positron Production in the FFTB – 286

Energy Deposition Using EGS4 – 286

Shi, Le-Gen
Channel Simulation of Leo Satellites – 92

Shin, E.
A Simple Theoretical Model for Polarization Diversity Reception in Wireless Mobile Environments – 68

Shin, H.
Low Noise Exhaust Nozzle Technology Development – 2

Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Shingledecker, J.
Boiler Materials for Ultrasupercritical Coal Power Plants. Third Quarterly Report April 1 to June 30, 2004 – 48

Shoki, H.
An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

Short, C.
An Analysis and Design Tool for Evaluation of Integrated Antenna Diversity Systems in Portable Wireless Devices – 90

Shrivastava, S. K.
Distributed Enactment of Composite Web Services – 82

Notations for the Specification and Verification of Composite Web Services – 304

Shrivastava, S.
Component Middleware to Support Nonrepudiable Service Interactions – 82

Monitoring of Contractual Service Level Agreement – 232

Shubair, R. M.
Accurate and Efficient Computation of the Periodic Green's Function in Multilayered Media via a Hybrid Spectral/Spatial Summation with Optimized Complex Images – 146

Shubitidze, P.
The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

Shujaee, Ali
Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment – 69

Shuley, Nicholas V.
Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159

Shumay, Dianne M.
A Longitudinal Study of Emotional Distress and the Use of Complementary and Alternative Medicine in Women with Breast Cancer – 223

Sias, Dave
STS Derived Exploration Launch Operations – 22

Sibata, O.
An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

Sibille, Laurent
Manufacture of Solar Cells on the Moon – 57

Sibille, L.
Present Status of Lunar Regolith Simulants, Workshop Overview and Objectives – 322

The Status of Lunar Simulants: Conclusions and Recommendations from the 2005 Lunar Regolith Simulant Materials Workshop – 322

Siders, J.
STS Derived Exploration Launch Operations – 22

Siemsen, Patrick J.
Development of a Conductive-polymer, Composite, Direction-finding Antenna – 106

Sierra-Perez, M.
Minimization of Mutual Coupling Effects in Eigenstructure Algorithms Based on Modal Analysis – 94

Sietzen, Frank, Jr.
From Mercury to CEV: Space Capsules Reemerge – 31

Sigwarth, John B.
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Silcox, Richard J.
High Speed Research Program Structural Acoustics Multi-Year Summary Report – 290

Silsbee, M. R.
Reaction Mechanisms of Magnesium Silicates with Carbon Dioxide in Microwave Fields – 41

Simons, Jesper
Downlink Propagation Measurements in the GSM 900 and 1800 MHz Bands – 93

Simons, Rainee N.
A Millimeter-wave Cavity-backed Suspended Substrate Stripline Antenna – 99

Simpson, Myles A.
High Speed Research Program Structural Acoustics Multi-Year Summary Report – 290

Sipus, Zvonimir
Analysis of Reflection from Multilayer Cylinder by Using a Black-hole Approach – 315

Sjoeqvist, L.
Retrocommunication – 63

Skinn, D. A.
Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

Skinner, C. H.
Deposition Diagnostics for Next-Step Devices – 296

Skipworth, William
Ion Flux Environments for Exposed Spacecraft Surfaces in Interplanetary Space – 30

Sleeper, Robert K.
Measurements of Flow Turbulence in the NASA Langley Transonic Dynamics Tunnel – 10

Slone, Rodney D.
Matrix Pade Via Lanczos for FEM Problems – 142

Smette, A.
Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Smith, C. D.
Harnessing Technology for Evidence-Based Education and Training in Minimally Invasive Surgery – 219

Smith, David D.
Slow and Fast Light in Coupled Microresonators – 294

Smith, Deedee
Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

Smith, G. A.
The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

Smith, Glenn S.
On the Accuracy of the Transmission Line Theory for the Insulated Linear Antenna – 113

Smith, Laura J.
Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

Smith, T. D.
A Spreadsheet for the Mixing of a Row of Jets With a Confined Crossflow – 16

Smolders, A. B.
A Fast and Accurate Scheme for Calibration of Active Phased-array Antennas – 117

Snell, Edward H.
Macromolecular Crystallization in Microgravity – 57

Snyder, A. M.
Spent Fuel Transportation Package Performance Study Experimental Design Challenges – 56

Snyder, Carl E., Jr.
Military Aerospace Fluids and Lubricants Workshop Proceedings – 53

Snyder Jr, Carl E.
Research and Development (R&D) on Advanced Nonstructural Materials. Delivery Order 0001: Study of Hydraulic System Component Storage With Operational and Rust-Inhibited Hydraulic Fluids – 53

Sol, H.
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Pair Jets – 316

Solberg, Ruell F., Jr.
Development of a Conductive-polymer, Composite, Direction-finding Antenna – 106

Solter, Micah J.
A Prototype Actuator Concept for Membrane Boundary Vibration Control – 176

Song, J. M.
Higher-Order MoM Implementation to Solve Integral Equations – 268

Song, J.
Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control – 188

Song, Jiming
Impedance Calculation of Complex Surfaces-wire Structures with Multilevel Fast Multipole Algorithm and Variational Formulation – 268

Song, P.
Triple-band Planar Inverted F Antenna – 70

Song, Y. M.
A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

Soon, Tan P.
OR Modeling of a Conceptual System of Systems for Maritime Littoral Dominance in 2020 – 272

Sorge, L.
STS Derived Exploration Launch Operations – 22

Soria, Rob
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Southall, H. L.
Experimental Validation of a Neural Network Direction Finder – 142

Spadaccini, Louis J.
Applications of Endothermic Reaction Technology to HSCT and AST – 16

Spann, J. F.
Experiments on Dust Grain Charging – 315

Spann, James F.
Packaging a Successful NASA Mission to Reach a Large Audience with a Small Budget. Earth's Dynamic Space: Solar-Terrestrial Physics and NASA's Polar Mission – 307

Spann, J.
The Utility of Auroral Image-based Activities Metrics – 193

Spanyer, Karen
Learning Lessons from the X-37 Project – 29

Sparrow, Ephraim
Patient Warming Device for Casualty Care – 222

Speck, James S.
Systematic Studies of Carbon Doping in High Quality GaN Grown by Molecular Beam Epitaxy – 136

