National Aeronautics and
Space Administration
Langley Research Center

Scientific and Technical
Information Program Office

Scientific and Technical Aerospace Reports

STAR

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NASA STI Program ... in Profile

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- TECHNICAL MEMORANDUM. Scientific and technical findings that are of preliminary or specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.
- CONFERENCE PUBLICATION. Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or co-sponsored by NASA.
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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 STI 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
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
- 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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Through NASA CASI, the NASA STI Program offers many information products and services to the aerospace community and to the public, including access to a selection of full text of the NASA STI. Free registration with the program is available to NASA, U.S. Government agencies and contractors. To register, contact CASI at help@sti.nasa.gov. Others should visit the program at www.sti.nasa.gov. The 'search selected databases' button provides access to the CASI TRS – the publicly available contents of the NASA STI Database.

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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.

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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/.

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Subject Term Index
Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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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*.

20030032952 NASA Glenn Research Center, Cleveland, OH, USA

Research and Technology 2002

Kim, Walter S.; March 2003; 270 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/TM-2003-211990; NAS 1.15:211990; E-13658; No Copyright; Avail: CASI; A12, Hardcopy

This report selectively summarizes NASA Glenn Research Center s research and technology accomplishments for fiscal year 2002. It comprises 166 short articles submitted by the staff scientists and engineers. The report is organized into five major sections: Aeronautics, Research and Technology, Space, Engineering and Technical Services, and Commercial Technology. A table of contents and author index have been developed to assist readers in finding articles of special interest. This report is not intended to be a comprehensive summary of all the research and technology work done over the past fiscal year. Most of the work is reported in Glenn-published technical reports, journal articles, and presentations prepared by Glenn staff and contractors. In addition, university grants have enabled faculty members and graduate students to engage in sponsored research that is reported at technical meetings or in journal articles. For each article in this report, a Glenn contact person has been identified, and where possible, a reference document is listed so that additional information can be easily obtained. The diversity of topics attests to the breadth of research and technology being pursued and to the skill mix of the staff that makes it possible. For more information about research at Glenn, visit us on the World Wide Web (http://www.grc.nasa.gov). This document is available online (http://www.grc.nasa.gov/WWW/RT). For publicly available reports, visit the Glenn Technical Report Server (http://gltrs.grc.nasa.gov/GLTRS/).

Author

Aeronautics; Aerospace Engineering; Research And Development; Aerospace Technology Transfer; Space Flight

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*.

20030032358 NASA Langley Research Center, Hampton, VA, USA

Historical Review of Uncommanded Lateral-Directional Motions At Transonic Conditions (Invited)

Chambers, Joseph R.; Hall, Robert M.; January 09, 2003; 20 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Original contains black and white illustrations

Contract(s)/Grant(s): F33657-96-D-2007

Report No.(s): AIAA Paper 2003-0590; Copyright; Avail: CASI; A03, Hardcopy

This paper presents the results of a survey of past experiences with uncommanded lateral-directional motions at transonic speeds during specific military aircraft programs. The effort was undertaken to provide qualitative and quantitative information on past airplane programs that might be of use to the participants in the joint NASA/Navy/Air Force Abrupt Wing Stall (AWS) Program. The AWS Program was initiated because of the experiences of the F/A-18E/F development program, during which unexpected, severe wing-drop motions were encountered by preproduction aircraft at transonic conditions. These motions were judged to be significantly degrading to the primary mission requirements of the aircraft. Although the problem was

subsequently solved for the production version of the F/A-l8E/F, a high-level review panel emphasized the poor understanding of such phenomena and issued a strong recommendation to: Initiate a national research effort to thoroughly and systematically study the wing drop phenomena. A comprehensive, cooperative NASA/Navy/Air Force AWS Program was designed to respond to provide the required technology requirements. As part of the AWS Program, a work element was directed at a historical review of wing-drop experiences in past aircraft development programs at high subsonic and transonic speeds. In particular, information was requested regarding: specific aircraft configurations that exhibited uncommanded motions and the nature of the motions; geometric characteristics of the air- planes; flight conditions involved in occurrences; relevant data, including wind-tunnel, computational, and flight sources; figures of merit used for analyses; and approaches used to alleviate the problem. An attempt was also made to summarize some of the more important lessons learned from past experiences, and to recommend specific research efforts. In addition to providing technical information to assist the AWS research objectives, the study produced fundamental information regarding the historical challenge of uncommanded lateral-directional motions at transonic conditions and the associated aerodynamic phenomena.
Author
Aerodynamic Stalling; Transonic Speed; Military Aircraft; Aerodynamics

20030032405 NASA Langley Research Center, Hampton, VA, USA
Aerodynamic Drag and Drag Reduction: Energy and Energy Savings (Invited)
Wood, Richard M.; [2003]; 20 pp.; In English; 41st AIAA Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2003-0209; No Copyright; Avail: CASI; A03, Hardcopy

An assessment of the role of fluid dynamic resistance and/or aerodynamic drag and the relationship to energy use in the USA is presented. Existing data indicates that up to 25\% of the total energy consumed in the USA is used to overcome aerodynamic drag, 27\% of the total energy used in the USA is consumed by transportation systems, and 60\% of the transportation energy or 16\% of the total energy consumed in the USA is used to overcome aerodynamic drag in transportation systems. Drag reduction goals of 50\% are proposed and discussed which if realized would produce a 7.85\% total energy savings. This energy savings correlates to a yearly cost savings in the $30Billion dollar range.
Author
Aerodynamic Drag; United States; Drag Reduction; Energy Conservation; Energy Consumption; Design Optimization; Research And Development

20030032412 NASA Langley Research Center, Hampton, VA, USA
Three-Dimensional Effects in Multi-Element High Lift Computations
Rumsey, Christopher L.; LeeReusch, Elizabeth M.; Watson, Ralph D., Elsevi; Computers and Fluids; 2003; ISSN 0045-7930; Volume 32, pp. 631-657; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

In an effort to discover the causes for disagreement between previous two-dimensional (2-D) computations and nominally 2-D experiment for flow over the three-element McDonnell Douglas 30P-30N airfoil configuration at high lift, a combined experimental/CFD investigation is described. The experiment explores several different side-wall boundary layer control venting patterns, documents venting mass flow rates, and looks at corner surface flow patterns. The experimental angle of attack at maximum lift is found to be sensitive to the side-wall venting pattern: a particular pattern increases the angle of attack at maximum lift by at least 2 deg. A significant amount of spanwise pressure variation is present at angles of attack near maximum lift. A CFD study using three-dimensional (3-D) structured-grid computations, which includes the modeling of side-wall venting, is employed to investigate 3-D effects on the flow. Side-wall suction strength is found to affect the angle at which maximum lift is predicted. Maximum lift in the CFD is shown to be limited by the growth of an off-body corner flow vortex and consequent increase in spanwise pressure variation and decrease in circulation. The 3-D computations with and without wall venting predict similar trends to experiment at low angles of attack, but either stall too early or else overpredict lift levels near maximum lift by as much as 5\%. Unstructured-grid computations demonstrate that mounting brackets lower the lift levels near maximum lift conditions.
Author
Computational Fluid Dynamics; Suction; Navier-Stokes Equation; Flow Distribution; Corner Flow; Mass Flow Rate; Computerized Simulation; Three Dimensional Models

20030032495 NASA Glenn Research Center, Cleveland, OH, USA

A Wind Tunnel Study of Icing Effects on a Business Jet Airfoil

Addy, Harlod E., Jr.; Broeren, Andy P.; Zoeckler, Joesph G.; Lee, Sam; February 2003; 22 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS-22-708-20-02

Report No.(s): NASA/TM-2003-212124; NAS 1.15:212124; E-13776; AIAA Paper 2003-0727; No Copyright; Avail: CASI; A03, Hardcopy

Aerodynamic wind tunnel tests were conducted to study the effects of various ice accretions on the aerodynamic performance of a 36-inch chord, two-dimensional business jet airfoil. Eight different ice shape configurations were tested. Four were castings made from molds of ice shapes accreted in an icing wind tunnel. Two were made using computationally smoothed tracings of two of the ice shapes accreted in the icing tunnel. These smoothed profiles were then extended in the spanwise direction to form a two-dimensional ice shape. The final two configurations were formed by applying grit to the smoothed ice shapes. The ice shapes resulted in as much as 48\% reduction in maximum lift coefficient from that of the clean airfoil. Large increases in drag and changes in pitching moment were also observed. The castings and their corresponding smoothed counterparts yielded similar results. Little change in performance was observed with the addition of grit to the smoothed ice shapes. Changes in the Reynolds number (from 3 x 10(exp 6) to 10.5 x 10(exp 6) and Mach number (from 0.12 to 0.28) did not significantly affect the iced-airfoil performance coefficients.

Author

Airfoils; Wind Tunnel Tests; Aircraft Icing; Jet Aircraft; Aerodynamic Characteristics

20030032536 Georgia Inst. of Tech., Atlanta, GA, USA

Large-Eddy/Lattice Boltzmann Simulations of Micro-Blowing Strategies for Subsonic and Supersonic Drag Control

Hwang, Danny P., Technical Monitor; Menon, Suresh; March 2003; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG3-2653; WU 708-87-23

Report No.(s): NASA/CR-2003-212196; E-13799; NAS 1.26:212196; CCL-02-004; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes the progress made in the first 8 to 9 months of this research. The Lattice Boltzmann Equation (LBE) methodology for Large-eddy Simulations (LES) of microblowing has been validated using a jet-in-crossflow test configuration. In this study, the flow intake is also simulated to allow the interaction to occur naturally. The Lattice Boltzmann Equation Large-eddy Simulations (LBELES) approach is capable of capturing not only the flow features associated with the flow, such as hairpin vortices and recirculation behind the jet, but also is able to show better agreement with experiments when compared to previous RANS predictions. The LBELES is shown to be computationally very efficient and therefore, a viable method for simulating the injection process. Two strategies have been developed to simulate multi-hole injection process as in the experiment. In order to allow natural interaction between the injected fluid and the primary stream, the flow intakes for all the holes have to be simulated. The LBE method is computationally efficient but is still 3D in nature and therefore, there may be some computational penalty. In order to study a large number or holes, a new 1D subgrid model has been developed that will simulate a reduced form of the Navier-Stokes equation in these holes.

Author

Aerodynamic Drag; Large Eddy Simulation; Boltzmann Distribution; Supersonic Drag; Subsonic Speed; Boltzmann Transport Equation; Subsonic Flow; Vortices; Cross Flow; Drag Reduction

20030032963 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA

An Experimental Investigation of Unsteady Surface Pressure on an Airfoil in Turbulence

Mish, Patrick F.; Devenport, William J.; March 31, 2003; 228 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG-1-2272; No Copyright; Avail: CASI; C01, CD-ROM; A11, Hardcopy

Measurements of fluctuating surface pressure were made on a NACA 0015 airfoil immersed in grid generated turbulence. The airfoil model has a 2 ft chord and spans the 6 ft Virginia Tech Stability Wind Tunnel test section. Two grids were used to investigate the effects of turbulence length scale on the surface pressure response. A large grid which produced turbulence with an integral scale 13\% of the chord and a smaller grid which produced turbulence with an integral scale 1.3\% of the chord. Measurements were performed at angles of attack, alpha from 0 to 20 . An array of microphones mounted subsurface was used to measure the unsteady surface pressure. The goal of this measurement was to characterize the effects of angle of attack on the inviscid response. Lift spectra calculated from pressure measurements at each angle of attack revealed two distinct interaction regions; for omega(sub r) = omega b / U(sub infinity) is less than 10 a reduction in unsteady lift of up to 7 decibels (dB) occurs while an increase occurs for omega(sub r) is greater than 10 as the angle of attack is increased. The

reduction in unsteady lift at low omega(sub r) with increasing angle of attack is a result that has never before been shown either experimentally or theoretically. The source of the reduction in lift spectral level appears to be closely related to the distortion of inflow turbulence based on analysis of surface pressure spanwise correlation length scales. Furthermore, while the distortion of the inflow appears to be critical in this experiment, this effect does not seem to be significant in larger integral scale (relative to the chord) flows based on the previous experimental work of McKeough suggesting the airfoils size relative to the inflow integral scale is critical in defining how the airfoil will respond under variation of angle of attack. A prediction scheme is developed that correctly accounts for the effects of distortion when the inflow integral scale is small relative to the airfoil chord. This scheme utilizes Rapid Distortion Theory to account for the distortion of the inflow with the distortion field modeled using a circular cylinder.
Author
Pressure; Airfoils; Turbulent Flow; Wind Tunnel Tests; Computational Grids; Pressure Measurement

20030033031 George Washington Univ., Washington, DC, USA
Flow Past a Descending Balloon
Baginski, Frank; December 31, 2001; 57 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-5292; No Copyright; Avail: CASI; A04, Hardcopy

In this report, we present our findings related to aerodynamic loading of partially inflated balloon shapes. This report will consider aerodynamic loading of partially inflated inextensible natural shape balloons and some relevant problems in potential flow. For the axisymmetric modeling, we modified our Balloon Design Shape Program (BDSP) to handle axisymmetric inextensible ascent shapes with aerodynamic loading. For a few simple examples of two dimensional potential flows, we used the Matlab PDE Toolbox. In addition, we propose a model for aerodynamic loading of strained energy minimizing balloon shapes with lobes. Numerical solutions are presented for partially inflated strained balloon shapes with lobes and no aerodynamic loading.
Author
Aerodynamic Loads; Balloons; Descent; Aerodynamics

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*.

20030032408 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
A Human Error Analysis of General Aviation Controlled Flight into Terrain Accidents Occurring Between 1990-1998
Shappell, Scott A.; Wiegmann, Douglas A.; March 2003; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FAA-HRR-521
Report No.(s): DOT/FAA/AM-03/4; Copyright; Avail: CASI; A03, Hardcopy

Although all aviation accidents are of interest to the Federal Aviation Administration (FAA), perhaps none is more disconcerting than those in which a fully functioning aircraft is inexplicably flown into the ground. Referred to as controlled flight into terrain (CFIT), these accidents continue to be a major safety concern within aviation, in particular general aviation (GA). A previous study as part of the FAA's Safer Skies agenda examined 165 CFIT accidents using root cause analysis and developed 55 interventions to address their causes. While the study represented the work and opinions of several experts in the FAA and industry, the findings might have benefited from a more detailed human error analysis involving a larger number of accidents. In this study, five pilot-raters independently analyzed more than 16,500 GA accidents occurring between 1990-1998 using the Human Factors Analysis and Classification System (HFACS). Of the GA accidents examined, 1407 were identified as CFIT and compared with non-CFIT accidents using HFACS. The analysis revealed a number of differences in the pattern of human error associated with CFIT accidents. Findings from this study support many of the interventions identified by the CFIT Joint Safety Analysis Team USAT) and Joint Safety Implementation Team USIT), permitting safety professionals to better develop, refine, and track the effectiveness of selected intervention strategies.
Author
Aircraft Accidents; Civil Aviation; Pilot Ratings; Pilot Performance; Error Analysis

20030033050 Army Safety Center, Fort Rucker, AL
FLIGHTFAX: Army Aviation Risk-Management Information. Volume 30, Number 12
Dec. 2002; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410539; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available.
Military Aviation; Aircraft Safety

20030033921 NASA Langley Research Center, Hampton, VA, USA
Evaluation of Trajectory Errors in an Automated Terminal-Area Environment
Oseguera-Lohr, Rosa M.; Williams, David H.; April 2003; 31 pp.; In English
Contract(s)/Grant(s): RTOP 722-01-26-21
Report No.(s): NASA/TM-2003-212174; NAS 1.15:212174; L-18273; No Copyright; Avail: CASI; A03, Hardcopy
A piloted simulation experiment was conducted to document the trajectory errors associated with use of an airplane's Flight Management System (FMS) in conjunction with a ground-based ATC automation system, Center-TRACON Automation System (CTAS) in the terminal area. Three different arrival procedures were compared: current-day (vectors from ATC), modified (current-day with minor updates), and data link with FMS lateral navigation. Six active airline pilots flew simulated arrivals in a fixed-base simulator. The FMS-datalink procedure resulted in the smallest time and path distance errors, indicating that use of this procedure could reduce the CTAS arrival-time prediction error by about half over the current-day procedure. Significant sources of error contributing to the arrival-time error were crosstrack errors and early speed reduction in the last 2-4 miles before the final approach fix. Pilot comments were all very positive, indicating the FMS-datalink procedure was easy to understand and use, and the increased head-down time and workload did not detract from the benefit. Issues that need to be resolved before this method of operation would be ready for commercial use include development of procedures acceptable to controllers, better speed conformance monitoring, and FMS database procedures to support the approach transitions.
Author
Flight Management Systems; Air Traffic Control; Aircraft Approach Spacing; Aircraft Guidance; Approach Control; Pilot Support Systems; Navigation Aids