Speirs, N. A.
From Crash Tolerance to Authenticated Byzantine Tolerance: A Structured Approach, the Cost and Benefits – 82

Sperling, D.
Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB-1493 Rulemarking – 186

Spivey, R.
The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

Srikanth, S.
An Overview of the Green Bank Telescope – 311

Stafford, M. W.
Oak Ridge National Laboratory Radiation Control Program-Partners in Site Restoration – 278

Stanko, G.
Boiler Materials for Ultrasupercritical Coal Power Plants. Third Quarterly Report April 1 to June 30, 2004 – 48

Stanley, Thomas
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

Statham, G.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

Stecker, Floyd W.
Bulk Comptonization of the Cosmic Microwave Background by Extragalactic Jets as a Probe of their Matter Content – 313

Steeghs, Daniel
A Survey of Helium Accreting White Dwarfs – 317

Steel, D.
Hybrid Molecular and Spin-Semiconductor Based Research – 168

Steer, Michael B.
Analysis of Shielded CPW Spatial Power Combiners – 151

Steggles, J.
Applying Petri Nets to Systems Biology using XML Technologies – 237

Steigerwald, J. E.
RACT/BACT/LAER Clearinghouse (RBLC) Clean Air Technology Center Annual Report for 2003 – 186

Steinberg, B. Z.
Error Control in the Reduced Expansion and Field Testing (REFT) Method for MoM Matrix Thinning – 233

Steinhurst, Daniel A.
Spectral-Based Volume Sensor Testbed Algorithm Development, Test Series VS2 – 166

Sterling, Alphonse C.
Slow-rise and Fast-rise Phases of an Erupting Solar Filament and Flare Emission Onset – 325

Sterling, Alphonse
Compact Flares and CMEs – 309

Stern, A.
Results of Aero/Acoustic Tests and Analytical Studies of a Two-Dimensional Eight-Lobe Mixer-Ejector Exhaust Nozzle at Takeoff Conditions – 2

Sternberg, Andrew
Validity of Using a Fixed Analog Input for Evaluating the SEU Sensitivity of a Flash Analog-to-Digital Converter – 140

Stetter, J.
Impact of Oil Consumption Mechanisms on Diesel Exhaust Particle Size Distributions and Detailed Exhaust Chemical Corporation – 173

Stewart, Eric C.
Turbulence Hazard Metric Based on Peak Accelerations for Jetliner Passengers – 8

Steyskal, Hans
Infinite Phased Array Analysis Using FDTD Periodic Boundary Conditions: Pulse Scanning in Oblique Directions – 265

Still, Ivan
Functional Interactions of the TACC2 Breast Tumor Suppressor Gene and Its Relevance to Breast Tumor Progression – 210

Still, Martin
The Optical Counterpart of M101 ULX-1 – 313

Stotler, D. P.
Three-Dimensional Simulation of Gas Conductance Measurement Experiments on Alcator C-Mod – 284

Stout, Margaret C.
The U.S. Navy Submarine Hydrodynamics/ Hydroacoustic Community: A Case Study in Strategic Planning for a Decentralized, Multi-Organizational, Military Community – 288

Strong, Janet D.
Are we There Yet? ... Developing In-Situ Fabrication and Repair (ISFR) Technologies to Explore and Live on the Moon and Mars – 18

In-situ Resource-based Lunar and Martian Habitat Structures Development at NASA/MSFC – 19

Lunar and Martian Sub-surface Habitat Structure Technology Development and Application – 320

Thin Films and Inflatable Applications in Exploration Habitat Structures – 320

Strong, Janet
Reuse International Space Station (ISS) Modules as Lunar Habitat – 318

Strutzenberg, Louise L.
Morphological Evolution of Directional Solidification Interfaces in Microgravity: An Analysis of Model Experiments Performed on the International Space Station – 204

Stubenrauch, Carl F.
Far-field Antenna Patterns Determined from Infrared Holograms – 89

Sturm, James C.
High Frequency Performance of Self-Assembled Monolayer (SAM) Organic FETs – 137

Su, C.-H.
Electrical Conductivity of HgTe at High Temperatures – 133

Su, Min-Ying L.
Anti-Angiogenesis Therapeutic Indicators in Breast Cancer – 211

Subudhi, Andrew W.
Oculomotor and Pupillary Reflexes During Acclimatization to Altitude (4300 m) – 209

Suchail, J.-L.
ESA's Ground Breaking Synthetic Aperture Radar: The ENVISAT-1 ASAR Active Antenna – 100

Sudhoff, Scott D.
Demonstration of Silicon Carbide Power Devices in Practical Power Conversion Systems – 46

Suebdorf, W.
Dismantling of the Upper RPV Components of the Karlsruhe Multi-Purpose Research Reactor (MZFR), Germany – 291

Suess, S. T.
A Detection of the Same Hot Plasma in the Corona: During a CME and Later at Ulysses – 192

Current Sheet Evolution in the Aftermath of a CME Event – 324

Sugg, Sonia L.
Use of a Transgenic Mouse Model With a Regulatable Estrogen Receptor Alpha (ER) to Study the Role of ER in Mammary Gland Development and Cancer – 206

Sukumar, Saraswati
HOXB7: An Oncogenic Gene in Breast Cancer Cells – 217

Imaging the Vascular and Metabolic Impact on Claudin-7, a Tight Junction Protein, in Transgenic Human Breast Cancer Models – 206

Sullivan, Dennis M.
Three Dimensional Optical Fiber Simulation – 117

Sullivan, Jon L.
Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements – 156

Sumanen, L.
Pipeline Analog-to-Digital Converters for Wide-Band Wireless Communications – 140

Sumihiro, S.
Characteristics of Digital Terrestrial Broadcasting Antennas – 105

Sun, L. Q.
Distributed Aperture Design for Low Profile Earth Station Antennas – 101

Surmacz, Eva
Obesity and Postmenopausal Breast Cancer: Leptin-Estrogen Cross-Talk – 214

Susukida, Y.
3D Super Resolution Algorithm for Analysis of Multi-path Propagation Structure – 148

Sutter, C.
Disposal of True Waste from the Plutonium Finishing Plant in Pipe Overpack Containers to WIPP Including New Security Requirements – 187

Suvannapattana, P.
Effects of the Human Head on the Radiation Pattern Performance of the Quadrifilar Helix Antenna – 205

Suzuki, Y.
An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

Swadley, S. D.
The Impact of AMSU-A Radiance Assimilation in the U.S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) – 23

Swall, J.
Developing Spatially Interpolated Surfaces and Estimating Uncertainty – 182

Swanson, E.
An Analysis and Design Tool for Evaluation of Integrated Antenna Diversity Systems in Portable Wireless Devices – 90

Swider-Lyons, Karen S.
Proceedings of the Workshop on Power Sources for Distributed Autonomous Systems – 137

Sze, Jia-Yi
Designs of Broadband Microstrip Antennas with Embedded Slots – 126

Sze, K. Y.
Microstrip Patches for a Reflectarray – 96

Szofran, Frank
Research Opportunities Supporting the Vision for Space Exploration from the Transformation of the Former Microgravity Materials Science Program – 36

Szybist, J.
Fuel Formulation Effects on Diesel Fuel Injection, Combustion, Emissions, and Emission Control – 188

Tabbert, Chuck
Hierarchical CAD Tools for Radiation Hardened Mixed Signal Electronic Circuits – 135

Tacina, Robert R.
Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Taflove, Allen
FDTD Computed Numerical Diffraction Coefficients of 3-D Infinite Material Wedges – 265

Three-Dimensional FDTD Analysis of an Ultrawideband Antenna-array Element for Confocal Microwave Imaging of Nonpalpable Breast Tumors – 158

Tai, Hsiang
Shape Sensing a Morphed Wing with an Optical Fiber Bragg Grating – 16

Takacs, Thomas P.
UV Baked/Cured Photoresist Used as a Sacrificial Layer in MEMS Fabrication – 280

Takahashi, Toru
Super Lightweight Planar Array Antenna with Stretched Structure for Satellite Communication Systems – 91

Takano, Tadashi
Large Deployable Antennas: Concepts and Realization – 104

Takatori, Yasushi
A New Calibration Method of Adaptive Array for TDD Systems – 74

Takeda, E.
Characteristics of 60GHz Band Conical Beam Radial Line Slot Antennas – 91

Tamir, Theodor
Scattering by Multilayered Periodic Structures Containing Asymmetric Dielectric and Metallic Components – 153

Tamisiea, M. E.
Climate-Driven Deformation of the Solid Earth from GRACE and GPS – 196

Tamisiea, M.
Regional Deformation Studies with GRACE and GPS – 253

Tan, Nicholas
Limited Evaluation of Automated Aerial Refueling Algorithm (Project Self Serve) – 7

Tan, Peng S.
Using Agent-Based Modeling to Assess the Impact of Martial Law on a Representative Iraqi Town – 244

Tananbaum, Harvey
The Chandra X-Ray Observatory: The Past, the Present, and the Future – 314

Tang, W. H.
Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics – 291

Tankosic, D.
Experiments on Dust Grain Charging – 315

Tantawi, S.
Low Field Accelertor Structure Couplers and Design Techniques – 284

Taraza, Dinu
Adaptation of Advanced Diesel Engines for Military Requirements Under Severe Environmental Conditions – 61

Tasdemir, John
Determination of Laminar Flame Speed of Diesel Fuel for Use in a Turbulent Flame Spread Premixed Combustion Model – 160

Tasic, M.
Efficient and Accurate Inclusion of Radomes into Antenna Analysis – 71

Tawada, M.
Beam-beam Simulation Studies for PEP-II and KEKB – 284

Tay, Chee B.
An Architecture for Network Centric Operations in Unconventional Crisis: Lessons Learnt from Singapore's SARS Experience – 303

Taylor, Clayborne D.
Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

Taylor, G. B.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Taylor, Travis
A Strategic Roadmap to Centauri – 19

Teas, Jane
Do the Effects of Exercise on Breast Cancer Prevention Vary With Environment – 213

Tecuci, Gheorghe
Collaborative Assistant for Rapid Knowledge Formation and Reasoning – 303

Tehrani, Hooman
A Multi-frequency Microstrip-fed Shorted Square Ring Slot Line Antenna – 71

Teixejra, F. L.
Cylindrical 3D PML-PLRC-FDTD Schemes for Frequency-dispersive and Inhomogeneous Media – 118

Tellez, Galdino M.
Infrared Characterization of SiN Films on Si for High Speed Electronics Applications – 43

Tender, Leonard M.
Proceedings of the Workshop on Power Sources for Distributed Autonomous Systems – 137

Teng, William
NASA GES DISC DAAC Satellite Data for GIS – 308

Terret, C.
Antenna Beam Forming Using Active Metallic Photonic Band-gap Materials – 132

Mixed Metallic Photonic Band-gap Material and Bragg Mirror – 298

Terzuoli, Andrew J., Jr.
Bistatic Scattering Characterization of a Complex Object – 87

Testov, S.
Regulatory Approaches for Solid Radioactive Waste Storage in Russia – 181

Texixeira, F. L.
A Topological Viewpoint on Consistency Aspects of Electromagnetic Theory on a Lattice – 131

Thacher, E. F.
Thermoelectrical Energy Recovery from the Exhaust of a Light Truck – 173

Theilacker, J. C.
Oxygen Monitoring Cells at FERMILAB – 276

Thiagalingam, Sam
Metastatic Progression of Breast Cancer by Allelic Loss on Chromosome 18q21 – 223

Thierfeldt, S.
Release of Residues from Melting Norm-Contaminated Steel Scrap. A German Approach – 50

Thom, Robert L.
Nondestructive Evaluation of Space Shuttle External Tank Foam – 28

Thomas, D. W. P.
Time-Domain Modelling of Propagation in Nonlinear Dielectrics Using TLM – 258

Thomas, Edwin L.
Bio-Derived Photonic Assemblies – 45

Thomas, Kimberly J.
Analyses of Elemental Partitioning in Advanced Nickel-Base Superalloy Single Crystals – 14

Thomas, N.
Challenges and Opportunities in Grid Performability – 235

Thompson, G. T.
Low-power Low-profile Multifunction Helmet-mounted Smart Array Antenna – 107