20030033927 Robertson Aviation, LLC, Tempe, AZ, USA
A Study of Transport Airplane Crash-Resistant Fuel Systems
Jones, Lisa, Technical Monitor; Robertson, S. H.; Johnson, N. B.; Hall, D. S.; Rimson, I. J.; March 2002; 240 pp.; In English
Contract(s)/Grant(s): DTFA03-98-C-00016; RTOP 728-50-10-01
Report No.(s): NASA/CR-2002-211437; NAS 1.26:211437; DOT/FAA/AR-01/82; RA-00-305-FAA; Copyright; Avail: CASI; A11, Hardcopy
This report presents the results of a study, funded by the Federal Aviation Administration (FAA), of transport airplane crash-resistant fuel system (CRFS). The report covers the historical studies related to aircraft crash fires and fuel containment concepts undertaken by the FAA, NASA, and the U.S. Army, which ultimately led to the current state of the art in CRFS technology. It describes the basic research, testing, field investigations and production efforts which have led to the highly successful military CRFS, which has saved many lives and reduced costs of accidents. Current CRFS technology used in transport category airplanes is defined and compared to the available state-of-the-art technology. The report provides information to the FAA and other government organizations which can help them plan their efforts to improve the state of crash fire protection in the transport airplane fleet. The report provides guidance to designers looking for information about CRFS design problems, analysis tools to use for product improvement, and a summary of current and proposed regulations for transport category airplane fuel systems.
Author
Transport Aircraft; Crashworthiness; Aircraft Design; Technology Utilization; Aircraft Fuel Systems

20030033943 NASA Langley Research Center, Hampton, VA, USA
Evaluation of a Dispatcher's Route Optimization Decision Aid to Avoid Aviation Weather Hazards
Dorneich, Michael C.; Olofinboba, Olu; Pratt, Steve; Osborne, Dannielle; Feyereisen, Thea; Latorella, Kara; April 2003; 121 pp.; In English
Contract(s)/Grant(s): RTOP 728-40-10-03
Report No.(s): NASA/TM-2003-212172; NAS 1.15:212172; L-18271; No Copyright; Avail: CASI; A06, Hardcopy

This document describes the results and analysis of the formal evaluation plan for the Honeywell software tool developed under the NASA AWIN (Aviation Weather Information) 'Weather Avoidance using Route Optimization as a Decision Aid' project. The software tool aims to provide airline dispatchers with a decision aid for selecting optimal routes that avoid weather and other hazards. This evaluation compares and contrasts route selection performance with the AWIN tool to that of subjects using a more traditional dispatcher environment. The evaluation assesses gains in safety, in fuel efficiency of planned routes, and in time efficiency in the pre-flight dispatch process through the use of the AWIN decision aid. In addition, we are interested in how this AWIN tool affects constructs that can be related to performance. The construct of Situation Awareness (SA), workload, trust in an information system, and operator acceptance are assessed using established scales, where these exist, as well as through the evaluation of questionnaire responses and subject comments. The intention of the experiment is to set up a simulated operations area for the dispatchers to work in. They will be given scenarios in which they are presented with stored company routes for a particular city-pair and aircraft type. A diverse set of external weather information sources is represented by a stand-alone display (MOCK), containing the actual historical weather data typically used by dispatchers. There is also the possibility of presenting selected weather data on the route visualization tool. The company routes have not been modified to avoid the weather except in the case of one additional route generated by the Honeywell prototype flight planning system. The dispatcher will be required to choose the most appropriate and efficient flight plan route in the displayed weather conditions. The route may be modified manually or may be chosen from those automatically displayed.
Author
Decision Support Systems; Air Traffic Control; Flight Plans; Optimization; Computer Programs; Aviation Meteorology; Air Traffic Controllers (Personnel)

20030036972 Vigyan Research Associates, Inc., Hampton, VA, USA
Atmospheric Boundary Layer Sensors for Application in a Wake Vortex Advisory System
Zak, J. Allen; Rutishauser, David, Technical Monitor; April 2003; 37 pp.; In English
Contract(s)/Grant(s): NAS1-00135; RTOP 727-04-10-01
Report No.(s): NASA/CR-2003-212175; NAS 1.26:212175; No Copyright; Avail: CASI; A03, Hardcopy

Remote sensing of the atmospheric boundary layer has advanced in recent years with the development of commercial off-the-shelf (COTS) radar, sodar, and lidar wind profiling technology. Radio acoustic sounding systems for vertical temperature profiles of high temporal scales (when compared to routine balloon soundings- (radiosondes) have also become increasingly available as COTS capabilities. Aircraft observations during landing and departures are another source of available boundary layer data. This report provides an updated assessment of available sensors, their performance specifications and rough order of magnitude costs for a potential future aircraft Wake Vortex Avoidance System (WakeVAS). Future capabilities are also discussed. Vertical profiles of wind, temperature, and turbulence are anticipated to be needed at airports in any dynamic wake avoidance system. Temporal and spatial resolution are dependent on the selection of approach and departure corridors to be protected. Recommendations are made for potential configurations of near-term sensor technologies and for testing some of the sensor systems in order to validate performance in field environments with adequate groundtruth.
Author
Atmospheric Boundary Layer; Aircraft Wakes; Vortex Avoidance; Vortex Advisory System; Remote Sensors; Turbulent Wakes

20030037098 MITRE Corp., McLean, VA, National Aeronautics and Space Administration, Moffett Field, CA
Summary of FlightDeck Observer Data from SafeFlight 21 OpEval-2
Joseph, K. M.; Domino, D.; Battiste, V.; Bone, R. S.; Olmos, B. O.; Feb. 2003; 68 pp.; In English
Report No.(s): PB2003-102980; No Copyright; Avail: CASI; A04, Hardcopy

In 2000, the Cargo Airlines Association and the Federal Aviation Administration conducted Operational Evaluation 2 (OpEval-2) of Cockpit Display of Traffic Information (CDTI) and Automatic Dependent Surveillance - Broadcast (ADS-B) technologies at the Standiford International Airport in Louisville, KY. This evaluation was designed to demonstrate the benefits of CDTI/ADS-B, including safety, efficiency, and capacity. Toward this end, five flight periods were designed to test five different applications: Airport Surface Situation Awareness (ASSA), Departure Spacing, Initial and Final Approach Spacing, Final Approach Runway Occupancy Awareness (FAROA), and Visual Acquisition and Traffic Awareness. OpEval-2 included 16 aircraft of various types and their flight crews. Flightdeck observers accompanied these flight crews to record human factors data. This report summarizes the collection and analysis of flightdeck observer data. In addition, the report includes empirically based recommendations for addressing human factors issues related to certification of CDTI for the five applications that were tested in OpEval-2.
NTIS
Aircraft Safety; Airports; Air Traffic; Flight Crews; Civil Aviation; Airline Operations

20030037107 National Transportation Safety Board, Washington, DC

National Transportation Safety Board Aircraft Accident Report: Loss of Control and Impact with Pacific Ocean, Alaska Airlines Flight 261, McDonnell Douglas MD-83, N963AS, About 2.7 Miles North of Anacapa Island, California, on January 31, 2000

Dec. 30, 2002; 250 pp.

Report No.(s): PB2002-910401; NTSB/AAR-02/01; No Copyright; Avail: CASI; A11, Hardcopy

This report explains the accident involving Alaska Airlines flight 261, a McDonnell Douglas MD-83, which crashed into the Pacific Ocean about 2.7 miles north of Anacapa Island, California. Safety issues discussed in this report include lubrication and inspection of the jackscrew assembly, extension of lubrication and end play check intervals, jackscrew assembly overhaul procedures, the design and certification of the MD-80 horizontal stabilizer trim control system, Alaska Airlines' maintenance program, and Federal Aviation Administration (FAA) oversight of Alaska Airlines. Safety recommendations are addressed to the FAA.

NTIS

Aircraft Accidents; Airline Operations; Commercial Aircraft

20030037123 General Accounting Office, Washington, DC

National Airspace System: Better Cost Data Could Improve FAA's Management of the Standard Terminal Automation Replacement System

Jan. 2003; 30 pp.

Report No.(s): PB2003-102660; GAO-03-343; No Copyright; Avail: CASI; A03, Hardcopy

To enhance the capacity and safety of the national airspace system, the Federal Aviation Administration (FAA), within the Department of Transportation, is acquiring 74 Standard Terminal Automation Replacement Systems (STARS). STARS will replace some outdated air traffic control equipment. Since 1996, when FAA initiated this major computer hardware and software acquisition, the scope and estimated costs of STARS have changed many times. FAA now estimates that STARS's remaining costs will total about $2.54 billion. GAO was asked to assess the reliability of FAA's life-cycle cost estimate for STARS, determine the impact of STARS's estimated costs on future FAA budgets, and identify any alternatives to STARS that FAA is considering. GAO based its analysis on published FAA cost data and the guidance FAA uses for managing major acquisitions.

NTIS

Air Traffic Control; National Airspace System; Automatic Control; Control Equipment

20030038804 NASA Langley Research Center, Hampton, VA, USA

Wake Vortex Advisory System (WakeVAS) Concept of Operations

Rutishauser, David; Lohr, Gary; Hamilton, David; Powers, Robert; McKissick, Burnell; Adams, Catherine; Norris, Edward; April 2003; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 727-04-10-01

Report No.(s): NASA/TM-2003-212176; L-18281; NAS 1.15:212176; No Copyright; Avail: CASI; A03, Hardcopy

NASA Langley Research Center has a long history of aircraft wake vortex research, with the most recent accomplishment of demonstrating the Aircraft VOrtex Spacing System (AVOSS) at Dallas/Forth Worth International Airport in July 2000. The AVOSS was a concept for an integration of technologies applied to providing dynamic wake-safe reduced spacing for single runway arrivals, as compared to current separation standards applied during instrument approaches. AVOSS included state-of-the-art weather sensors, wake sensors, and a wake behavior prediction algorithm. Using real-time data AVOSS averaged a 6\% potential throughput increase over current standards. This report describes a Concept of Operations for applying the technologies demonstrated in the AVOSS to a variety of terminal operations to mitigate wake vortex capacity constraints. A discussion of the technological issues and open research questions that must be addressed to design a Wake Vortex Advisory System (WakeVAS) is included.

Author

Aircraft Wakes; Vortex Advisory System; Vortices; NASA Programs

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*.

20030032372 Air Force Flight Test Center, Edwards AFB, CA

A Comparison of Nonlinear Algorithms in the Prevention of Pilot-Induced Oscillations Caused by Actuator Rate Limiting (Project HAVE PREVENT)

Hanley, James; Ritter, Stefan; Gloystein, John; Griffiths, George, Jr.; Luker, JOel; Dec. 2002; ISBN0309084997; 58 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410173; AFFTC-TIM-02-07; No Copyright; Avail: CASI; A04, Hardcopy

This report presents the results of Project HAVE PREVENT, a comparison of nonlinear algorithms in the prevention of pilot-induced oscillations (PIO) caused by actuator rate limiting. The overall test objective was to compare the ability of two flight control system filters in the prevention of PIO during actuator rate limiting. The Air Force Institute of Technology, Engineering Department (AFIT/ENY) requested this testing. The USAF Test Pilot School (TPS), Class O2A, conducted 13 flight tests totaling 21.0 hours at Edwards AFB, California, from 16 to 23 October 2002.

DTIC

Pilot Induced Oscillation; Flight Control; Actuators; Algorithms

20030032381 Army Research Lab., Adelphi, MD

Acoustic Data Collection of Tactical Unmanned Air Vehicles (TUAVs)

Pham, Tien; Sim, Leng; Dec. 2002; ISBN0309084997; 47 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410088; ARL-TR-2749; No Copyright; Avail: CASI; A03, Hardcopy

This report discusses the data collection experiments of tactical unmanned air vehicles (TUAVs) conducted by the U.S. Army Research Laboratory of Webster Airfield, Patuxent River, MD in October 2001 and January 2002. The purpose of these data collection experiments was to collect raw acoustic signatures of TUAVs and to develop an acoustic database to support activities of the Action Group 6 (AG6) under the Technical Cooperative Program. The AG6's main objectives are to improve the understanding and utilization of acoustic sensor technology and to evaluate acoustic sensor performance in the detection, tracking, and classification of TUAVs.

DTIC

Data Acquisition; Drone Aircraft; Acoustics

20030032479 Sest, Inc., Middleburgh Heights, OH, USA

Enhancement/Upgrade of Engine Structures Technology Best Estimator (EST/BEST) Software System

Shah, Ashwin; Chamis, Christos C., Technical Monitor; March 2003; 64 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NASA Order C-76751-J; WBS-22-708-90-53

Report No.(s): NASA/CR-2003-212126; NAS 1.26:212126; E-13778; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the work performed during the contract period and the capabilities included in the EST/BEST software system. The developed EST/BEST software system includes the integrated NESSUS, IPACS, COBSTRAN, and ALCCA computer codes required to perform the engine cycle mission and component structural analysis. Also, the interactive input generator for NESSUS, IPACS, and COBSTRAN computer codes have been developed and integrated with the EST/BEST software system. The input generator allows the user to create input from scratch as well as edit existing input files interactively. Since it has been integrated with the EST/BEST software system, it enables the user to modify EST/BEST generated files and perform the analysis to evaluate the benefits. Appendix A gives details of how to use the newly added features in the EST/BEST software system.

Author

Computer Systems Programs; Software Engineering; Computer Programming; Aerodynamics; Structural Analysis; Engine Tests

20030032531 NASA Langley Research Center, Hampton, VA, USA

Avionic Pictorial Tunnel-/Pathway-/Highway-In-The-Sky Workshops

Parrish, Russell V., Compiler; March 2003; 112 pp.; In English; Avionic Pictorial Tunnel-/Pathway-/Highway-In-The-Sky Workshop #1, 25-27 Apr. 1994, Hampton, VA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 728-60-10-01

Report No.(s): NASA/CP-2003-212164; L-18270; NAS 1.55:212164; No Copyright; Avail: CASI; A06, Hardcopy

In 1994-96, Langley Research Center held a series of interactive workshops investigating highway-in-the-sky concepts, which enable precise flight path control. These workshops brought together government and industry display designers and pilots to discuss and fly various concepts in an iterative manner. The primary emphasis of the first workshops was the utility and usability of pathways and the pros and cons of various features available. The final workshops were focused on the specific applications to the eXternal Visibility System (XVS) of the NASA High-speed Research Program, which was concerned with replacement of the forward windows in a High-speed Civil Transport with electronic displays and high resolution video cameras to enable a 'No-Droop' configuration. The primary concerns in the XVS application were the prevention of display clutter and obscuration of hazards, as the camera image was the primary means of traffic separation in clear visibility conditions. These concerns were not so prominent in the first workshops, which assumed a Synthetic Vision System application in which hazard locations are known and obscuration is handled easily. The resulting consensus concept has been used since in simulation and flight test activities of many Government programs. and other concepts have been influenced by the workshop discussions.

Author

Avionics; Display Devices; Flight Paths; Flight Control; Enhanced Vision; Civil Aviation; Flight Simulation

20030032933 NASA Glenn Research Center, Cleveland, OH, USA, Texas Univ., Edinburg, TX, USA

A Reduced Model for Prediction of Thermal and Rotational Effects on Turbine Tip Clearance

Kypuros, Javier A.; Melcher, Kevin J.; March 2003; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 22-708-87-06

Report No.(s): NASA/TM-2003-212226; NAS 1.15:212226; E-13846; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes a dynamic model that was developed to predict changes in turbine tip clearance the radial distance between the end of a turbine blade and the abradable tip seal. The clearance is estimated by using a first principles approach to model the thermal and mechanical effects of engine operating conditions on the turbine sub-components. These effects are summed to determine the resulting clearance. The model is demonstrated via a ground idle to maximum power transient and a lapse-rate takeoff transient. Results show the model demonstrates the expected pinch point behavior. The paper concludes by identifying knowledge gaps and suggesting additional research to improve the model.

Author

Scale Models; Temperature Effects; Turbine Blades; Mathematical Models; Dynamic Models; Clearances; Blade Tips

20030032958 Georgia Inst. of Tech., Atlanta, GA, USA

150 Passenger Commercial Aircraft

Bucovsky, Adrian; Romli, Fairuz I.; Rupp, Jessica; December 09, 2002; 221 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-2235

Report No.(s): AE-880-04A-7; No Copyright; Avail: CASI; C01, CD-ROM; A10, Hardcopy

It has been projected that the need for a short-range mid-sized, aircraft is increasing. The future strategy to decrease long-haul flights will increase the demand for short-haul flights. Since passengers prefer to meet their destinations quickly, airlines will increase the frequency of flights, which will reduce the passenger load on the aircraft. If a point-to-point flight is not possible, passengers will prefer only a one-stop short connecting flight to their final destination. A 150-passenger aircraft is an ideal vehicle for these situations. It is mid-sized aircraft and has a range of 3000 nautical miles. This type of aircraft would market U.S. domestic flights or inter-European flight routes. The objective of the design of the 150-passenger aircraft is to minimize fuel consumption. The configuration of the aircraft must be optimized. This aircraft must meet CO2 and NOx emissions standards with minimal acquisition price and operating costs. This report contains all the work that has been performed for the completion of the design of a 150 passenger commercial aircraft. The methodology used is the Technology Identification, Evaluation, and Selection (TIES) developed at Georgia Tech Aerospace Systems Design laboratory (ASDL). This is an eight-step conceptual design process to evaluate the probability of meeting the design constraints. This methodology also allows for the evaluation of new technologies to be implemented into the design. The TIES process begins with defining the problem with a need established and a market targeted. With the customer requirements set and the target values

established, a baseline concept is created. Next, the design space is explored to determine the feasibility and viability of the baseline aircraft configuration. If the design is neither feasible nor viable, new technologies can be implemented to open up the feasible design space and allow for a plausible solution. After the new technologies are identified, they must be evaluated to determine the physical compatibility of integrating multiple technologies and then the impact on the design, both improvements and degradations, must be determined. These technologies are assessed deterministically. Again, Response Surface Equations (RSEs) are developed to allow for a full factorial evaluation of the combinations of the technologies. The best combination of technologies is selected and then the design space is again reevaluated for feasibility and viability.
Author
Passenger Aircraft; Design Analysis; Product Development; Aircraft Design; Design Optimization; Commercial Aircraft

20030032965 Georgia Inst. of Tech., Atlanta, GA, USA
Exploration of Advanced Probabilistic and Stochastic Design Methods
Mavris, Dimitri N.; March 31, 2003; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG1-2235; No Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The primary objective of the three year research effort was to explore advanced, non-deterministic aerospace system design methods that may have relevance to designers and analysts. The research pursued emerging areas in design methodology and leverage current fundamental research in the area of design decision-making, probabilistic modeling, and optimization. The specific focus of the three year investigation was oriented toward methods to identify and analyze emerging aircraft technologies in a consistent and complete manner, and to explore means to make optimal decisions based on this knowledge in a probabilistic environment. The research efforts were classified into two main areas. First, Task A of the grant has had the objective of conducting research into the relative merits of possible approaches that account for both multiple criteria and uncertainty in design decision-making. In particular, in the final year of research, the focus was on the comparison and contrasting between three methods researched. Specifically, these three are the Joint Probabilistic Decision-Making (JPDM) technique, Physical Programming, and Dempster-Shafer (D-S) theory. The next element of the research, as contained in Task B, was focused upon exploration of the Technology Identification, Evaluation, and Selection (TIES) methodology developed at ASDL, especially with regards to identification of research needs in the baseline method through implementation exercises. The end result of Task B was the documentation of the evolution of the method with time and a technology transfer to the sponsor regarding the method, such that an initial capability for execution could be obtained by the sponsor. Specifically, the results of year 3 efforts were the creation of a detailed tutorial for implementing the TIES method. Within the tutorial package, templates and detailed examples were created for learning and understanding the details of each step. For both research tasks, sample files and tutorials are attached in electronic form with the enclosed CD.
Author
Design Optimization; Decision Making; Stochastic Processes

20030033934 California Polytechnic State Univ., San Luis Obispo, CA, USA
Runway Independent Aircraft Extremely Short Takeoff and Landing Regional Airliner: The Model 110
Hall, David W.; April 15, 2003; 43 pp.; In English; Original document contains extra large color foldouts which cannot be scanned. Original doucment also contains color illustrations.
Contract(s)/Grant(s): NCC2-5508; No Copyright; Avail: CASI; A03, Hardcopy

Airports throughout the USA are plagued with growing congestion. With the increase in air traffic predicted in the next few years, congestion will worsen. The accepted solution of building larger airplanes to carry more travelers is no longer a viable option, as airports are unable to accommodate larger aircraft without expensive infrastructure changes. Past NASA research has pointed to the need for a new approach, which can economically and safely utilize smaller airports. To study this option further, NASA requested the California Polytechnic State University at San Luis Obispo (Cal Poly/SLO) to design a baseline aircraft to be used for system studies. The requirements put forth by NASA are summarized. The design team was requested to create a demonstrator vehicle, which could be built without requiring enabling technology development. To this end, NASA requested that the tested and proven high-lift system of the Boeing C-17 Globemaster III be combined with the fuselage of the BAe-146. NASA also requested that Cal Poly determine the availability and usability of underutilized airports starting with California, then expanding if time and funds permitted to the U.S.
Derived from text
Aircraft Landing; Runways; Aircraft Models; Short Takeoff Aircraft; Aircraft Performance; Aircraft Design

20030034653 Northrop Grumman Corp., El Segundo, CA, USA

Autonomous Unmanned Aerial Vehicle (UAV) Airspace Operations Sensing Requirements, Volume 1, Performance

Chen, Won-Zon; DeLuca, Jan M.; Koeller, Jeffrey D.; ONeil, William F.; Wong, Ivan H.; Jul. 2002; 80 pp.; In English

Contract(s)/Grant(s): F33615-01-C-3147; AF Proj. 2403

Report No.(s): AD-A410310; AFRL-VA-WP-TR-2002-3096; No Copyright; Avail: CASI; A05, Hardcopy

Presented are results of an initial phase of an AFRL/VACC effort to determine the sensing requirements for an autonomous UAV - to replace the pilot's sensing capability with on-board sensors. These sensors need to enable the autonomous execution of airspace tasks, such as conflict avoidance (see & avoid), autonomous landing, and ground operations. Baseline requirements which will allow UAVs to meet near-term airspace integration goals are presented along with impacts and questions future work will have to address. This describes 6.2 work accomplished to set the baseline requirements for future work. Although our work is for the USAF, the portion of work contained in the report is equally applicable to civilian and commercial use since all share controlled airspace.

DTIC

Pilotless Aircraft; Detection; Ground Operational Support System

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*.

20030032276 Defence Science and Technology Organisation, Fishermans Bend, Australia

Root Flexibility and Untwist Effects on Vibration Characteristics of a Gas Turbine Blade

Hou, Jian-Fu; Wicks, Bryon J.; November 2002; 20 pp.; In English; Original contains color illustrations

Report No.(s): DSTO-RR-0250; Copyright; Avail: Other Sources

Blade vibration is generally recognized as one of the most significant causes of high cycle fatigue failure in gas turbine engines. The blade root flexibility often cannot be determined easily in the assessment of blade vibration behaviour and exclusion of this effect may lead to a false prediction of vibration characteristics. This report outlines a study of root flexibility and aerofoil untwist effects on the vibration characteristics of a turbine blade using 3-D finite element analysis, together with laboratory testing. The vibration characteristics of the blade were analysed and the predicted results were correlated with laboratory test results at ambient temperature. The vibration characteristics of the blade assembly during engine operation were then predicted through a pre-stressed modal analysis, including the centrifugal stiffening effect, the temperature effect and the interactions between the blade and disc. The root flexibility effect due to differences in clamping condition was then investigated in detail. Aerofoil untwist effects due to creep were also revealed in this analysis.

Author

Turbine Blades; Vibration; Fatigue (Materials); Airfoils

20030032464 Kentucky Univ., Lexington, KY, USA

An Experimental and Computational Investigation of Oscillating Airfoil Unsteady Aerodynamics at Large Mean Incidence

Capece, Vincent R.; Platzer, Max F.; March 2003; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG3-2613; WU-708-87-23-00

Report No.(s): NASA/CR-2003-212199; NAS 1.26:212199; E-13802; No Copyright; Avail: CASI; A03, Hardcopy

A major challenge in the design and development of turbomachine airfoils for gas turbine engines is high cycle fatigue failures due to flutter and aerodynamically induced forced vibrations. In order to predict the aeroelastic response of gas turbine airfoils early in the design phase, accurate unsteady aerodynamic models are required. However, accurate predictions of flutter and forced vibration stress at all operating conditions have remained elusive. The overall objectives of this research program are to develop a transition model suitable for unsteady separated flow and quantify the effects of transition on airfoil steady and unsteady aerodynamics for attached and separated flow using this model. Furthermore, the capability of current state-of-the-art unsteady aerodynamic models to predict the oscillating airfoil response of compressor airfoils over a range of realistic reduced frequencies, Mach numbers, and loading levels will be evaluated through correlation with benchmark data. This comprehensive evaluation will assess the assumptions used in unsteady aerodynamic models. The results of this evaluation can be used to direct improvement of current models and the development of future models. The transition

modeling effort will also make strides in improving predictions of steady flow performance of fan and compressor blades at off-design conditions. This report summarizes the progress and results obtained in the first year of this program. These include: installation and verification of the operation of the parallel version of TURBO; the grid generation and initiation of steady flow simulations of the NASA/Pratt&Whitney airfoil at a Mach number of 0.5 and chordal incidence angles of 0 and 10 deg.; and the investigation of the prediction of laminar separation bubbles on a NACA 0012 airfoil.
Author
Unsteady Aerodynamics; Turbomachinery; Airfoils; Aeroelasticity; Gas Turbine Engines; Incidence; Forced Vibration

20030032493 NASA Glenn Research Center, Cleveland, OH, USA
Strength, Fracture Toughness, and Slow Crack Growth of Zirconia/Alumina Composites at Elevated Temperature
Choi, Sung R.; Bansal, Narottam P.; February 2003; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS-22-708-75-03
Report No.(s): NASA/TM-2003-212108; NAS 1.15:212108; E-13763; No Copyright; Avail: CASI; A03, Hardcopy

Various electrolyte materials for solid oxide fuel cells were fabricated by hot pressing 10 mol% yttria-stabilized zirconia (10-YSZ) reinforced with two different forms of alumina particulates and platelets each containing 0 to 30 mol% alumina. Flexure strength and fracture toughness of platelet composites were determined as a function of alumina content at 1000 C in air and compared with those of particulate composites determined previously. In general, elevated-temperature strength and fracture toughness of both composite systems increased with increasing alumina content. For a given alumina content, flexure strength of particulate composites was greater than that of platelet composites at higher alumina contents (greater than or equal to 20 mol%), whereas, fracture toughness was greater in platelet composites than in particulate composites, regardless of alumina content. The results of slow crack growth (SCG) testing, determined at 1000 C via dynamic fatigue testing for three different composites including 0 mol% (10-YSZ matrix), 30 mol % particulate and 30 mol% platelet composites, showed that susceptibility to SCG was greatest with SCG parameter n = 6 to 8 for both 0 and 30 mol% particulate composites and was least with n = 33 for the 30 mol% platelet composite.
Author
Fabrication; Fracture Strength; Yttria-Stabilized Zirconia; Zirconium Oxides; Aluminum Oxides; Mechanical Properties; Crack Propagation; High Temperature

20030032940 NASA Glenn Research Center, Cleveland, OH, USA
Real Gas Effects on the Performance of Hydrocarbon-Fueled Pulse Detonation Engines
Povinelli, Louis A.; Yungster, Shaye; March 2003; 20 pp.; In English; 41st Aerospace Sciences Meeting, 6-9 Jan. 2003, Reno, NV, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-719-10-01
Report No.(s): NASA/TM-2003-212211; E-13819; NAS 1.15:212211; AIAA Paper 2003-0712; ICOMP-2003-02; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents results for a single-pulse detonation tube wherein the effects of high temperature dissociation and the subsequent recombination influence the sensible heat release available for providing propulsive thrust. The study involved the use of ethylene and air at equivalence ratios of 0.7 and 1.0. The real gas effects on the sensible heat release were found to be significantly large so as to have an impact on the thrust, impulse and fuel consumption of a PDE.
Author
Pulse Detonation Engines; Real Gases; Thermodynamics; Hydrocarbon Fuels; Flow Distribution; Gas Mixtures

20030032968 NASA Glenn Research Center, Cleveland, OH, USA
Mode I, Mode II, and Mixed-Mode Fracture of Plasma-Sprayed Thermal Barrier Coatings at Ambient and Elevated Temperatures
Choi, Sung R.; Zhu, Dongming; Miller, Robert A.; March 2003; 27 pp.; In English; Eighth International Symposium on Fracture Mechanics of Ceramics, 25-28 Feb. 2003, Houston, TX, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS-22-714-04-30
Report No.(s): NASA/TM-2003-212185; NAS 1.15:212185; E-13787; Copyright; Avail: CASI; A03, Hardcopy

The mixed-mode fracture behavior of plasma-sprayed ZrO2-8 wt% Y2O3 thermal barrier coatings was determined in air at 25 and 1316 C in asymmetric four-point flexure with single edge v-notched beam (SEVNB) test specimens. The mode I fracture toughness was found to be K(sub Ic) = 1.15 plus or minus 0.07 and 0.98 plus or minus 0.13 MPa the square root of m, respectively, at 25 and 1316 C. The respective mode II fracture toughness values were K(sub IIc) = 0.73 plus or minus 0.10

and 0.65 plus or minus 0.04 MPa the square root of m. Hence, there was an insignificant difference in either K(sub Ic or K(sub IIc) between 25 and 1316 C for the coating material, whereas there was a noticeable distinction between K(sub Ic) and K(sub IIc), resulting in K(sub IIc) per K(sub Ic) = 0.65 at both temperatures. The empirical mixed-mode fracture criterion best described the coatings' mixed-mode fracture behavior among the four mixed-mode fracture theories considered. The angle of crack propagation was in reasonable agreement with the minimum strain energy density criterion. The effect of the directionality of the coating material in on K(sub Ic) was observed to be insignificant, while its sintering effect at 1316 C on K(sub Ic) was significant.
Author
Thermal Control Coatings; Zirconium Oxides; Plasma Spraying; Ambient Temperature; High Temperature Tests; Fracture Mechanics; Yttrium Oxides; Mechanical Properties

20030032975 QSS Group, Inc., Cleveland, OH, USA
Aircraft Engine Sensor/Actuator/Component Fault Diagnosis Using a Bank of Kalman Filters
Kobayashi, Takahisa; Simon, Donald L., Technical Monitor; March 2003; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-00145; WBS-22-728-30-05
Report No.(s): NASA/CR-2003-212298; NAS 1.26:212298; E-13862; No Copyright; Avail: CASI; A03, Hardcopy

In this report, a fault detection and isolation (FDI) system which utilizes a bank of Kalman filters is developed for aircraft engine sensor and actuator FDI in conjunction with the detection of component faults. This FDI approach uses multiple Kalman filters, each of which is designed based on a specific hypothesis for detecting a specific sensor or actuator fault. In the event that a fault does occur, all filters except the one using the correct hypothesis will produce large estimation errors, from which a specific fault is isolated. In the meantime, a set of parameters that indicate engine component performance is estimated for the detection of abrupt degradation. The performance of the FDI system is evaluated against a nonlinear engine simulation for various engine faults at cruise operating conditions. In order to mimic the real engine environment, the nonlinear simulation is executed not only at the nominal, or healthy, condition but also at aged conditions. When the FDI system designed at the healthy condition is applied to an aged engine, the effectiveness of the FDI system is impacted by the mismatch in the engine health condition. Depending on its severity, this mismatch can cause the FDI system to generate incorrect diagnostic results, such as false alarms and missed detections. To partially recover the nominal performance, two approaches, which incorporate information regarding the engine s aging condition in the FDI system, will be discussed and evaluated. The results indicate that the proposed FDI system is promising for reliable diagnostics of aircraft engines.
Author
Aircraft Engines; Fault Detection; Kalman Filters; Systems Health Monitoring; Sensors; Actuators; Component Reliability

20030033034 Pennsylvania State Univ., University Park, PA, USA
Thrust Augmentation Measurements Using a Pulse Detonation Engine Ejector
Santoro, Robert J.; Pal, Sibtosh; March 2003; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG3-2657; WU-708-87-23
Report No.(s): NASA/CR-2003-212191; NAS 1.26:212191; E-13794; No Copyright; Avail: CASI; A03, Hardcopy

The present NASA GRC-funded three-year research project is focused on studying PDE driven ejectors applicable to a hybrid Pulse Detonation/Turbofan Engine. The objective of the study is to characterize the PDE-ejector thrust augmentation. A PDE-ejector system has been designed to provide critical experimental data for assessing the performance enhancements possible with this technology. Completed tasks include demonstration of a thrust stand for measuring average thrust for detonation tube multi-cycle operation, and design of a 72-in.-long, 2.25-in.-diameter (ID) detonation tube and modular ejector assembly. This assembly will allow testing of both straight and contoured ejector geometries. Initial ejectors that have been fabricated are 72-in.-long-constant-diameter tubes (4-, 5-, and 6-in.-diameter) instrumented with high-frequency pressure transducers. The assembly has been designed such that the detonation tube exit can be positioned at various locations within the ejector tube. PDE-ejector system experiments with gaseous ethylene/ nitrogen/oxygen propellants will commence in the very near future. The program benefits from collaborations with Prof. Merkle of University of Tennessee whose PDE-ejector analysis helps guide the experiments. The present research effort will increase the TRL of PDE-ejectors from its current level of 2 to a level of 3.
Author
Pulse Detonation Engines; Ejectors; Thrust Augmentation; Thrust Measurement

20030036911 Pittsburgh Univ., PA

Impermeable thin Al(2)O(3) overlay for TBC Protection from Sulfate and Vanadate Attack in Gas Turbines

Mao, S. X.; Aug. 31, 2002; In English

Report No.(s): DE2002-802866; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available

NTIS

Protective Coatings; Corrosion Resistance; Thermal Control Coatings; Gas Turbines

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*.