Thomson, Mark W.
The AstroMesh Deployable Reflector – 154

Thong, Lee K.
Performance Analysis of Mobile Ad Hoc Networking Routing Protocols – 261

Tice, Jeffrey A.
Soy and Tamoxifen for Breast Cancer Prevention in High Risk Pre-Menopausal Women – 210

Tillery, J. K.
Low-power Low-profile Multifunction Helmet-mounted Smart Array Antenna – 107

Tinker, Michael L.
Preliminary Design of a Manned Nuclear Electric Propulsion Vehicle Using Genetic Algorithms – 34

Tiong, Yeo Hwee
High Responsivity Tunable Step Quantum Well Infrared Photodetector – 165

Tipps, D. O.
Statistical Data for the Boeing-747-400 Aircraft in Commercial Operations – 10

Titarenko. L. A.
A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

Tlsty, Thea D.
Modification of Epigenetic Changes in Cancer by the Stromal Environment – 228

Tolson, Robert
A Program of Research and Education in Astronautics – 21

Toney, M. F.
Relationship of Magnetocrystalline Anisotropy and Stoichiometry in Epitaxial L1(sup 0) CoPt(001) and FePT (001) Thin Films – 297

Topsakal, E.
Surface Integral Equations for Three Dimensional Surfaces Containing Circuit Analog Sheets – 143

Tornai, Martin P.
Development and Characterization of Novel Olumetric Acquisition Orbits With an Application Specific Emission Tomograph for Improved Breast Cancer Detection – 215

Torres, I.
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

Torres, R.
ESA's Ground Breaking Synthetic Aperture Radar: The ENVISAT-1 ASAR Active Antenna – 100

Toutanji, Houssam
Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Towner, Robert
Evaluation of Thermal Protection Tile Transmissibility for Ground Vibration Test – 18

Townsend, J.
Modal Survey of ETM-3, A 5-Segment Derivative of the Space Shuttle Solid Rocket Booster – 34

Trabelsi, Samir
Density- and Structure-independent Calibration Method for Microwave Moisture Determination in Granular Materials – 157

Trausch, Ann
A Strategic Roadmap to Centauri – 19

Trenchard, Michael E.
Moving-Map Composers System Version 3.4P Acceptance Test Procedures Developed for the Finnish Air Force Modification for FIAF MMC System Without DMUI/DMU – 177

Trentesaux, C.
Differences and Similarities in Andra's Assessment of Activities Carried Out by Radioactive Waste Generators and Affecting the Quality of IL-LL Short-Lived Waste Packages and HL-IL Long-Lived Waste Packages – 187

Trevino, Luis C.
IVHM Framework for Intelligent Integration for Vehicle Health Management – 250

Trinh, Huu P.
Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup – 158

Trinh, Huu
Modeling of Turbulence Effects on Liquid Jet Atomization and Breakup – 161

Trivedi, R. K.
Morphological Evolution of Directional Solidification Interfaces in Microgravity: An Analysis of Model Experiments Performed on the International Space Station – 204

Tropeano, Anne
Estimating Supplies Program: Evaluation Report – 245

Tsai, Shang-Yuan
Device Profiling Analysis in Device-Aware Network – 249

Tsang, S. H.
Advance Path Measurement for Automotive Radar – 102

Tseng, Wen-Jen
Analysis and Design of a Planar Two-Dimensional Retrodirective Array Reflector – 86

Tsiboukis, T. D.
An Enhanced Higher-Order FDTD Technique for the Construction of Efficient Reflectionless PMLs in 3-D Generalized Curvilinear Coordinate Systems – 274

Tsujihata, Akio
The 13 m Aperture Space Antenna Reflectors for Engineering Test Satellite VIII – 104

Tsurumi, H.
An Adaptive Array for High Speed Wireless Local Loops Steered by Local Signal Phase Shifters – 72

Tucker, Dennis
Lunar Contour Crafting: A Novel Technique for ISRU-Based Habitat Development – 21

Tucker, Steven P.
A Bipolar Electrode for Use in a Semi Fuel Cell – 139

Tungkahotara, Siroj
Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

Turentine, T.
Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB-1493 Rulemarking – 186

Turnbaugh, Eugene D.
Geographically Locating an Internet Node Using Network Latency Measurement – 242

Turner, Susan
Learning Lessons from the X-37 Project – 29

Tyan, Rong-Chung
Modeling of Gaussian Beam Diffraction from a Thick Single-slit Perfectly Conducting Screen: Finite-Difference Time-Domain Method Versus Rigorous Theory – 269

Tyo, J. S.
Beamforming in Time-Domain Arrays – 106

Tyson, Daniel S.
Diels-Alder Trapping of Photochemically Generated Dienes with Acrylic Esters: A Novel Approach to Photocured Polymer Film Development – 47

Uber, J.
Design Concepts for the Radarsat-2 SAR Antenna – 88

Uckun, Savas
On the Incompatibility of Chirality Parameter Alpha and Chirality Admittance xi of Chiral Media – 155

Ulaby, F. T.
A Novel Design of an Ultra-Fast Wideband Polarimetric Radar – 107

Ulrey, Michael L.
Assessment of the NASA AvSTAR Project Plan – 1

Underwood, Craig
The Evaluation of Un-Cooled Detectors for Low-Cost Thermal-IR Earth Observation at the Surrey Space Center – 24

Unger, Ronald J.
Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative – 34

Uzunoglu, N. K.
The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

Uzunoglu, Nikolaos K.
Radiation Properties of Two Cylindrical Conformal Arrays Isolated by a Space Filter – 59

Vahldieck, Rudiger
A Combined Mode-matching and Coupled-integral-equations Technique for the Design of Narrow-band H-plane Waveguide Diplexers – 256

Vainikainen, Pertti
An Efficient Technique for Modelling Wideband Propagation in an Urban Parallel Street Microcellular Environment – 305

Valentine, Peter G.
Lightweight Nonmetallic Thermal Protection Materials Technology – 51

Vall-llossera, M.
Reduction of the Model Noise in Nonlinear Reconstruction via an Efficient Calculation of the Incident Field: Application to a 434 MHz Scanner – 125

Valsecchi, G.
Nickel Sandwich Technology for High Precision Reflector Antennas – 97

Van Alstine, R.
Demonstration and Validation of the Excited Dielectric Test (Trade Name) Method to Detect and Locate Defects in Aircraft Wiring Systems – 141

VAN DE Pol, Corina
Preliminary Evaluation of Visual and Flight Performance of Three Current Multifocal Contact Lens Designs for Presbyopic US Army Aviators – 166

vandenBerg, P. M.
Nonlinear Inversion in Three-dimensional Cross-well Induction Logging using Full-Vectorial Multi-Frequency Data – 148

vandenBerg, Peter M.
A Conjugate Gradient FFT Method for Transient Scattering by Dielectric Cylinders – 259

VandenBerghe, S.
Efficient FDTD S-parameter Calculation of Microwave Structures with TEM Ports – 130

vandenEikhoff, J.
Implementation of Gas Bubble Loading in 2DCAV – 61

vanderMeulen, Marjolein C. H.
Do Integrins Mediate the Skeletal Response to Altered Loading? – 230

VanDyke, Melissa
Hardware Progress Made in the Early Flight Fission Test Facilities (EFF-TF) To Support Near-Term Space Fission Systems – 29

VanLaningham, Sam
Testing Spatial Correlation of Subduction Interplate Coupling and Forearc Morpho-Tectonics – 194

van'tKlooster, Kees
Nickel Sandwich Technology for High Precision Reflector Antennas – 97

Varsta, M.
Self-Organizing Maps in Sequence Processing – 238

Vassallo, Juan
Large 2-D Thinned Array for the Microwave Imaging Radiometer with Synthetic Aperture (MIRAS) – 100

Vassilaras, Plousia
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Vatsa, V. N.
Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics – 291

Vaughan, Ronand
Atmospheric Correction of High-Spatial-Resolution Commercial Satellite Imagery Products Using MODIS Atmospheric Products – 177

Vaughan, W. C.
Compilation of Data Sources Used to Construct Bottom-Sediment Province Maps for the USA East Coast Continental Shelf from Cape Kennedy to Cape Hatteras and for Various Indonesian Waters – 176

Vaughan, William W.
Atmospheric/Space Environment Support Lessons Learned Regarding Aerospace Vehicle Design and Operations – 28

Engineering Lessons Learned and Systems Engineering Applications – 59

Vazquez, J.
Design of Coplanar Integrated Sub MMAW Receivers by Using FDTD Lumped Element Method – 60

Vazquez, Sixto L.
Comparison of Fiber Optic Strain Demodulation Implementations – 168

Vecchi, G.
Full-wave Spectral Cavity Mode Analysis of Line-fed Annular Patch Antennas – 112

Venskauskas, E. K.
A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

Venskauskas, Eduard
Interference Cancellation Systems for Electromagnetically Dense Platforms – 148

Venskauskas, K. K.
A Method of Adaptive Antenna Array Design for Coherent Signal and Interferences – 144

Venskauskas, Kostas
Interference Cancellation Systems for Electromagnetically Dense Platforms – 148

Verolino, L.
A New Method to Compute the Fundamental Mode Resonant Frequencies of Microstrip Annular Rings – 121

Vescovo, Roberto
Null Control for Linear Arrays by Phase-only or Amplitude-only Modification of the Excitations – 85

Vickers, Eugene L.
Evaluation of the Lewisite Protection Provided by the Oquirrh Mountain Facility (OMF) Process Filter – 43

Vidal, A.
A New Hybrid Mode-matching Method for the Analysis of Inductive Obstacles and Discontinuities – 257

Viswanathan, R.
Boiler Materials for Ultrasupercritical Coal Power Plants. Third Quarterly Report April 1 to June 30, 2004 – 48

Voersmann, Peter
MAV State-of-the-Art and Technology Drivers – 11

Volakis, J. L.
Surface Integral Equations for Three Dimensional Surfaces Containing Circuit Analog Sheets – 143

Volakis, John L.
Fast Spectral Domain Algorithm for Hybrid Finite Element/Boundary Integral Modeling of Infinite Periodic Arrays – 260

Optimization of Patch Antennas on Ferrite Substrate Using the Finite Element Methods – 127

Vollset, E.
Design and Evaluation of an Efficient Reliable Manycast Protocol for Ad-hoc Networks – 83

Volz, M. P.
Reproducible Crystal Growth Experiments in Microgravity Science Glovebox at the International Space Station (SUBSA Investigation) – 57

The Pore Formation and Mobility Investigation: A Case Study for Conducting Research on the International Space Station in Support of Exploration – 306

Vreeswijk, P. M.
Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Vu, T. B.
Computer Simulated and Analytical Results of MSE in Adaptive Integrated Reduced-complexity Receiver for Multipath DS/CDMA Systems – 73

Vyazovkin, Sergey
A Method of Monitoring Explosive Under Cyclic Mechanical Stress – 54

Wagner, William J.
Seismic Study of the Solar Interior: Inferences from SOI/MDI Observations During Solar Activity – 325

Wait, James R.
A Viable Model for Power Focussing in a Lossy Cylinder – 142

Waite, Hunter, Jr.
Aurora and Non-Auroral X-ray Emissions from Jupiter: A Comparative View – 321

Waits, David A.
Auxiliary Propulsion Activities in Support of NASA's Exploration Initiative – 34

Wake, D. D.
Numerical Solution of Plasma Fluid Equations Using Locally Refined Grids – 294

Wakelin, A.
An Evaluation of Total Flooding High Expansion Foam Fire Suppression Systems for Machinery Space Applications – 38

Walker, James L.
Nondestructive Evaluation of Space Shuttle External Tank Foam – 28

Walsh, Brandon J.
Microhematuria Associated With a Special Operations Craft Mission – 225

Walton, T. L.
Remote System Technologies for Deactivating Hanford Hot Cells – 141

Walton, William A., III
Selective Targeting: Developing a Space Time Array to Increase the Peak Power Delivered to a Localized Region in Space – 116

Wampler, W. R.
Deposition Diagnostics for Next-Step Devices – 296

Wan, Shan-Hu
Performance Improvement of Estimation Direction-of-arrival via Array Geometry Arrangement – 86

Wang, David
Evaluations of Global Wind Prediction at Fleet Numerical Meteorology and Oceanography Center: from the Perspective of a Wave Modeler – 197