20030032935 Ohio State Univ., Columbus, OH

Robustness Study of the Dynamic Inversion Based Indirect Adaptive Control of Flight Vehicles with Uncertain Model Data

Yedavalli, Rama K.; Shankar, Praveen; Doman, David B.; Oct. 2002; 15 pp.; In English

Contract(s)/Grant(s): F33615-01-2-3154

Report No.(s): AD-A410308; ACC03-AIAA0020; AFRL-VA-WP-TP-2002-325; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this paper is to analyze the stability robustness of dynamic inversion based control laws being used for flight control with uncertainties in model data such as the aerodynamic stability and control derivatives. In particular, the proposed method is aimed at determining the robustness of an indirect adaptive control system developed by the researchers at the AFRL, which is built around a baseline dynamic inversion inner loop. MATLAB/SIMULINK is the environment used for the development and simulation of the flight controller.

DTIC

Adaptive Control; Aerodynamic Stability; Control Systems Design; Flight Vehicles; Dynamic Control; Mathematical Models; Robustness (Mathematics)

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20030032354 Army Research Lab., Hampton, VA, USA

A Survey of Research Performed at NASA Langley Research Center's Impact Dynamics Research Facility

Jackson, K. E.; Fasanella, E. L., Americ; [2003]; 21 pp.; In English; 44th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 7-10 Apr. 2003, Norfolk, VA, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2003-1896; No Copyright; Avail: CASI; A03, Hardcopy

The Impact Dynamics Research Facility (IDRF) is a 240-ft-high gantry structure located at NASA Langley Research Center in Hampton, Virginia. The facility was originally built in 1963 as a lunar landing simulator, allowing the Apollo astronauts to practice lunar landings under realistic conditions. The IDRF was designated a National Historic Landmark in 1985 based on its significant contributions to the Apollo Program. In 1972, the facility was converted to a full-scale crash test facility for light aircraft and rotorcraft. Since that time, the IDRF has been used to perform a wide variety of impact tests on full-scale aircraft and structural components in support of the General Aviation (GA) aircraft industry, the US Department of Defense, the rotorcraft industry, and NASA in-house aeronautics and space research programs. The objective of this paper is to describe most of the major full-scale crash test programs that were performed at this unique, world-class facility since 1974. The past research is divided into six sub-topics: the civil GA aircraft test program, transport aircraft test program, military test programs, space test programs, basic research, and crash modeling and simulation.

Author

Research Facilities; Flight Tests; Crashworthiness; Gantry Cranes; Destructive Tests; General Aviation Aircraft; Structural Reliability

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*.

20030033044 NASA Johnson Space Center, Houston, TX, USA
Expedition 7 Crew Interview: Ed Lu
April 25, 2003; In English
Report No.(s): JSC-1939B; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Ed Lu of Expedition Seven is seen during a pre-launch interview. He explains why he became interested in space flight. He states that this is a different type of mission and gives his reaction to the Columbia Space Shuttle tragedy. The handover of Expedition six is explained by Ed Lu. The challenges of this mission are also described by Lu. These challenges include working with a crew member reduction from three to two, and the conservation of clothing and consumables. Ed Lu talks about what it is like to work with commander Yuri Malenchenko in space. Finally, Ed Lu states that he will continue scientific experiments in space on calcium loss in bones.
CASI
Expeditions; Flight Crews; Soyuz Spacecraft; Spacecraft Launching

20030033047 NASA Johnson Space Center, Houston, TX, USA
Expedition 7 Crew Interview: Yuri Malenchenko
April 25, 2003; In English
Report No.(s): JSC-1939A; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

Cosmonaut Yuri Malenchenko of Expedition Seven is seen during a pre-launch interview. He begins by telling why he wanted to become a cosmonaut. Malenchenko expresses his reaction about the news of the Space Shuttle Columbia accident, and how this mission will be different from other missions. He also expresses the challenges that face Malenchenko and Ed Lu such as the crew reduction from three to two, less supplies and no space shuttle flights. Malenchenko says that he will have to work on a compressed schedule, which will make the mission even more challenging. A description of the handover of Expedition Six is given. Malenchenko and Ed Lu will be cramped in a confined space on the Soyuz Spacecraft for two days before docking, and he talks about this experience. Lastly, Malenchenko gives his thoughts on how it will be to work with Ed Lu in space, and tells of Lu's trustworthiness and reliability as a fellow crew member.
CASI
Cosmonauts; Expeditions; Soyuz Spacecraft; Spacecraft Launching; Space Flight

20030033116 Air Force Research Lab., Edwards AFB, CA, USA
Yes--This is Rocket Science: MMCs for Liquid Rocket Engines
Shelley, J. S.; LeClaire, R.; Miracle, D.; Nichols, J.; June 05, 2001; 49 pp.; In English
Contract(s)/Grant(s): F33615-97-C-5285; AF Proj. 4847
Report No.(s): AD-A410606; AFRL/PRS-ED-TP-2001-131; No Copyright; Avail: CASI; A03, Hardcopy

The Air Force's Integrated High-Payoff Rocket Propulsion Technologies (IHPRPT) Program has established aggressive goals for both improved performance and reduced cost of rocket engines and components. Achieving these goals relies on developing affordable Metal Matrix Composite (MMC) technologies for application to Liquid Rocket Engines (LREs). Efforts are being conducted on three types of MMCs: Aluminum, Copper, and Nickel matrix material systems. Potential applications include turbopump housings, rotating machinery, and high stiffness flanges and ductwork. This article will address affordability goals, and review the IHPRPT goals as well as the current material requirements for MMC technologies being developed for application to LREs. The authors conclude that MMCs are considered mid-term material solutions to rocket component needs. The potential to spread development costs over several industries make MMC technologies affordable to develop. The potential to tailor specific properties and produce near-net shape components with small capital investment promises to make MMC fabrication technologies affordable for the extremely low production rates of rocket engine components. On the current IHPRPT roadmaps, components employing MMCs should be demonstrated in 2005 with advances continuing through 2010. In the far term, weight and turbine inlet temperature goals may force the community away from metallic materials and toward ceramic and CMC material systems. Thermal and environmental coatings technologies will also require development. However, ductility requirements, geometric constraints, and environmental compatibility needs in rocket

engines ensure that metal matrix composites will play an important role in rocket technology development for the foreseeable future. The report includes 37 viewgraphs.
DTIC
Propellant Combustion; Liquid Propellant Rocket Engines; Materials; Development; Engine Parts; Metal Matrix Composites; Copper; Aluminum; Space Shuttles; Programs

20030033864 Morton Thiokol, Brigham City, UT, USA
Focus Control System for Solar Thermal Propulsion
Wassom, Steven R.; May 04, 2000; 12 pp.; In English
Contract(s)/Grant(s): F04611-97-C-0033; AF Proj. 1011
Report No.(s): AD-A410345; AFRL-PR-ED-TP-2000-105; No Copyright; Avail: CASI; A03, Hardcopy

The concept of solar thermal propulsion (STP) has been around for many years. One approach, shown in Figure 1, uses an off-axis parabolic concentrator mirror like a large magnifying glass to focus the sun's energy and heat-working fluid such as hydrogen to very high temperatures (3,000 K). The hydrogen is then expelled through a nozzle to produce thrust. This innovative concept is predicted to have twice the specific impulse of currently used chemical upper stage propulsion systems, and can therefore place twice the payload mass into geosynchronous orbit. Alternatively, smaller and cheaper launch vehicles can be used for the same payload size. The main drawback is the low thrust level of 0.1 to 10 lb, thus requiring trip times of 30-60 days. However, many payloads can tolerate longer trip times.
DTIC
Solar Thermal Propulsion; Control Systems Design; Inflatable Space Structures; Concentrators

20030033892 Air Force Research Lab., Edwards AFB, CA, USA
MicroPPT Development for Small Spacecraft Propulsion
Bushman, Stewart S.; White, David; Schilling, John H.; Spanjers, Gregory G.; Bromaghim, Daron R.; May 14, 2002; 3 pp.; In English
Contract(s)/Grant(s): F04611-00-C-0036; AF Proj. 3005
Report No.(s): AD-A410467; AFRL-PR-ED-AB-2002-112; No Copyright; Avail: CASI; A01, Hardcopy

A class of miniaturized pulsed plasma thrusters (PPT), known as MicroPPTs, is currently in development at the Air Force Research Laboratory. Operating by means of a surface discharge across a Teflon (TM) propellant fuel bar only a few millimeters in diameter, the MicroPPT delivers a thrust-to-power ratio of 5-10 Micro-N-s/J. In the near term, these thrusters can provide propulsive attitude control on 150-kilogram-class spacecraft using one-fifth the dry mass of conventional torque rods and reaction wheels. Eventually these thrusters are designed for primary and attitude control propulsion on future 25-kilogram-class spacecraft. Efforts to characterize MicroPPT performance and the thruster plume are underway. To this end, a modified torsional thrust stand has been developed for the purpose of accurately measuring the low-level thrust generated by the MicroPPT. A Herriott Cell interferometer is introduced to establish the plume electron and neutral densities. Comparison of the measured electron density with modeling predictions shows close agreement. Additionally, a Pockels cell has been developed to provide a zero-impedance MicroPPT breakdown voltage measurement, and an intensified CCD array has been used to characterize the divergence of both the thruster plume and the late-time particulate emission. A synopsis is presented of the status of the thruster's development, including lifetime, thermal, and environmental testing.
DTIC
Pulsed Plasma Thrusters; Spacecraft Propulsion; Technology Assessment; Solid Propellant Rocket Engines; Miniaturization; Thermodynamic Properties

20030034854 NASA, Washington, DC, USA
NASA Vision
Fenton, Mary, Editor; Wood, Jennifer, Editor; May 2003; 12 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This newsletter contains several articles, primarily on International Space Station (ISS) crewmembers and their activities, as well as the activities of NASA administrators. Other subjects covered in the articles include the investigation of the Space Shuttle Columbia accident, activities at NASA centers, Mars exploration, a collision avoidance test on a unmanned aerial vehicle (UAV). The ISS articles cover landing in a Soyuz capsule, photography from the ISS, and the Expedition Seven crew.
CASI
Columbia (Orbiter); International Space Station; Pilotless Aircraft; Collision Avoidance; Mars Exploration; Management; Spacecrews

13
ASTRODYNAMICS

Includes powered and free flight trajectories; orbital and launching dynamics.

20030032294 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Flight Dynamics Analysis Branch End of Fiscal Year 2002 Report
Mangus, David, Editor; Mendelsohn, Chad, Editor; Starin, Scott, Editor; Stengle, Tom, Editor; Truong, Son, Editor; December 2002; 118 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A06, Hardcopy

This report summarizes the major activities and accomplishments carried out by the Flight Dynamics Analysis Branch (FDAB), Code 572, in support of flight projects and technology development initiatives in Fiscal Year (FY) 2002. The report is intended to serve as a summary of the type of support carried out by the FDAB, as well as a concise reference of key accomplishments and mission experience derived from the various mission support roles. The primary focus of the FDAB is to provide expertise in the disciplines of flight dynamics including navigation, spacecraft trajectory design, attitude analysis, attitude determination and attitude control. The FDAB currently provides support for missions and technology development projects involving NASA, government, university, and private industry.
Author
Technology Utilization; Flight Mechanics; Flight Characteristics; Satellite Design; Systems Engineering; NASA Programs; Dynamic Models

20030032945 American Telephone and Telegraph Government Solutions, Vienna, VA, USA
Preliminary Planar Formation: Flight Dynamics Near Sun-Earth L2 Point
Segerman, Alan M.; Zedd, Michael F.; [2003]; 2 pp.; In English; 2003 AAS/AIAA Space Flight Mechanics Meeting, 9-12 Feb. 2003, Ponce, Puerto Rico; Copyright; Avail: CASI; A01, Hardcopy

NASA's Goddard Space Flight Center is planning a series of missions in the vicinity of the Sun-Earth L2 libration point. Some of these projects will involve a distributed space system of telescope spacecraft acting together as a single telescope for high-resolution. The individual telescopes will be configured in a plane, surrounding a hub, where the telescope plane can be aimed toward various astronomical targets of interest. In preparation for these missions, it is necessary to develop an improved understanding of the dynamical behavior of objects in a planar configuration near L2. The classical circular restricted three body problem is taken as the basis for the analysis. At first order, the motion of such a telescope relative to the hub is described by a system of linear second order differential equations. These equations are identical to the circular restricted problem's linear equations describing the hub motion about L2. Therefore, the fundamental frequencies, both parallel to and normal to the ecliptic plane, are the same for the relative telescope motion as for the hub motion. To maintain the telescope plane for the duration necessary for the planned observations, a halo-type orbit of the telescopes about the hub is investigated. By using a halo orbit, the individual telescopes remain in approximately the same plane over the observation duration. For such an orbit, the fundamental periods parallel to and normal to the ecliptic plane are forced to be the same by careful selection of the initial conditions in order to adjust the higher order forces. The relative amplitudes of the resulting oscillations are associated with the orientation of the telescope plane relative to the ecliptic. As in the circular restricted problem, initial conditions for the linearized equations must be selected so as not to excite the convergent or divergent linear modes. In a higher order analysis, the telescope relative motion equations include the effects of the position of the hub relative to L2. In this paper, the differential equations are developed through second order in the distance of the hub from the libration point. A modified Lindstedt-Poincad perturbation method is employed to construct the solution of these differential equations through that same order of magnitude. In the course of the solution process, relationships are determined between the initial conditions of the telescopes, selected in order to avoid resonance excitation. As the differential equations include the hub position, it is necessary to simultaneously develop the solution for the hub. As has been done in past analyses of the circular restricted problem, the hub position is written in a power series formulation in terms of its distance from L2. Then, in order to be included in the telescope equations, the hub solution is cast in terms of the nonlinear frequency of the relative telescope motion. In the course of the analysis, it is determined that the hub should also maintain a halo orbit - about L2. Additionally, relationships are formed between the initial conditions of the telescopes and the hub. These relationships may be used to associate sets of initial conditions with particular orientations of the telescope plane. The accuracy of the analytical solution is verified through various simulations and comparison to numerical integration of the differential equations. The results of the simulations are presented, along with a graphical representation of the relationships between the initial conditions of the telescopes and hub.
Author
Orbital Mechanics; Satellite Constellations; Three Body Problem; Spaceborne Telescopes

20030038806 NASA Langley Research Center, Hampton, VA, USA

Dynamics and Control of Attitude, Power, and Momentum for a Spacecraft Using Flywheels and Control Moment Gyroscopes

Roithmayr, Carlos M.; Karlgaard, Christopher D.; Kumar, Renjith R.; Seywald, Hans; Bose, David M.; April 2003; 87 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): RTOP 706-25-02-33

Report No.(s): NASA/TP-2003-212178; NAS 1.60:212178; L-18277; Copyright; Avail: CASI; A05, Hardcopy

Several laws are designed for simultaneous control of the orientation of an Earth-pointing spacecraft, the energy stored by counter-rotating flywheels, and the angular momentum of the flywheels and control moment gyroscopes used together as an integrated set of actuators for attitude control. General, nonlinear equations of motion are presented in vector-dyadic form, and used to obtain approximate expressions which are then linearized in preparation for design of control laws that include feedback of flywheel kinetic energy error as a means of compensating for damping exerted by rotor bearings. Two flywheel steering laws are developed such that torque commanded by an attitude control law is achieved while energy is stored or discharged at the required rate. Using the International Space Station as an example, numerical simulations are performed to demonstrate control about a torque equilibrium attitude, and illustrate the benefits of kinetic energy error feedback. Control laws for attitude hold are also developed, and used to show the amount of propellant that can be saved when flywheels assist the CMGs. Nonlinear control laws for large-angle slew maneuvers perform well, but excessive momentum is required to reorient a vehicle like the International Space Station.

Author

Spacecraft Control; Attitude Control; Control Moment Gyroscopes; Flywheels; Control Systems Design; Control Simulation; Control Theory; Equations Of Motion

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

20030032429 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Space Based Communications

Simpson, James; Denson, Erik; Valencia, Lisa; Birr, Richard; [2003]; 9 pp.; In English; Space Congress, 29 Ap. - 1 May 2003, Cape Canaveral, FL, USA; Original contains black and white illustrations

Report No.(s): KSC-2003-024; No Copyright; Avail: CASI; A02, Hardcopy

Current space lift launches on the Eastern and Western Range require extensive ground-based real-time tracking, communications and command/control systems. These are expensive to maintain and operate and cover only limited geographical areas. Future spaceports will require new technologies to provide greater launch and landing opportunities, support simultaneous missions, and offer enhanced decision support models and simulation capabilities. These ranges must also have lower costs and reduced complexity while continuing to provide unsurpassed safety to the public, flight crew, personnel, vehicles and facilities. Commercial and government space-based assets for tracking and communications offer many attractive possibilities to help achieve these goals. This paper describes two NASA proof-of-concept projects that seek-to exploit the advantages of a space-based range: Iridium Flight Modem and Space-Based Telemetry and Range Safety (STARS). Iridium Flight Modem uses the commercial satellite system Iridium for extremely low cost, low rate two-way communications and has been successfully tested on four aircraft flights. A sister project at Goddard Space Flight Center's (GSFC) Wallops Flight Facility (WFF) using the Globalstar system has been tested on one rocket. The basic Iridium Flight Modem system consists of a L1 carrier Coarse/Acquisition (C/A)-Code Global Positioning System (GPS) receiver, an on-board computer, and a standard commercial satellite modem and antennas. STARS uses the much higher data rate NASA owned Tracking and Data Relay Satellite System (TDRSS), a C/A-Code GPS receiver, an experimental low-power transceiver, custom built command and data handler processor, and digitized flight termination system (FTS) commands. STARS is scheduled to fly on an F-15 at Dryden Flight Research Center in the spring of 2003, with follow-on tests over the next several years.

Author

Spacecraft Launching; Satellite Communication; Flight Tests; Command And Control; Ground Support Systems; Spacecraft Tracking; Space Surveillance (Spaceborne); Spacecraft Landing

20030032478 InDyne, Inc., Cocoa Beach, FL, USA
Chronology of KSC and KSC Related Events for 2002
Liston, Elaine E.; February 2003; 85 pp.; In English
Report No.(s): NASA/TM-2003-211183; NAS 1.15:211183; No Copyright; Avail: CASI; A05, Hardcopy

This document is intended to serve as a record of KSC events and is a reference source for historians and other researchers. Arrangement is by day and month and individual articles are attributed to published sources. Materials were researched and described by the KSC Library Archivist for KSC Library Services Contractor, InDyne, Inc.
Author
Launch Vehicles; Space Shuttle Orbiters; Launching; Landing; Schedules; Payloads; Operations; Cape Kennedy Launch Complex

20030033052 NASA Johnson Space Center, Houston, TX, USA
Expedition 7 Crew Training Clip
April 25, 2003; In English
Report No.(s): JSC-1939; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

This video shows the Expedition 7 crew of the International Space Station (ISS) during various training activities prior to launch. The crew consisted of Commander Yuri Malenchenko and Flight Engineer Ed Lu. At the virtual reality lab, the two astronauts work at a control panel, with Lu operating a joystick and speaking on earphones. Another section of the video shows Lu and Malenchenko inputting data into laptop computers, Lu testing an intercom and a video camera, and Lu using a machine to analyze blood samples from the crew. At the neutral buoyancy lab, the astronauts are helped in suit-up. The attachment of their gloves is shown. The video ends with Lu and Malenchenko lowered into a pool on a platform.
CASI
International Space Station; Spacecrews; Virtual Reality; Neutral Buoyancy Simulation

20030034662 Massachusetts Univ., Amherst, MA, USA
Decision-Theoretic Control of Planetary Rovers
Zilberstein, Shlomo; Washington, Richard; Bernstein, Daniel S.; Mouaddib, Abdel-Illah; Morris, Robert, Technical Monitor; [2003]; 19 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG2-1463; Copyright; Avail: CASI; A03, Hardcopy

Planetary rovers are small unmanned vehicles equipped with cameras and a variety of sensors used for scientific experiments. They must operate under tight constraints over such resources as operation time, power, storage capacity, and communication bandwidth. Moreover, the limited computational resources of the rover limit the complexity of on-line planning and scheduling. We describe two decision-theoretic approaches to maximize the productivity of planetary rovers: one based on adaptive planning and the other on hierarchical reinforcement learning. Both approaches map the problem into a Markov decision problem and attempt to solve a large part of the problem off-line, exploiting the structure of the plan and independence between plan components. We examine the advantages and limitations of these techniques and their scalability.
Author
Roving Vehicles; Unmanned Ground Vehicles; Decision Theory; Markov Processes; Mathematical Models; Control Theory

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*.

20030032947 Aerospace Corp., El Segundo, CA
The Removal of Silicone Contaminants from Spacecraft Hardware
Luey, K.; Coleman, D. J.; Sep 2002; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A410311; TR-2002(8565)-6; No Copyright; Avail: CASI; A03, Hardcopy

Silicone compounds are found in a wide variety of aerospace applications and are thus frequently encountered in ground processing accidents. Silicones are largely inert with respect to many chemical reactions, which make them highly desirable as sealants, adhesives, and vacuum pumping fluids. However, this same property makes them difficult to remove. In the course of several major accidents in the last five years, many cleaning approaches have been used. The most common approach has

been the use of isopropyl alcohol (IPA). In this report, we test the solubility of various silicone products in an array of organic solvents and two commercial cleaning agents. The solubility was evaluated by visually assessing the turbidity of the solution. Good solubility is observed for most silicones in hexane, heptane, and toluene. Only modest solubility was observed for the commercial cleaners. Initially, silicones were found to be insoluble in IPA. However, with extended time of up to 20 min, or slightly elevated temperature, silicones were seen to eventually dissolve in IPA. Thus, IPA could be an effective remover of silicones if the contaminated part can be immersed in an IPA bath. Silicone removal using CO sub 2 jet spray is also discussed.
DTIC
Silicones; Solubility; Computers; Decontamination; Chemical Cleaning

20030034603 Air Force Research Lab., Edwards AFB, CA, USA
A Non-Magnetic Ion Micro-Thruster for Small Spacecraft Applications
Young, Marc; Muntz, E. P.; Ketsdever, Andrew D.; Jul. 1998; 15 pp.; In English
Contract(s)/Grant(s): AF Proj. 3058
Report No.(s): AD-A410235; AFRL-PR-ED-TP-1998-147; No Copyright; Avail: CASI; A03, Hardcopy

The applicability of a unique discharge chamber, previously studied by VI Miljevic, as the ion source for a meso-scale ion thruster was investigated. The discharge chamber geometry was chosen due to promising results which appear to alleviate the requirement of external magnetic fields, while achieving an adequate degree of ionization. The earlier results from spectroscopic studies done on a similar discharge chamber indicated a high degree of ionization, therefore making it a possible configuration for an ion thruster. An estimate of the degree of ionization made using a simple model of the discharge chamber showed a lack of ionization which warranted further examination of Miljevic's work. The previous spectroscopic studies were reinvestigated and discrepancies were found. Additional spectroscopic and Langmuir probe measurements are made in the plume to determine degree of ionization of the discharge chamber of several operating conditions. The degree of ionization was experimentally shown to be 0.06-0.1\%. S simple extraction ring increases the degree of ionization by roughly a factor of 3.
DTIC
Spacecraft Propulsion; Mesoscale Phenomena; Electrostatic Probes; Launch Vehicles; Microthrust

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*.

20030033907 NASA Langley Research Center, Hampton, VA, USA
Analysis of a Radiation Model of the Shuttle Space Suit
Anderson, Brooke M.; Nealy, John E.; Kim, Myung-Hee; Qualls, Garry D.; Wilson, John W.; March 2003; 41 pp.; In English
Contract(s)/Grant(s): RTOP 732-50-00-01
Report No.(s): NASA/TP-2003-212158; NAS 1.60:212158; L-18235; Copyright; Avail: CASI; A03, Hardcopy

The extravehicular activity (EVA) required to assemble the International Space Station (ISS) will take approximately 1500 hours with 400 hours of EVA per year in operations and maintenance. With the Space Station at an inclination of 51.6 deg the radiation environment is highly variable with solar activity being of great concern. Thus, it is important to study the dose gradients about the body during an EVA to help determine the cancer risk associated with the different environments the ISS will encounter. In this paper we are concerned only with the trapped radiation (electrons and protons). Two different scenarios are looked at: the first is the quiet geomagnetic periods in low Earth orbit (LEO) and the second is during a large solar particle event in the deep space environment. This study includes a description of how the space suit's computer aided design (CAD) model was developed along with a description of the human model. Also included is a brief description of the transport codes used to determine the total integrated dose at several locations within the body. Finally, the results of the transport codes when applied to the space suit and human model and a brief description of the results are presented.
Author
Radiation Dosage; Space Suits; Radiation Protection; Trapped Particles; Human Beings; Models

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*.

20030032295 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Initialization of Formation Flying Using Primer Vector Theory
Mailhe, Laurie; Schiff, Conrad; Folta, David; January 2002; 8 pp.; In English; International Symposium on Formation Flying Missions and Technology, 29-31 Oct. 2002, Toulouse, France; Copyright; Avail: CASI; A02, Hardcopy

In this paper, we extend primer vector analysis to formation flying. Optimization of the classical rendezvous or free-time transfer problem between two orbits using primer vector theory has been extensively studied for one spacecraft. However, an increasing number of missions are now considering flying a set of spacecraft in close formation. Missions such as the Magnetospheric MultiScale (MMS) and Leonardo-BRDF (Bidirectional Reflectance Distribution Function) need to determine strategies to transfer each spacecraft from the common launch orbit to their respective operational orbit. In addition, all the spacecraft must synchronize their states so that they achieve the same desired formation geometry over each orbit. This periodicity requirement imposes constraints on the boundary conditions that can be used for the primer vector algorithm. In this work we explore the impact of the periodicity requirement in optimizing each spacecraft transfer trajectory using primer vector theory. We first present our adaptation of primer vector theory to formation flying. Using this method, we then compute the AV budget for each spacecraft subject to different formation endpoint constraints.
Author
Formation Flying; Vectors (Mathematics); Trajectory Optimization; Spacecraft Trajectories; Transfer Orbits

20030032361 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The LISA Integrated Model
Merkowitz, Stephen M.; [2002]; 7 pp.; In English; LISA Symposium, 19-24 Jul. 2002, PA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Laser Interferometer Space Antenna (LISA) space mission has unique needs that argue for an aggressive modeling effort. These models ultimately need to forecast and interrelate the behavior of the science input, structure, optics, control systems, and many other factors that affect the performance of the flight hardware. In addition, many components of these integrated models will also be used separately for the evaluation and investigation of design choices, technology development and integration and test. This article presents an overview of the LISA integrated modeling effort.
Author
Dynamic Models; Lisa (Observatory); Spacecraft Instruments; Performance Prediction; Systems Engineering; Systems Integration; Systems Simulation; Aerospace Engineering

20030032967 Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil
Development of an Electrostatic Energy Analyzer (ESA) for EQUARS Scientific Satellite
Dallaqua, RenatoSegio; Tan, IngHwie; Alves, MariaVirginia; delBosco, Edson; [2003]; 37 pp.; In English; Original contains black and white illustrations
Report No.(s): INPE-9603-NTC/352; Copyright; Avail: CASI; A03, Hardcopy

We present in this report the development of an electrostatic energy analyzer to be launched onboard the EQUARS Scientific Satellite. The instrument will be capable to detect electron beams with energies in the 0.1 - 40 keV range. This document concerns mainly with the scientific objectives and the mass and power requirements of the instrument.
Author
Electron Beams; Satellite Instruments; Charged Particles; Wave Propagation; Data Processing; Design Analysis; Structural Design

20030036954 NASA Goddard Space Flight Center, Greenbelt, MD, USA
JASON-1 Precise Orbit Determination (POD) Through the Combination and Comparison of GPS, SLR, DORIS and Altimeter Crossover Data
Luthcke, S. B.; Zelensky, N. P.; Lemoine, Frank G.; Chinn, D. S.; Williams, T. A.; [2002]; 1 pp.; In English; American Geophysical Union Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

Jason-1, launched on December 7, 2001, is continuing the time series of centimeter level ocean topography observations as the follow-on to the highly successful TOPEX/POSEIDON (T/P) radar altimeter satellite. The precision orbit determination (POD) is a critical component to meeting the ocean topography goals of the mission. T/P has demonstrated that the time variation of ocean topography can be determined with an accuracy of a few centimeters, thanks to the availability of highly accurate orbits based primarily on SLR+DORIS tracking. The Jason-1 mission is intended to continue measurement of the ocean surface with the same, if not better accuracy. Fortunately, Jason-1 POD can rely on four independent tracking data types available including near continuous tracking data from the dual frequency codeless BlackJack GPS receiver. Orbit solutions computed using individual and various combinations of GPS, SLR, DORIS and altimeter crossover data types have been determined from over 100 days of Jason-1 tracking data. The performance of the orbit solutions and tracking data has been evaluated. Orbit solution evaluation and comparison has provided insight into possible areas of refinement. Several aspects of the POD process are examined to obtain orbit improvements including measurement modeling, force modeling and solution strategy. The results of these analyses will be presented.
Author
Satellite Altimetry; Orbit Determination; Satellite Tracking; Global Positioning System; Satellite Orbits; Data Processing

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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*.

20030036992 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GEOSAT Follow-on (GFO) Altimeter Document Series, Volume 3, GFO Altimeter Engineering Assessment Report, Version 1
Hancock, David W., III; Hayne, George S.; Brooks, Ronald E.; Lockwood, Dennis W.; March 2002; 73 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): RTOP 622-47-36-02
Report No.(s): NASA/TM-2002-209984/VER1/VOL3; NAS 1.15:209984/VER1/VOL3; Rept-2002-01549-0; No Copyright; Avail: CASI; A04, Hardcopy

The U.S. Navy's Geosat Follow-On (GFO) Mission, launched on February 20, 1998, is one of a series of altimetric satellites which include Seasat, Geosat, ERS-1, and TOPEX/POSEIDON (T/P). The purpose of this report is to document the GFO altimeter performance determined from the analyses and results performed by NASA's GSFC and Wallops altimeter, calibration team. It is the second of an anticipated series of NASA's GSFC and Wallops GFO performance documents, each of which will update assessment results. This report covers the performance from instrument acceptance by the Navy on November 29, 2000, to the end of Cycle 20 on November 21, 2001. Data derived from GFO will lead to improvements in the knowledge of ocean circulation, ice sheet topography, and climate change. In order to capture the maximum amount of information from the GFO data, accurate altimeter calibrations are required for the civilian data set which NOAA will produce. Wallops Flight Facility has provided similar products for the Geosat and T/P missions and is doing the same for GFO.
Author
Altimeters; Geosat Satellites; Topography; Ocean Surface; Satellite Instruments; Satellite Altimetry; Satellite-Borne Radar

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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*.