Wang, Gang
Causality and Restrictions on the Initial-Boundary Conditions for Signal Propagation in Attenuating Medium – 147

Wang, Hai
Development of a Comprehensive and Predictive Reaction Mechanism of Liquid Hydrocarbon Fuel Combustion – 45

Wang, J. J. H.
Low-power Low-profile Multifunction Helmet-mounted Smart Array Antenna – 107

Wang, J.
A Diagonal Translation Operator for the Fast Evaluation of Two-dimensional Transient Wave Fields – 260

Wang, Jiang-Guo
Acceleration of Two-dimensional Time Domain Integral Equation Solvers Using a Hilbert Transform – 261

Wang, Jian-Guo
A 2.5-D PSTD Algorithm in Cylindrical Coordinates – 259

Wang, K.
Gas System Upgrade for the BaBar IFR Detector at SLAC – 283

Wang, Q.
Large Engine Technology Program. Task 22: Variable Geometry Concepts for Rich-Quench-Lean Combustors – 14

Wang, Ten-See
Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

Wang, Wenbing
Causality and Restrictions on the Initial-Boundary Conditions for Signal Propagation in Attenuating Medium – 147

Wang, Yong-Liang
Performance Improvement of Estimation Direction-of-arrival via Array Geometry Arrangement – 86

Wang, Yung-Yi
Improved Wavelet-Based Beamformers with Dynamic Subband Selection – 256

Ward, E. J.
Supersonic Through-Flow Fan Engines for a Mach 2.4 Transport – 15

Warne, L. K.
Reflections on the Electric Dyadic Green's Function, Its Singularity, and the Potential Method – 144

Warren, Lewis
Uncertainties in the Analytic Hierarchy Process – 272

Waterhouse, R. B.
Design of Large Broadband Patch Arrays – 123

Waters, Deborah L.
Atomic Oxygen Treatment and Its Effect on a Variety of Artist's Media – 38

Waters, J. W.
EOS Microwave Limb Sounder Observations of the Antarctic Polar Vortex Breakup in 2004 – 177

Watkins, Jessica L.
Moving-Map Composers System Version 3.4P Acceptance Test Procedures Developed for the Finnish Air Force Modification for FIAF MMC System Without DMUI/DMU – 177

Watkins, R. J.
The Adaptive Control of Optical Beam Jitter – 170

Watson, Curtis W.
The Reliability and Validity of the Outcome Rating Scale: A Replication Study of a Brief Clinical Measure – 214

Watson, D. W.
X-Ray Calibration Facility/Advanced Video Guidance Sensor Test – 32

Watson, Michael D.
IVHM Framework for Intelligent Integration for Vehicle Health Management – 250

Watson, P.
Using Web Services to Build Grid Applications-The No Risk WSGAF Profile – 235

Watson, W. R.
Algorithms and Application of Sparse Matrix Assembly and Equation Solvers for Aeroacoustics – 291

Watson, Willie R.
Parallel Domain Decomposition Formulation and Software for Large-Scale Sparse Symmetrical/Unsymmetrical Aeroacoustic Applications – 239

Parallel Finite Element Domain Decomposition for Structural/Acoustic Analysis – 290

Watts, Ed
Simulated Space Environment Effects on Tether Materials with Protective Coatings – 37

Watts, W. F.
Gasoline Vehicle Exhaust Particle Sampling Study – 179

Webber, J.
Assessing the Risk and Valie of Adopting Emerging and Unstable Web Services Specifications – 234

Using Web Services to Build Grid Applications-The No Risk WSGAF Profile – 235

Wee, Oh K.
Wireless Network Security: Design Considerations for an Enterprise Network – 81

Weger, H.
Demonstration and Evaluation of Potential High Level Waste Melter Decontamination Technologies for Savannah River Site – 185

Wei, Hong
A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78

Wei, P. S. P.
Wideband Radar Echoes from Cylindrical Rods – 74

Wei, Yih-Feng
Numerical Computation on Radiation Characteristics of Square Loop Antennas at the Wrist Position of a Human Body in Personal Wireless Communications – 116

Weidemann, A.
Ocean Color Satellite Derived Products in Support of Diver and Special Forces Operations During OPERATION IRAQI FREEDOM – 264

Weiland, Kenneth E.
Neural Network for Image-to-Image Control of Optical Tweezers – 169

Weile, D. S.
Rational Krylov Reduced Order Modeling of Frequency Selective Surfaces Through the Blazing Onset Using Woodbury Singularity Extraction – 265

Weingarten, Norman
Flight and Aerospace Research: Airborne Simulation and Research Investigations, 1999 - 2004 – 11

Weischedel, Ralph
Extracting Dynamic Evidence Networks – 251

Weisskopf, M. C.
Five Years of Observations with the Chandra X-Ray Observatory – 310

Weisskopf, Martin C.
Observations of Compact X-Ray Binaries with Chandra – 315

The Chandra X-Ray Observatory: The Past, the Present, and the Future – 314

Welch, Lonnie
An Optimization Framework for Dynamic, Distributed Real-Time Systems – 299

Weller, T.
FDTD Modeling of Ceramic Multi-layer Capacitors Using Lumped Equivalent Models – 253

Werner, D. H.
Efficient MoM Analysis of Polarization Selective Surfaces Using Trefoil Knot Arrays – 293

Werner, H.
FDTD Modeling of an Artificially-synthesized Absorbing Medium – 155

Werner, J.
Representation of Absolute Electric Fieldstrength by Superposition of Radiated and Guided Waves – 111

West, E. A.
Experiments on Dust Grain Charging – 315

West, Jerry
Mathematical Model of Generalized Radiation Patterns of Point-to-point and Point-to-multipoint Fixed Service Antennas for Use in Statistical Interference Assessment – 69

Westphal, Richard J.
Discourse Analysis of Navy Leaders' Attitudes About Mental Health Problems – 207

Wetherhold, Robert C.
Fracture Toughness Improvement of Composites Reinforced with Optimally Shaped Short Ductile Fibers – 40

Whaley, K. B.
Microscopic Analysis of Spin Coherences in Semiconductor Nanostructures – 297