20030032338 NASA Glenn Research Center, Cleveland, OH, USA
High-Performance, Space-Storable, Bi-Propellant Program Status
Schneider, Steven J.; [2002]; 14 pp.; In English; Propulsion Engineering Research Center 14th Annual Symposium on Propulsion, 10-11 Dec. 2002, PA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Bipropellant propulsion systems currently represent the largest bus subsystem for many missions. These missions range from low Earth orbit satellite to geosynchronous communications and planetary exploration. The payoff of high performance bipropellant systems is illustrated by the fact that Aerojet Redmond has qualified a commercial NTO/MMH engine based on the high Isp technology recently delivered by this program. They are now qualifying a NTO/hydrazine version of this engine. The advanced rhenium thrust chambers recently provided by this program have raised the performance of earth storable propellants from 315 sec to 328 sec of specific impulse. The recently introduced rhenium technology is the first new technology introduced to satellite propulsion in 30 years. Typically, the lead time required to develop and qualify new chemical thruster technology is not compatible with program development schedules. These technology development programs must be supported by a long term, Base R&T Program, if the technology s to be matured. This technology program then addresses the need for high performance, storable, on-board chemical propulsion for planetary rendezvous and descent/ascent. The primary NASA customer for this technology is Space Science, which identifies this need for such programs as Mars Surface Return, Titan Explorer, Neptune Orbiter, and Europa Lander. High performance (390 sec) chemical propulsion is estimated to add 105\% payload to the Mars Sample Return mission or alternatively reduce the launch mass by 33\%. In many cases, the use of existing (flight heritage) propellant technology is accommodated by reducing mission objectives and/or increasing enroute travel times sacrificing the science value per unit cost of the program. Therefore, a high performance storable thruster utilizing fluorinated oxidizers with hydrazine is being developed.
Derived from text
Chemical Propulsion; Liquid Rocket Propellants; Storable Propellants; Technology Utilization; NASA Programs

20030033102 Air Force Research Lab., Edwards AFB, CA, USA
High Performance Hall System Info for AIAA Short Course to be Taught by Roger Myers of Primex
McFall, Keith; July 08, 1998; 3 pp.; In English
Contract(s)/Grant(s): F04611-97-C-0064; AF Proj. 4373
Report No.(s): AD-A410592; AFRL/PRS-AFRL-PR-ED-TP-1998-123; No Copyright; Avail: CASI; A01, Hardcopy
The USA Air Force's Air Force Research Laboratory is supporting the development and ground demonstration of a 4.5 kW class Hall Effect Thruster propulsion system under the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program. Flight derivatives of this system will be applicable to orbit raising, station-keeping, and maneuvering applications. The High Performance Hall System (HPHS) program, a four-year effort begun in September 1997, is projected to meet the Phase I IHPRPT spacecraft goal of improving total impulse over wet mass by 20\%. The jointly funded government/industry effort includes the qualification of a flight-like thruster and power processing unit, and an integrated system demonstration. The contractor team is lead by Atlantic Research Corporation and includes International Space Technology Incorporated Space Systems/Loral, and Engineering Design Bureau/Fakel.
DTIC
Rocket Propellants; Propulsion

20030033104 Air Force Research Lab., Edwards AFB, CA, USA
Advanced Expander Combustor (AEC) Hot Firing Test Results
Fentress, Steve; Cooley, Christine; Spero, Eric; January 28, 2002; 5 pp.; In English
Contract(s)/Grant(s): F04611-95-C-0123; AF Proj. 1011
Report No.(s): AD-A410589; AFRL/PRS-AFRL-PR-ED-AB-2002-016; No Copyright; Avail: CASI; A01, Hardcopy
This paper summarizes the test results of a full scale copper tubular combustion chamber for application in a high thrust Upper Stage Expander Cycle Engine. The chamber was developed by Pratt & Whitney Liquid Space Propulsion under contract for the USA Air Force Research Laboratory (AFRL). The Advanced Expander Copper Tubular Combustor (AEC) was hot fire tested on Pratt & Whitney's E8 component test facility in July 2001 and demonstrated the necessary heat load capacity and coolant pressure drop characteristics to support future high thrust expander engine applications.
DTIC
Combustion Chambers; Liquid Propellant Rocket Engines; Engine Tests; Test Firing

20030033861 Air Force Research Lab., Edwards AFB, CA, USA
High Performance Hall Thruster Ground Demo
Fife, John M.; Sep. 1999; 16 pp.; In English
Contract(s)/Grant(s): F04611-97-C-0064; AF Proj. 4373
Report No.(s): AD-A410320; AFRL-PR-ED-TP-FY99-0182; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Hall Thrusters; Spacecraft Propulsion; Technology Utilization; Electric Rocket Engines; Propulsion System Performance

20030034605 ENERGY RESEARCH CONSULTANTS INC LAGUNA HILLS CA
Hemispherical Measurements of the SPT - 140 Plume
Engelman, S. F.; Fife, John M.; June 18, 2002; 7 pp.; In English
Contract(s)/Grant(s): AF Proj. 4847
Report No.(s): AD-A410330; AFRL-PR-ED-TP-2002-157; No Copyright; Avail: CASI; A02, Hardcopy

The results of a 3-dimensional hemispherical Faraday probe rake assembly are investigated. Such a system is attractive because it allows measurement of current density at multiple locations simultaneously, and can be used to detect asymmetry in the Hall Effect thruster (HET) beam. For ease of correlation, experiments were conducted using Faraday probes and biasing techniques similar to other organizations within the EP community. Results can be used to validate simulations and to gain an understanding of the proper positioning of HETs on spacecraft. Additionally, the effects of varying the Faraday electrode material are presented.
DTIC
Hall Effect; Plumes; Faraday Effect; Plasma Engines; Spacecraft Propulsion; Thrust

20030034620 Atlantic Research Corp., Alexandria, VA
Additions to the Industry Paper for the 1998 JPC, Attachment 1
July 07, 1998; 3 pp.; In English
Contract(s)/Grant(s): F04611-97-C-0064; AF Proj. 4373
Report No.(s): AD-A410413; AFRL-PR-ED-TP-1998-134; No Copyright; Avail: CASI; A01, Hardcopy

Atlantic Research Corporation (ARC) was awarded a IHPRPT contract by the Air Force Research Laboratory (AFRL), Edwards AFB, for a 4.5 kW high Performance Hall System developed by International Space Technology, Inc (ISTI) and based on the Fakel SPT-140 and the Space Systems/Loral (SS/L) power processor technology. This contract builds upon the successful ISTI SPT-l40 development program started in early 1996 and will demonstrate a complete propulsion system by 2000. In this IHPRPT program the team of ARC, ISTI, Fakel, SS/L and RIAME have conducted the thruster PDR, built the development model thruster and initiated acceptance testing of the thruster. In addition, SS/L has initiated development of the PPU for the SPT-l40.
DTIC
Aerospace Engineering; Industries; Technology Utilization; Solid Propellant Rocket Engines; Spacecraft Propulsion

20030034700 Air Force Research Lab., Edwards AFB, CA, USA
New Materials Design
Boatz, Jerry; Gordon, Mark S.; Voth, Gregory; Hammes-Schiffer, Sharon; Pachter, Ruth; May 17, 2002; 11 pp.; In English
Contract(s)/Grant(s): AF Proj. 2303
Report No.(s): AD-A410653; AFRL-PR-ED-TP-2002-117; No Copyright; Avail: CASI; A03, Hardcopy

The identification, development, and formulation of new energetic materials for advanced rocket propulsion applications is an area of long standing interest to the Air Force. The performance limits of currently used propellants have been reached, so new energetic compounds are required to significantly improve the ability of the warfighter to access and control space.
DTIC
Rocket Propellants; Energy Transfer

20030034746 Air Force Research Lab., Edwards AFB, CA, USA
Aerophysics
Levine, Jay; May 20, 1999; 22 pp.; In English
Contract(s)/Grant(s): AF Proj. 5503
Report No.(s): AD-A410701; AFRL-PR-ED-TP-99-0105; No Copyright; Avail: CASI; A03, Hardcopy

Viewing slides for presentation on Air Force research in propulsion systems under the auspices of the Propulsion Directorate, Edwards Air Force Base, California.
DTIC
Propulsion System Configurations; Propulsion System Performance; Atmospheric Physics

20030036998 NASA Marshall Space Flight Center, Huntsville, AL, USA
Pulse Detonation Rocket Magnetohydrodynamic Power Experiment
Litchford, R. J.; Jones, J. E.; Dobson, C. C.; Cole, J. W.; Thompson, B. R.; Plemmons, D. H.; Turner, M. W.; February 2003; 45 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TP-2003-212284; NAS 1.60:212284; M-1063; Copyright; Avail: CASI; A03, Hardcopy

The production of onboard electrical power by pulse detonation engines is problematic in that they generate no shaft power; however, pulse detonation driven magnetohydrodynamic (MHD) power generation represents one intriguing possibility for attaining self-sustained engine operation and generating large quantities of burst power for onboard electrical systems. To examine this possibility further, a simple heat-sink apparatus was developed for experimentally investigating pulse detonation driven MHD generator concepts. The hydrogen oxygen fired driver was a 90 cm long stainless steel tube having a 4.5 cm square internal cross section and a short Schelkin spiral near the head end to promote rapid formation of a detonation wave. The tube was intermittently filled to atmospheric pressure and seeded with a CsOH/methanol prior to ignition by electrical spark. The driver exhausted through an aluminum nozzle having an area contraction ratio of A*/A(sub zeta) = 1/10 and an area expansion ratio of A(sub zeta)/A* = 3.2 (as limited by available magnet bore size). The nozzle exhausted through a 24-electrode segmented Faraday channel (30.5 cm active length), which was inserted into a 0.6 T permanent magnet assembly. Initial experiments verified proper drive operation with and without the nozzle attachment, and head end pressure and time resolved thrust measurements were acquired. The exhaust jet from the nozzle was interrogated using a polychromatic microwave interferometer yielding an electron number density on the order of 10(exp 12)/cm at the generator entrance. In this case, MHD power generation experiments suffered from severe near-electrode voltage drops and low MHD interaction; i.e., low flow velocity, due to an inherent physical constraint on expansion with the available magnet. Increased scaling, improved seeding techniques, higher magnetic fields, and higher expansion ratios are expected to greatly improve performance.
Author
Magnetohydrodynamics; Pulse Detonation Engines; Heat Sinks; Pulse Generators; Spacecraft Power Supplies; Spacecraft Propulsion; Magnetohydrodynamic Generators

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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*.

20030032472 Iowa Univ., Iowa City, IA, USA
Emulsion Liquid Membrane Extraction in a Hollow-Fiber Contactor
Wiencek, John M.; Hu, Shih-Yao; Chemical Engineering Technology; 2000; ISSN 0930-7516; Volume 23, No. 6, pp. 551-553; In English; Extracted from document 2003026665
Contract(s)/Grant(s): NAG8-1588; Copyright; Avail: Other Sources

Supported emulsion liquid membranes (SELMs) can be used in a variety of applications ranging from wastewater treatment to recovery of valuable fermentation byproducts. The use of a hollow-fiber contactor avoids the mixing between the feed stream and the extracting phase while providing a large contacting area for extraction. The use of an emulsion liquid membrane eliminates the equilibrium limitation of conventional liquid-liquid extraction and substantially improves the efficiency as well as the capacity of separation. In principle. SELMs do not require the use of a surfactant, greatly simplifying the downstream demulsification and product recovery processes. This provides a substantial reduction in energy and volume requirements for the unit. The presence of the stripping phase will sustain a high driving force for the extraction; thus, reducing or eliminating the need for extractants which are likely to be toxic as well as expensive.
Derived from text
Solvent Extraction; Emulsions; Membranes; Fibers; Contactors

20030032923 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Polyhedral Oligomeric Silsesquioxane (POSS) Styrene Macromers
Haddad, Timothy S.; Viers, Brent D.; Phillips, Shawn H.; November 20, 2001; 20 pp.; In English
Contract(s)/Grant(s): AF Proj . 2303
Report No.(s): AD-A410398; AFRL-PR-ED-TP-2001-228; AFRL-PR-ED-TP-2001-228; No Copyright; Avail: CASI; A03, Hardcopy

Four polyhedral oligomeric silsesquioxane (POSS) macromers, R7Si8O12Styrene (R = isobutyl, cyclopentyl, cyclohexyl or phenyl) containing a single polymerizable styrene unit were synthesized from the POSS-trisilanols R7Si7O9(OH)3 in high yield and purity. The base-assisted reaction to produce these macromers appears to be general for POSS-trisilanols of this type. However, in some cases it may be necessary to control the rate at which base is present during reaction to prevent unwanted side reactions that decompose the trisilanol. Cyclohexyl, cyclopentyl and isobutyl substituted POSS-stryenes (at 30 weight %

loadings) undergo free radical bulk polymerizations with styrene to produce polymers with an enhanced modulus above the glass transition temperature. The phenylPOSS-derivative is too insoluble in styrene to undergo this polymerization. The effect on modulus is more pronounced for the copolymers containing 30 weight % cycloalkylPOSS than that seen with isobutylPOSS. The effect of the group at the POSS cage on bulk polymer properties has been noted before and is presumed to arise from differences in polymer microstructure.
DTIC
Polymerization; Styrenes; Synthesis (Chemistry)

20030032997 NASA Marshall Space Flight Center, Huntsville, AL, USA
Dwell Time and Surface Parameter Effects on Removal of Silicone Oil From D6ac Steel Using TCA
Boothe, R. E.; April 2003; 25 pp.; In English
Report No.(s): NASA/TM-2003-212345; NAS 1.15:212345; M-1073; No Copyright; Avail: CASI; A03, Hardcopy
This study was conducted to evaluate the impact of dwell time, surface roughness, and the surface activation state on 1,1,1-trichloroethane's (TCA's) effectiveness for removing silicone oil from D6ac steel. Silicone-contaminated test articles were washed with TCA solvent, and then the surfaces were analyzed for residue, using Fourier transform infrared spectroscopy. The predominant factor affecting the ability to remove the silicone oil was surface roughness.
Author
Infrared Spectroscopy; Fourier Transformation; Silicones; Oils; Dwell; Steels; Surface Roughness Effects; Solvents

20030033098 Army Engineer Research and Development Center, Vicksburg, MS, USA
Dredged Material Composting at Milwaukee and Green Bay, WI, Confined Disposal Facilities
Jan. 2003; 18 pp.; In English
Report No.(s): AD-A410585; ERDC-TN-DOER-C33; No Copyright; Avail: CASI; A03, Hardcopy
This technical note reports results from demonstration-scale studies of dredged material composting at the Jones Island confined disposal facility (CDF) , Milwaukee, WI, and the Bayport CDF, Green Bay, WI. The purpose of these studies was to determine the feasibility of bioremediating dredged material contaminated with polycyclic aromatic hydrocarbons (PAHs) and polychiorinated biphenyls (PCBs). This is the third in a series of technical notes on the feasibility of using low-cost and relatively passive biotechnology to reduce hydrophobic organic chemical concentrations in dredged material. The first technical note (Myers and Bowman 1999) described initial studies at the Milwaukee CDF. The second technical note (Myers and Williford 2000) provided an overview of bioremediation technologies that show promise for practical application to hydrophobic organic compounds in dredged material.
DTIC
Dredged Materials; Organic Compounds

20030033879 Air Force Research Lab., Edwards AFB, CA, USA
Poly(Dimethysiloxanes) Modified with Inorganic Polyhedra
Haddad, Timothy S.; Lee, Andre; Phillips, Shawn H.; Jan. 2001; 4 pp.; In English
Contract(s)/Grant(s): AF Proj. 2303
Report No.(s): AD-A410326; AFRL-PR-ED-TP-2001-027; No Copyright; Avail: CASI; A01, Hardcopy
There has been recent interest in using polyhedral oligomeric silsesquioxanes (POSS) as molecular building blocks in many polymer systems This interest is driven by significant property enhancements imparted by dispersion of a covalently bound nanosized inorganic particulate into an organic matrix. Most of the work to date has focused on thermoplastic hybrid inorganic/organic polymers derived from either a triol or a diol-silsesquioxane.
DTIC
Polyhedrons; Polysiloxanes; Dimethyl Compounds; Copolymers

20030033884 Osaka Inst. of Tech., Japan
Effect of Segmented Polyurethane Coating on Thrombus Regulated With Pulsatile Shear Flow
Hashimoto, Shigehiro; Murashige, Yoshinori; Yamanaka, Atsushi; Otani, Hajime; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410431; No Copyright; Avail: CASI; A01, Hardcopy
The effect of segmented polyurethane coating on thrombus formation was quantitatively studied under shear field in vitro. The Couette-type of shear rate was applied to the canine blood between the concave and the convex cones, Variation was made about materials of cones: Polymethyl-methacrylate, polyvinyl chloride, and polyvinyl chloride coated with segmented

polyurethane The study shows that the clotting time extends on the segmented polyurethane especially at the higher shear rates, although the clot ratio is in the same level as that of without coating. This clotting time extension should regulate thrombus formation under pulsatile shear flow.
DTIC
Coatings; Polyurethane Resins; Shear Flow; Polyvinyl Chloride; Thrombosis

20030033891 Electric Power Research Inst., Palo Alto, CA, Southwest Research Inst., San Antonio, TX
Combustion Turbine (CT) Hot Section Coating Life Management
Viswanathan, R.; Krzywosz, K.; Cheruvu, S.; Wan, E.; Aug. 09, 2002; In English
Report No.(s): DE2002-803736; No Copyright; Avail: National Technical Information Service (NTIS)

The integrity of coatings used in hot section components of combustion turbine is crucial to the reliability of the buckets. This project was initiated in recognition of the need for predicting the life of coatings analytically, and nondestructively; Correspondingly, three principal tasks were established. Task 1, with the objective of analytically developing stress, strain and temperature distributions in the bucket and thereby predicting thermal fatigue (TMF) damage for various operating conditions; Task 2 with the objective of developing eddy current techniques to measure both TMF damage and general degradation of coatings and, Task 3, with the objective of developing mechanism based algorithms. This report is a record of the progress to date on these 3 key tasks. Two supporting tasks relating to field validation (Task 4) and economic analysis (Task 5) have not yet been initiated.
NTIS
Protective Coatings; Combustion Chambers; Refractory Coatings; Engine Parts

20030033929 Space Physics Research Inst., Sunnyvale, CA, USA
Theoretical Studies of Molecular Spectra
McKay, Christopher, Technical Monitor; Freedman, Richard S.; [2002]; 5 pp.; In English
Contract(s)/Grant(s): NCC2-1068; No Copyright; Avail: CASI; A01, Hardcopy

This summary describes the research activities of the principal investigator during the reporting period. The research includes spectroscopy, management of molecular databases, and generation of spectral line profiles and opacity data. The spectroscopy research includes oxygen broadening of nitric oxide (NO), analysis of CO2 spectra, analysis of HNO3 spectra, and analysis of CO spectra.
Derived from text
Molecular Spectra; Spectroscopy; Data Bases; Line Spectra; Opacity

20030034628 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Gas Phase Reaction Kinetics of O-Atoms with (CH3)2NNH2, CH3NHNH2 and N2H4, and Branching Ratios of the OH Product
Vaghjiani, Ghanshyam L.; March 16, 2001; 42 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; AF Proj. 2308
Report No.(s): AD-A410221; AFRL-PR-ED-TP-2001-060; No Copyright; Avail: CASI; A03, Hardcopy

The gas phase reaction kinetics of O-atoms with the two alkylated di-amine rocket fuels (CH3)2NNH2 and CH3NHNH2 was studied in a discharge flow-tube apparatus under pseudo first-order conditions in O-atom. Direct vuv cw-resonance fluorescence monitoring of the O-atom temporal profiles in a known excess of the DI-AMINE yielded the following absolute second-order O-atom rate coefficient expressions; k(sub j) = (1.94 + or - 0.34) x 10(exp -11) e(25 + or - 25)/T and k2 = (2.29 + or - 0.40) x 10(exp -11) e(-145 + or - 40)/T cu cm molec(exp -1) s(exp -1), respectively, for reactions with (CH3)2NNH2 and CH3NHNH2 in the temperature range 232-644 K and in He pressure of 2.0 torr. The total yields of OH in the reactions were measured to be (0.12 + or - 0.09) and (0.14 + or - 0. 10) at 298 K and in 2.0 torr He pressure. Close to approx. 53\% and approx. 59\% of the OH produced was estimated to be vibrationally excited. A pulsed-photolysis reactor was used to extend our measurements on the O-atom reaction kinetics with the unsubstituted rocket fuel N2H4 that we had previously studied in the flow-tube apparatus. At 298 K, both the rate coefficient, k3 = (0.59 = or - 0.12) x 10(exp -11) cu cm/molec s and the total OH yield = (0.35 + or - 0.14) did not show any discernable dependence on He or N2 buffer gas pressures of up to 404 torr. The magnitude of the weak temperature dependence and the lack of pressure effects in the O + N2H4 reaction rate coefficient suggests that simple direct metathesis of H-atom may not be important compared to initial addition of the O-atom

to the di-amine, followed by rapid dissociation of the intermediate into a variety of products.
DTIC
Reaction Kinetics; Oxygen Atoms; Dimethylhydrazines; Metathesis; Vapor Phases

20030034679 Air Force Research Lab., Edwards AFB, CA, USA
New Application of Bromotrimethylsilane: Elaboration of Aldehydes/Ketones into Homologous Alpha-Beta-Unsaturated Esters via Beta-Hydroxy Esters
Suri, Suresh C.; Marcischak, Jacob C.; Jan 2003; 7 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A410496; AFRL-PR-ED-TP-2002-305; No Copyright; Avail: CASI; A02, Hardcopy

Alpha,beta-unsaturated ester is formed when beta-hydroxy-ester is reacted with bromotrimethylsilane generated from chlorotrimethylsilane-lithium bromide in acetonitrile.
DTIC
Aldehydes; Ketones

20030034744 Air Force Research Lab., Tyndall AFB, FL
Classification of Organophosphorus Compound Infrared Spectra by Pattern Recognition Techniques
Mayfield, Howard T.; Eastwood, DeLyle; Burggraf, Larry A.; Aug 1999; 20 pp.; In English
Contract(s)/Grant(s): Proj-OAFT0062
Report No.(s): AD-A410700; AFRL-ML-TY-TP-2003-4513; No Copyright; Avail: CASI; A03, Hardcopy

Infrared spectra of organophosphorus compounds, including pesticides and a set of neurotoxins which have been banned from use by international agreement, along with their precursors and hydrolysis products, were obtained from a variety of sources. The data were treated to minimize spectral information related to the spectral origin. A common spectral wavelength range was selected and spectral data within this range were transduced into data vectors. Computer-assisted classification tools were used to classify the spectra as pesticides versus neurotoxins and their precursors and hydrolysis products. The performance of a k-nearest neighbor classifier for this distinction is compared with several artificial neural network classifiers.
DTIC
Infrared Spectra; Pattern Recognition; Neurology; Applications Programs (Computers); Organic Phosphorus Compounds; Classifications

20030036912 Westinghouse Savannah River Co., Aiken, SC
Demonstration of Caustic-Side Solvent Extraction with Optimized Solvent int he 2-CM Centrifugal Contactor Apparatus Using Dissolved Salt Cake from Tank 37H
Norato, M. A.; Fink, S. D.; Fondeur, F. F.; Kessinger, G. F.; Pierce, R. A.; Aug. 23, 2002; In English
Report No.(s): DE2002-803618; WSRC-TR-2002-00307; No Copyright; Avail: National Technical Information Service (NTIS)

WSRC-TR-2002-00307, REV. 0 Page 1 of 39 1.0 SUMMARY Researchers successfully demonstrated the chemistry of the Caustic-Side Solvent Extraction (CSSX) flow sheet with optimized solvent. This represents the third such process demonstration using actual Savannah River Site (SRS) high level waste (HLW).1-2 The present test differed from previous studies in the use of radioactive waste derived from Tank 37H dissolved salt cake, as opposed to supernate solutions used in previous demonstrations. The test used a 33-stage, 2-cm centrifugal contactor apparatus in a shielded facility at the Savannah River Technology Center (SRTC). The test with Tank 37H waste processed 44.6 L of solution in 25.5 hours. A 4-hour trial with simulated Tank 37H waste preceded the demonstration.
NTIS
Solvent Extraction; Cesium; Radioactive Wastes; Flow Characteristics

20030036913 Iowa State Univ., Ames. Dept. of Materials Science and Engineering
Effect of Oxygen Contamination on the Amorphous Structure of Thermally Sprayed Coatings of Cu(47)Ti(33)Zr(11)Ni(8)Si(1)
Besser, M. F.; 2002; 30 pp.; In English
Report No.(s): DE2002-803302; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
NTIS
Amorphous Materials; Oxygen; Sprayed Coatings

20030036922 Department of Energy, Albany, OR, Jack E. Bennett Consulting, Inc., Chardon, OH
Humectants to Augment Current From Metallized Zinc Cathodic Protection Systems on Concrete
Holcomb, G. R.; Covino, B. S.; Cramer, S. D.; Bennett, J. E.; Soltesz, S. M.; Dec. 2002; 134 pp.; In English
Report No.(s): PB2003-102185; No Copyright; Avail: CASI; A07, Hardcopy

Cathodic protection (CP) systems using thermal-sprayed zinc anodes are employed to mitigate the corrosion process in reinforced concrete structures. However, the performance of the anodes is improved by moisture at the anode-concrete interface. Research was conducted to investigate the effect of hydrophilic chemical additives, humectants, on the electrical performance and service life of zinc anodes. Lithium bromide and lithium nitrate were identified as feasible humectants with lithium bromide performing better under galvanic CP and lithium nitrate performing better under impressed current CP. Both humectants improved the electrical operating characteristics of the anode and increased the service life by up to three years.
NTIS
Spraying; Bridges (Structures); Thermal Protection; Protective Coatings; Zinc; Cathodic Coatings; Concrete Structures

20030036982 Environmental Protection Agency, Washington, DC
Reregistration Eligibility Decision for Acephate. (Includes Acephate Facts)
Sep. 2001; 198 pp.
Report No.(s): PB2003-102670; EPA/738/R-01/013; No Copyright; Avail: CASI; A09, Hardcopy

EPA has completed its review of public comments on the revised risk assessments and is issuing its risk management decisions for acephate. The decisions outlined in this document do not include the final tolerance reassessment decision for acephate; however, some tolerance actions will be undertaken prior to completion of the final tolerance reassessment. The Agency now recommends expressing the acephate tolerances in terms of acephate per se under 40 CFR part 180.108. Residues of methamidophos resulting from the metabolism of acephate are more appropriately placed under the tolerance expression for methamidophos in 40 CFR part 180.315(c). In addition, the Agency recommends lowering the tolerance level for cottonseed, as suggested by the data. The final tolerance reassessment decision for this chemical will be issued once the cumulative assessment for all of the organophosphates is complete. The Agency may need to pursue further risk management measures for acephate once the cumulative risks from organophosphates are considered. Additionally, since acephate degrades to another, registered organophosphate pesticide, methamidophos, further risk management measures for acephate may be necessary once the methamidophos assessment itself is completed.
NTIS
Pesticides; Organic Phosphorus Compounds; Decision Making; Environmental Quality; Ecosystems

20030037028 Lawrence Livermore National Lab., Livermore, CA
Ablation Front Rayleigh-Taylor Growth Experiments in Spherically Convergent Geometry
Glendinning, S. G.; Cherfils, C.; Colvin, J.; Divol, L.; Galmiche, D.; Nov. 03, 1999; 36 pp.
Report No.(s): DE2002-790921; No Copyright; Avail: Department of Energy Information Bridge

Experiments were performed on the Nova laser, using indirectly driven capsules mounted in cylindrical gold hohlraums, to measure the Rayleigh-Taylor growth at the ablation front by time-resolved radiography. Modulations were preformed on the surface of Ge-doped plastic capsules. With initial modulations of 4(micro)m, growth factors of about 6 in optical depth were seen, in agreement with simulations using the radiation hydrocode FCI2. With initial modulations of 1(micro)m, growth factors of about 100-150 in optical depth were seen.
NTIS
Ablation; Optical Thickness; Gold; Doped Crystals; Cylindrical Bodies

20030037133 Department of Housing and Urban Development, Washington, DC, Centers for Disease Control and Prevention, Atlanta, GA, Environmental Protection Agency, Washington, DC
Lead Paint Safety: A Field Guide for Painting, Home Maintenance, and Renovation Work
Mar. 2001; 88 pp.; In English
Report No.(s): PB2003-102699; HUD-1779-LHC; No Copyright; Avail: CASI; A05, Hardcopy

Every child should have a lead-safe home. That's why HUD is working to create lead-safe affordable housing through

outreach and public education, a lead hazard control grant program, worker training, and the enforcement of regulations. This guide is one part of HUDs comprehensive approach to lead safety in the home. If you perform routine maintenance on homes or apartments built before 1978, this guide will help you plan and carry out your work safely. Step-by-step instructions and illustrations explain and show what you need to do to protect yourself and your clients if you are working in older housing that could contain lead paint. This Field Guide is a valuable tool that thousands of workers and contractors across the country are using as part of a national effort to eliminate childhood lead poisoning.
NTIS
Lead Poisoning; Paints; Safety; Handbooks

20030037142 Geological Survey, Portland, OR, Corps of Engineers, Portland, OR
Total Dissolved Gas and Water Temperature in the Lower Columbia River, Oregon and Washington, 2002: Quality-Assurance Data and Comparison to Water-Quality Standards
Tanner, D. W.; Johnston, M. W.; Bragg, H. M.; 2002; In English
Report No.(s): PB2003-102723; WRIR-02-4283; No Copyright; Avail: National Technical Information Service (NTIS)

The U.S. Army Corps of Engineers (USACE) operates several dams in the Columbia River Basin, which encompasses 259,000 square miles of the Pacific Northwest. These dams are multipurpose facilities that fill regional needs for flood control, navigation, irrigation, recreation, hydopower production, fish and wildlife habitat, water-quality maintenance, and municipal and industrial water supply. When water is released through the spillways of these dams (instead of being routed through the turbines to generate electricity), air is entrained in the water, increasing the concentration of total dissolved gas (TDG) down-stream from the spillways. Consequently, TDG may exceed Oregon and Washington water-quality standards for the protection of freshwater aquatic life. Concentrations above 110\% saturation have been shown to cause gas-bubble trauma in fish and adversely affect other aquatic organisms.
NTIS
Water Quality; Water Temperature

20030037144 Westinghouse Savannah River Co., Aiken, SC
PUREX Organic Waste Solidification (U)
Langton, C. A.; Dec. 03, 2002; In English
Report No.(s): DE2002-805854; WSRC-TR-2002-00570; No Copyright; Avail: National Technical Information Service (NTIS)

Approximately 38,000 gallons of PUREX waste is currently stored in H-Area at the New Solvent Storage Facility (NSST). About 25,000 gallons of this waste is an organic liquid containing solvents from the PUREX process. This waste was originally planned for treatment at the Consolidated Incineration Facility (CIF). However, because of the high cost to restart and operate the CIF, a more cost effective treatment alternative is desired. The goal is a waste treatment producing an acceptable waste form for final disposal either at the SRS low-level waste landfill in E-Area or at the Nevada Test Site (NTS). This report summarizes the results of a feasibility study that evaluated solidification as an alternative treatment for organic waste.
NTIS
Solvents; Radioactive Wastes; Waste Treatment; Organic Compounds

20030038795 Lawrence Livermore National Lab., Livermore, CA
Livermore Big Trees Park: 1998 Results
Mac Queen, D.; Gallegos, G.; Surano, K.; Apr. 18, 2002; 134 pp.; In English
Report No.(s): DE2002-15002152; UCRL-ID-143311; No Copyright; Avail: Department of Energy Information Bridge

This report is an in-depth study of results from environmental sampling conducted in 1998 by the Lawrence Livermore National Laboratory (LLNL) at Big Trees Park in the city of Livermore. The purpose of the sampling was to determine the extent and origin of plutonium found in soil at concentrations above fallout-background levels in the park. This report describes the sampling that was conducted, the chemical and radio-chemical analyses of the samples, the quality control assessments and statistical analyses of the analytical results, and LLNL's interpretations of the results. It includes a number of data analyses not presented in LLNL's previous reports on Big Trees Park.
NTIS
Plutonium; Background Radiation

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COMPOSITE MATERIALS

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

20030032272 NASA Glenn Research Center, Cleveland, OH, USA
Effect of Environment on Stress-Rupture Behavior of a Carbon Fiber-Reinforced Silicon Carbide (C/SiC) Ceramic Matrix Composite
Verrilli, Michael J.; Opila, Elizabeth J.; Calomino, Anthony; Kiser, J. Douglas; November 26, 2002; 25 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-708-73-13; Copyright; Avail: CASI; A03, Hardcopy

Stress-rupture tests were conducted in air, vacuum, and steam-containing environments to identify the failure modes and degradation mechanisms of a carbon fiber-reinforced silicon carbide (C/SiC) composite at two temperatures, 600 and 1200 C. Stress-rupture lives in air and steam containing environments (50 - 80\% steam with argon) are similar for a composite stress of 69 MPa at 1200 C. Lives of specimens tested in a 20\% steam/argon environment were about twice as long. For tests conducted at 600 C, composite life in 20\% steam/argon was 20 times longer than life in air. Thermogravimetric analysis of the carbon fibers was conducted under similar conditions to the stress-rupture tests. The oxidation rate of the fibers in the various environments correlated with the composite stress-rupture lives. Examination of the failed specimens indicated that oxidation of the carbon fibers was the primary damage mode for specimens tested in air and steam environments at both temperatures.
Author
Ceramic Matrix Composites; Silicon Carbides; Creep Rupture Strength; Environment Effects; High Temperature Tests

20030032273 NASA Glenn Research Center, Cleveland, OH, USA
Additive Effects on Si3N4 Oxidation/Volatilization in Water Vapor
Opila, Elizabeth J.; Robinson, R. Craig; Fox, Dennis S.; Wenglarz, Richard A.; Ferber, Mattison K.; [2002]; 38 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Two commercially available additive-containing silicon nitride materials were exposed in four environments which range in severity from dry oxygen at 1 atm pressure, and low gas velocity to an actual turbine engine. Oxidation and volatilization kinetics were monitored at temperatures ranging from 1066 to 1400 C. The main purpose of this paper is to examine the surface oxide morphology resulting from the exposures. It was found that the material surface was enriched in rare earth silicate phases in combustion environments when compared to the oxides formed on materials exposed in dry oxygen. However, the in situ formation of rare earth disilicate phases offered little additional protection from the volatilization of silica observed in combustion environments. It was concluded that externally applied environmental barrier coatings are needed to protect additive-containing silicon nitride materials from volatilization reactions in combustion environments. Introduction Si3N4 is proposed for use as components, such as vanes, in turbine applications. Tens of thousands of hours of life are needed for both land-based turbines and aeropropulsion applications. Additive-containing SisN4 materials are
Author
Silicon Nitrides; Oxidation; Turbine Engines; Surface Distortion; Reaction Kinetics; Vaporizing