Wheater, S. M.
Distributed Enactment of Composite Web Services – 82

Notations for the Specification and Verification of Composite Web Services – 304

Whitaker, Ann F.
Materials Requirements for Advanced Propulsion Systems – 35

White, A. G.
Experimental Implementation of Efficient Linear Optics Quantum Computation – 138

White, S.
Survey of Technologies Relevant to Defense From Near-Earth Objects – 28

White, W. B.
Reaction Mechanisms of Magnesium Silicates with Carbon Dioxide in Microwave Fields – 41

White, William G.
Appropriate Treatment of Head Injuries by Surgeons During the Civil War – 213

Whitehouse, Chris A.
Vaccines and Animal Models for Arboviral Encephalitides – 222

Whites, Keith W.
Static Permittivity of a Multiphase System of Spheres – 274

Wicks, Michael
Knowledge-Based Generalized Likelihood Ratio Test (KB-GLRT): Exploiting Knowledge of the Clutter Ridge in Airborne Radar – 167

Wiesbeck, W.
Conformal Aperture Coupled Microstrip Phased Array on a Cylindrical Surface – 66

Wiesman, Carol D.
Measurements of Flow Turbulence in the NASA Langley Transonic Dynamics Tunnel – 10

Wijers, R. A. M. J.
An Expanding Radio Nebula Produced by a Giant Flare from the Magnetar SGR 1806-20 – 310

Low-resolution VLT Spectroscopy of GRBs 991216, 011211, 021211 and 030328 – 308

Wilcox, William R.
Residual Gas Effects on Detached Solidification in Microgravity – 297

Wilhelm, Gary L.
Analyzing and Sharing Data for Surface Combat Weapons Systems – 246

Wilkes, Jennifer A.
Development of a Pulsed Combustion Actuator For High-Speed Flow Control – 163

Will, John E.
Far-field Antenna Patterns Determined from Infrared Holograms – 89

Williams, Jeffery T.
An Annular-Ring Reduced Surface Wave Microstrip Antenna – 114

Mutual Coupling Between Shorted Annular Ring-Reduced Surface Wave Antennas – 122

Reduction of the Excitation of Surface and Lateral Waves by Microstrip Patch Antennas – 150

Williams, Reuben A.
Third Generation Wireless Phone Threat Assessment for Aircraft Communication and Navigation Radios – 141

Williams, Robert
Asymmetric Base-Bleed Effect on Aerospike Plume-Induced Base-Heating Environment During Power-Pack Out – 161

Wills, M. T.
Correlation Between Solids Content and Hiding as it Relates to Calculation of VOC Content in Architectural Coatings – 55

Wilson, Colleen A.
Using the EXIST Active Shields for Earth Occultation Observations of X-Ray Sources – 309

Wilson, J. R.
Quiet Plan for Tomorrow's Jet Engines – 17

Wiltse, James C.
History and Evolution of Fresnel Zone Plate Antennas For Microwaves and Millimeter Waves – 119

Winter, J. Blake
Low Distortion Positioning Equipment for Mobile Antenna Pattern Measurements – 156

Winterbottom, Marc D.
An Integrated Procedure for Measuring the Spatial and Temporal Resolution of Visual Displays – 138

Wipat, A.
Applying Petri Nets to Systems Biology using XML Technologies – 237

Wittmann, Paul
Evaluations of Global Wind Prediction at Fleet Numerical Meteorology and Oceanography Center: from the Perspective of a Wave Modeler – 197

Wittmers, Nicole K.
Direct-Connect Performance Evaluation of a Valveless Pulse Detonation Engine – 298

Witton, J. J.
Porous Media Combustors for Clean Gas Turbine Engines – 42

Wlodarczyk, W.
Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

Woerlen, S.
Release of Residues from Melting Norm-Contaminated Steel Scrap. A German Approach – 50

Wojcik, Jacek J.
Advancement of Methodology for RF Dosimetry – 126

Wolf, E.
Linear Inverse Problems in Wave Motion: Non-self-adjoint Integral Equations of the First Kind – 273

Wong, Kin-Lu
Compact Dual-frequency Operation of Rectangular Microstrip Antennas – 96

Designs of Broadband Microstrip Antennas with Embedded Slots – 126

Wood, L. T.
Premonitory Martensitic Surface Relief via Novel X-Ray Diffuse and Laser Light Reflectivity from the (001)-Surface of a Ni(63)AL(37) Single Crystal – 48

Woodman, S. J.
Distributed Enactment of Composite Web Services – 82

Notations for the Specification and Verification of Composite Web Services – 304

Woods, M.
Design Studies for Flux and Polarization Measurements of Photons and Positrons for SLAC Proposal E166: An Experiment to Test Polarized Positron Production in the FFTB – 286

Woodward, C.
Ab-Initio Simulation of a/2\h110\g Screw Dislocations Gamma-TiAl – 49

Wrbanek, Susan Y.
Neural Network for Image-to-Image Control of Optical Tweezers – 169

Wu, Ke
A Novel Sleeve Monopole with Broad Bandwidth – 74

Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section – 118

Wu, Thomas X.
Chaotic Wave Scattering and Synchronization – 75

Wunsch, Gregory J.
Scattering by Resistively Loaded, Multilayer Frequency Selective Surfaces over Two-octave Bandwidth – 98

Wurmser, Daniel
Stochastic Cross-Sections Based on the Small Slope Approximation: Theory – 269

Wust, P.
Systematic Design of Antennas for Cylindrical 3D Phased Array Hyperthermia Applicator – 125

Xiao, X.
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Numbers – 162

Xiaowei, Zhu
A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78

Xiaoxing, Yin
A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78

Xinyu, Zai
A Fast Algorithm Based on MEI and FMM for Field Prediction in Urban Mobile Communications – 78

Xiqin, Wang
Application of Conjugate Gradient Algorithm to Adaptive Beamforming – 255

Xu, S. J.
Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section – 118

Xu, Shan-Jia
Experiment Research On MM Wavelength Radar Absorbing Materials – 155

Yablonovitch, Eli
Microstrip Line Fed Slot Antenna with PBG Superstrate – 89

Yakovlev, Alexander B.
Analysis of Shielded CPW Spatial Power Combiners – 151

Yamamoto, Manabu
A Resonant Type Leaky-Wave Antenna Using an Image NRD Guide – 122

Yamamoto, Tetsuya
Near Field Distributions in Radial Line Slot Antennas for Surface Wave Coupled Plasma Generation – 125

Yamauchi, Junji
Theoretical and Experimental Investigations on Focusing Properties of the Fresnel Zone Lens and Plate – 294

Yang, C. H.
A Novel InAs Quantum Wire System – 139

Yang, Chieh
Multi-state Markov Model for Satellite Propagation Channels – 92

Yang, F. R.
PBG-Assisted Gain Enhancement of Patch Antennas on High-dielectric Constant Substrate – 109

Yang, Kai-Ping
Compact Dual-frequency Operation of Rectangular Microstrip Antennas – 96

Yang, Kehu
Performance Estimation of Space-Time Adaptive Processing via Subband Processing in Mobile Communications – 69

Yang, M. J.
A Novel InAs Quantum Wire System – 139

Yap, D.
Photonic Analog-to-Digital Conversion Technology – 133

Yariv, Amnon
Monolithic Waveguide Geometry for Voltage Controlled Switching and Routing of Optical Beams Based on Waveguide-Resonator Coupling – 134

Yau, Desmond
Moment Method Analysis of an Aperture Coupled Rectangular Dielectric Resonator Antenna – 159

Yeh, M.
Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs) – 231

Yemelyanov, K. M.
Numerical Calculation of the Volterra Integral Equation for a Time-varying Medium – 109

Yilmaz, Ali E.
Fast Computation of Scattering from (Near-)Resonant Structures – 233

Yin, Lei
Domain Decomposition Method: A Direct Solution of Maxwell Equations – 258

Yingning, Peng
Application of Conjugate Gradient Algorithm to Adaptive Beamforming – 255

Yoda, Minami
Novel Optical Diagnostic Techniques for Studying Particle Contact and Deposition Upon a Large Cylinder in a Sheared Suspension – 163

Yoneyama, T.
Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section – 118

Yong, Siow Y.
Radar Polarimetry – 165

Yore, Michelle M.
Motor Vehicle Fatalities among Men in the U.S. Army from 1980-1997 – 270

York, R.
Lattices. Subgroup Summary Report – 275

Yoshimura, Hiroyuki
Numerical Analysis of Thin Coaxial Antennas for Microwave Coagulation Therapy – 112

Yoshioka, Hiroki
Measurement of Radiation Efficiency of Antennas in the Vicinity of Human Head Model Proposed By COST 244 – 131

Young, Howard A.
Pathogenesis of Ebola Hemorrhagic Fever in Cynomolgus Macaques – 224

Yu, Q. S.
Extension and Validation of the Equivalent Sources Helical Antenna Modeling with the FDTD Code – 130

Yu, Wen-Hua
FDTD Modeling of an Artificially-synthesized Absorbing Medium – 155

Yu, Z.
B0 --\g K+ pi- pi0 Dalitz Plot Analysis – 287

Yuan, Xiaobin
Modeling and Characterization of Dielectric-Charging Effects in RF MEMS capacitive Switches – 280

Yumiceva, F.
D+ --\g K-K+pi+ Meson Decays: A Search for CP Violation and a Measurement of the Branching Ratio – 285

Yung, Tae-Yeoul
A Multi-frequency Microstrip-fed Shorted Square Ring Slot Line Antenna – 71

Yung, Yuk L.
A Mechanism For Solar Forcing of Climate: Did the Maunder Minimum Cause the Little Ice Age? – 203

Zaghioul, A. I.
Distributed Aperture Design for Low Profile Earth Station Antennas – 101

Zagriadski, S. V.
Beamforming by Magnetostatic Wave Microstrip Antennas – 98

Zaridze, R.
The Method of Auxiliary Sources in Solving Cylindrical Shaped Conformal Antennas – 123

Zarling, D.
Gasoline Vehicle Exhaust Particle Sampling Study – 179

Zec, Josko
On-orbit Calibration of the Seawinds Scatterometer Antennas – 192

Zeh, A.
Probing a Gamma-Ray Burst Progenitor at a Redshift of z = 2: A Comprehensive Observing Campaign Campaign of the Afterglow of GRB 030226 – 309

Zeng, X. Y.
Analysis of Leaky Characteristics for NRD Guide with Arbitrary Profile of Cross-Section – 118

Zewail, Ahmed H.
Femtosecond Real-Time Probing of Energetic Reactions: Complex Organics and Advanced Techniques – 291

Zhang, Guo-Hui
Crosslinking Amine-Modified Silica Aerogels with Epoxies: Mechanically Strong Lightweight Porous Materials – 47

Zhang, Lijun
Microstrip Line Fed Slot Antenna with PBG Superstrate – 89

Zhang, Nan-Xiong
Simulation Model and Eigen-Analysis for Polarimetric Scattering in SAR Imaging – 62

Zhang, Wei
An Efficient Technique for Modelling Wideband Propagation in an Urban Parallel Street Microcellular Environment – 305

Zhang, Wen-Xun
Review on the Layered Fresnel Zone Lens Antenna – 119

Zhang, Yimin
Performance Estimation of Space-Time Adaptive Processing via Subband Processing in Mobile Communications – 69

Zhao, W. Y.
A New Approach to Decompose MoM Matrix to Sparse Matrices by Using the Concept of MEI Method – 113

Zheng, X.
Precision Measurements of the Neutron Spin Structure at Jefferson Lab Hall A – 278

ZhiPing, Chen
Improved Smokescreen For MM Wave And IR – 116

Zhou, P. Y.
Array Pattern Synthesis with High Radiation Efficiency for Transmission Antenna Arrays – 89

Zhu, Jianwei
Production and Purification of Refolded Recombinant Human IL-7 From Inclusion Bodies – 227

Zhu, Qi
Experiment Research On MM Wavelength Radar Absorbing Materials – 155

Zhu, X.
Internal Combustion Engine (ICE) Air Toxic Emissions – 173

Zink, Katherine
Scattering by Resistively Loaded, Multilayer Frequency Selective Surfaces over Two-octave Bandwidth – 98

Zoltan-Jones, Alexandra
Promotion of Epithelial to Mesenchymal Transformation by Hyaluronan – 211

Zupo, D.
Comparison of Clean Diesel Buses to CNG Buses – 188