20030032275 NASA Glenn Research Center, Cleveland, OH, USA
Impact Resistance of Lightweight Hybrid Structures for Gas Turbine Engine Fan Containment Applications
Hebsur, Mohan G.; Noebe, Ronald D.; Revilock, Duane M.; [2003]; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 22-708-24-05; No Copyright; Avail: CASI; A03, Hardcopy

The ballistic impact resistance of hybrid composite sandwich structures was evaluated with the ultimate goal of developing new materials or structures for potential gas turbine engine fan containment applications. The sandwich structures investigated consisted of GLARE-5 laminates as face sheets with lightweight cellular metallic materials such as honeycomb, foam, and lattice block as a core material. The impact resistance of these hybrid sandwich structures was compared to GLARE-5 laminates and 2024-T3 Al sheet, which were tested as a function of areal weight (material thickness). The GLARE-5 laminates exhibited comparable impact properties to that of 2024-T3 Al at low areal weights, even though there were significant differences in the static tensile properties of these materials. The GLARE-5, however, did have a greater ballistic limit than straight aluminum sheet at higher areal weights. Furthermore, there is up to a 25\% advantage in ballistic limit for the GLARE-5/foam sandwich structures compared to straight 2024-T3 Al. But no advantage in ballistic limit was

observed between any of the hybrid sandwich structures and thicker versions of GLARE-5. Recommendations for future work are provided, based on these preliminary data.
Author
Gas Turbine Engines; Hybrid Composites; Impact Resistance; Fan Blades; Sandwich Structures; Mechanical Properties

20030032277 NASA Glenn Research Center, Cleveland, OH, USA
Health Monitoring of Thermal Barrier Coatings by Mid-Infrared Reflectance
Eldridge, J. I.; Spuckler, C. M.; Nesbitt, J. A.; Street, K. W.; December 30, 2002; 6 pp.; In English; Ceramic Engineering & Science Proceedings: 27th Annual Cocoa Beach Conference, 26-31 Jan. 2003, Cocoa Beach, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): 22-714-04-30
Report No.(s): E-13822; No Copyright; Avail: CASI; A02, Hardcopy

Mid-infrared (MIR) reflectance is shown to be a powerful tool for monitoring the integrity of 8wt% yttria-stabilized zirconia (8YSZ) thermal barrier coatings (TBCs). Because of the translucent nature of plasma-sprayed 8YSZ TBCs at MIR wavelengths (3 to 5 pm), measured reflectance does not only originate from the TBC surface, but contains strong contributions from internal scattering within the coating as well as reflectance from the underlying TBC/substrate interface. Therefore, changes in MIR reflectance measurements can be used to monitor the progression of TBC delamination. In particular, MIR reflectance is shown to reproducibly track the progression of TBC delamination produced by repeated thermal cycling (to 1163 C) of plasma-sprayed 8YSZ TBCs on Rene N5 superalloy substrates. To understand the changes in MIR reflectance with the progression of a delamination crack network, a four-flux scattering model is used to predict the increase in MIR reflectance produced by the introduction of these cracks.
Author
Thermal Control Coatings; Reflectance; Infrared Radiation; Mechanical Properties; Ceramics; Structural Reliability

20030032365 Air Force Research Lab., Edwards AFB, CA, USA
Multi-Scale Strain Measurements of a Particular Composite Material
Liu, C. T.; Smith, C. W.; Ravichandran, G.; June 05, 2002; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410120; AFRL-PR-ED-2002-137; No Copyright; Avail: CASI; A02, Hardcopy

In this study, the strain fields on two different length scales in a particulate composite material containing hard particles embedded in a rubbery matrix were investigated, using two different techniques. The experimental results were analyzed and are discussed.
DTIC
Composite Materials; Matrix Materials; Rubber; Strain Measurement

20030032486 NASA Glenn Research Center, Cleveland, OH, USA
Optimal Substrate Preheating Model for Thermal Spray Deposition of Thermosets Onto Polymer Matrix Composites
Ivosevic, M.; Knight, R.; Kalidindi, S. R.; Palmese, G. R.; Tsurikov, A.; Sutter, J. K.; March 2003; 14 pp.; In English; International Thermal Spray Conference and Exposition, 5-8 May 2003, Orlando, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-825; WBS-22-708-31-14
Report No.(s): NASA/TM-2003-212120; NAS 1.15:212120; E-13772; No Copyright; Avail: CASI; A03, Hardcopy

High velocity oxy-fuel (HVOF) sprayed, functionally graded polyimide/WC-Co composite coatings on polymer matrix composites (PMC's) are being investigated for applications in turbine engine technologies. This requires that the polyimide, used as the matrix material, be fully crosslinked during deposition in order to maximize its engineering properties. The rapid heating and cooling nature of the HVOF spray process and the high heat flux through the coating into the substrate typically do not allow sufficient time at temperature for curing of the thermoset. It was hypothesized that external substrate preheating might enhance the deposition behavior and curing reaction during the thermal spraying of polyimide thermosets. A simple analytical process model for the deposition of thermosetting polyimide onto polymer matrix composites by HVOF thermal spray technology has been developed. The model incorporates various heat transfer mechanisms and enables surface temperature profiles of the coating to be simulated, primarily as a function of substrate preheating temperature. Four cases were modeled: (i) no substrate preheating; (ii) substrates electrically preheated from the rear; (iii) substrates preheated by hot

air from the front face; and (iv) substrates electrically preheated from the rear and by hot air from the front.
Author
Coatings; Polymer Matrix Composites; Polyimides; Optimization; Heating; Mathematical Models; Hvof Thermal Spraying; Deposition

20030032529 New Mexico Inst. of Mining and Technology, Socorro, NM, USA
Analysis of the Effect of Surface Modification on Polyimide Composites Coated With Erosion Resistant Materials
Ndalama, Tchinga; Hirschfeld, Deidre; Sutter, James K., Technical Monitor; March 2003; 24 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2688; WU-708-87-23
Report No.(s): NASA/CR-2003-212190; NAS 1.26:212190; E-13793; No Copyright; Avail: CASI; A03, Hardcopy

The aim of this research is to enhance performance of composite coatings through modification of graphite-reinforced polyimide composite surfaces prior to metal bond coat/ hard topcoat application for use in the erosive and/or oxidative environments of advanced engines. Graphite reinforced polyimide composites, PMR-15 and PMR-II-50, formed by sheet molding and pre-pregging will be surface treated, overlaid with a bond coat and then coated with WC-Co. The surface treatment will include cleaning, RF plasma or ultraviolet light- ozone etching, and deposition of SiO(x) groups. These surface treatments will be studied in order to investigate and improve adhesion and oxidation resistance. The following panels were provided by NASA-Glenn Research Center(NASA-GRC): Eight compression molded PMR-II-50; 6 x 6 x 0.125 in. Two vacuum-bagged PMR-II-50; 12 x 12 x 0.125 in. Eight compression molded PMR-15; 6 x 6 x 0.125 in. One vacuum-bagged PMR-15; 12 x 12 x 0.125 in. All panels were made using a 12 x 12 in. T650-35 8HS (3K-tow) graphite fabric. A diamond-wafering blade, with deionized water as a cutting fluid, was used to cut PMR-II-50 and PMR-15 panels into 1 x 1 in. pieces for surface tests. The panel edges exhibiting delamination were used for the preliminary surface preparation tests as these would be unsuitable for strength and erosion testing. PMR-15 neat resin samples were also provided by NASA GRC. Surface profiles of the as-received samples were determined using a Dektak III Surface profile measuring system. Two samples of compression molded PMR-II-50 and PMR-15, vacuum-bagged PMR-II-50 and PMR-15 were randomly chosen for surface profile measurement according to ANSI/ASME B46.1. Prior to each measurement, the samples were blasted with compressed air to remove any artifacts. Five 10 mm-long scans were made on each sample. The short and long wavelength cutoff filter values were set at 100 and 1000 m, diamond stylus radius was 12.5 microns. Table 1 is a summary of the arithmetic average roughness (Ra) and waviness (Wa) for the composite surfaces.
Author
Composite Materials; Coatings; Erosion; Surface Treatment; Resistance; Polyimides

20030032917 NASA Glenn Research Center, Cleveland, OH, USA
Erosion Resistant Coatings for Polymer Matrix Composites in Propulsion Applications
Sutter, James K.; Naik, Subhash K.; Horan, Richard; Miyoshi, Kazuhisa; Bowman, Cheryl; Ma, Kong; Leissler, George; Sinatra, Raymond; Cupp, Randall; March 2003; 19 pp.; In English; SAMPE 2003, 11-15 May 2003, Long Beach, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-708-31-14
Report No.(s): NASA/TM-2003-212201; E-13804; NAS 1.15:212201; Copyright; Avail: CASI; A03, Hardcopy

Polymer Matrix Composites (PMCs) offer lightweight and frequently low cost alternatives to other materials in many applications. High temperature PMCs are currently used in limited propulsion applications replacing metals. Yet in most cases, PMC propulsion applications are not in the direct engine flow path since particulate erosion degrades PMC component performance and therefore restricts their use in gas turbine engines. This paper compares two erosion resistant coatings (SANRES and SANPRES) on PMCs that are useful for both low and high temperature propulsion applications. Collaborating over a multi-year period, researchers at NASA Glenn Research Center, Allison Advanced Developed Company, and Rolls-Royce Corporation have optimized these coatings in terms of adhesion, surface roughness, and erosion resistance. Results are described for vigorous hot gas/particulate erosion rig and engine testing of uncoated and coated PMC fan bypass vanes from the AE 3007 regional jet gas turbine engine. Moreover, the structural durability of these coatings is described in long-term high cycle fatigue tests. Overall, both coatings performed well in all tests and will be considered for applications in both commercial and defense propulsion applications.
Author
Polymer Matrix Composites; Refractory Coatings; Life (Durability); Corrosion Resistance; Fatigue Tests; Component Reliability; Mechanical Properties; Propulsion; Spacecraft Propulsion

20030032959 NASA Glenn Research Center, Cleveland, OH, USA
Analysis of the Barrier Properties of Polyimide-Silicate Nanocomposites
Campbell, Sandi; Johnston, J. Chris; Inghram, Linda; McCorkle, Linda; Silverman, Edward; April 2003; 13 pp.; In English; SAMPE 2003, 11-15 May 2003, Long Beach, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS-22-708-90-34
Report No.(s): NASA/TM-2003-212221; NAS 1.15:212221; E-13840; Copyright; Avail: CASI; A03, Hardcopy

Montmorillonite clay was organically modified and dispersed into a thermoplastic (BPADA-BAPP) and a thermosetting (PMR-15) polyimide matrix. The barrier properties of the neat resins and the nanocomposites were evaluated. Reductions in gas permeability and water absorption were observed in thermoplastic polyimide nanocomposites. The thermosetting polyimide showed a reduction in weight loss during isothermal aging at 288 C. Carbon fabric (T650-35, 8 HS, 8 ply) composites were prepared using both the BPADE-BAPP and PMR-15 based nanocomposites. Dispersion of the layered silicate in the BPADA-BAPP matrix reduced helium permeability by up to 70 percent. The PMR-15/ silicate nanocomposite matrix had an increase in thermal oxidative stability of up to 25 percent.
Author
Nanocomposites; Montmorillonite; Polyimides; Polymer Matrix Composites; Silicates

20030032998 Air Force Research Lab., Edwards AFB, CA, USA
Pressure Effects and Surface Cracks in a Rubbery Particulate Composite
Miller, T. C.; June 04, 2001; 20 pp.; In English
Report No.(s): AD-A410515; AFRL-PR-ED-VG-2001-054; No Copyright; Avail: CASI; A03, Hardcopy

Cracks developed during manufacturing, handling and storage of rubbery particulate composites. Previous tests used single edge notched tension (SENT) specimens. In this work, surface cracked specimens are compared with the previous results. Results for ambient and pressurized test conditions are also compared. Pressure affects fracture behavior by suppressing void nucleation, growth, and coalescence. Both initiation of growth and subsequent growth rates are affected. Applying ambient test data can result in overly conservative predictions.
DTIC
Fracture Mechanics; Cracks; Particulates; Composite Materials

20030033036 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Statistical Treatment of Crack Propagation Data
Heller, R. A.; May 22, 2001; 8 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410537; AFRL-PR-ED-TP-2001-120; No Copyright; Avail: CASI; A02, Hardcopy

Crack propagation data are available for two different particulate composite materials. A larger set of 38 observations is used to draw statistical inference for the second set consisting of 5 data. The Paris crack propagation relation, whose two parameters are functionally related, is used.
DTIC
Crack Propagation; Statistical Analysis; Composite Materials; Particulates

20030033059 Air Force Research Lab., Edwards AFB, CA, USA
In Situ Processing Route for Uniform Density Carbon-Carbon Composites
Hoffman, Wesley; October 31, 2001; 4 pp.; In English
Contract(s)/Grant(s): AF Proj. 4847
Report No.(s): AD-A410547; AFRL/PRS-ED-TP-2001-217; No Copyright; Avail: CASI; A01, Hardcopy

A recent development in composite processing at the Air Force Research Laboratory (AFRL) in Edwards, CA, drastically reduces both the cost of and processing time required for high performance carbon-carbon (C-C) composites. These composites possess a unique set of properties that make them ideal materials for high temperature structural uses, such as in rocket propulsion components, hypersonic vehicles, and aircraft brakes. C-C composites are stronger and stiffer than steel, while less dense than aluminum. In addition, they not only maintain their mechanical properties to temperatures in excess of 3000 degrees centigrade, the composite's material properties actually improve with heating as the non-ordered carbon is converted to the ordered graphite structure through the process of graphitization. In spite of their excellent properties, the use of carbon-carbon composites has been limited because of their high cost and oxidation at elevated temperatures. AFRL's In-Situ Densification Process is an impregnation process that, in contrast to commercial processes, is able to rapidly densify

the composite uniformly because it addresses the conflicting requirements of the impregnant's low viscosity and good wettability and the need for a high char yield carbon precursor. This is accomplished by using a low viscosity impregnant that wets the fiber preform surface in the first step of the process. The impregnant is sucked into the fiber preform like water into a sponge. This not only results in a uniform density, but there also is no need for machining after densification to open up the surface pores. After the impregnant has filled the preform, it is polymerized into a carbon matrix precursor that has a high carbon yield, which means that fewer cycles are needed to bring the composite to final density. The carbon matrix precursor is then pyrolyzed to produce a high quality carbon matrix. The in situ process also seems to have no size limitations.
DTIC
Carbon-Carbon Composites; Thermodynamic Properties

20030033908 Air Force Research Lab., Eglin AFB, FL, USA
Hybrid Experimental-Numerical J-Integral Analysis and Crack Growth Resistance of a Particulate Composite Material
Liu, C. T.; Gonzalez, Javier; May 23, 2001; 8 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410488; AFRL-PR-ED-TP-2001-123; No Copyright; Avail: CASI; A02, Hardcopy
In this study, a hybrid experimental-numerical method was used to determine the J-integral value in a particulate composite material subjected to a constant strain rate condition. The experimental data were analyzed and the results are discussed.
DTIC
Composite Materials; Crack Propagation; J Integral; Structural Analysis

20030034589 Florida Univ., Gainesville, FL
Synthesis and In-Situ Atomic Oxygen Erosion Studies of Space-Survivable Hybrid Organic/Inorganic Polyhedral Oligomeric Silsesquioxane Polymers
Gonzalez, Rene I.; March 22, 2002; 55 pp.; In English
Report No.(s): AD-A410323; AFRL-PR-ED-VG-2002-065; No Copyright; Avail: CASI; A04, Hardcopy
No abstract available
DTIC
Erosion; Oxygen Atoms; Synthesis (Chemistry); Oligomers; Nanocomposites; In Situ Measurement; Polymers

20030034636 Air Force Research Lab., Edwards AFB, CA
Investigating Near-Tip Damage and Crack Growth Behavior in a Solid Propellant
Liu, C. T.; March 2001; 10 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410276; AFRL-PR-ED-TP-2001-043; No Copyright; Avail: CASI; A02, Hardcopy
When cracks occur, whether resulting from the manufacturing process or from service loads, the stresses near the crack tip will be redistributed according to nonlinear material behavior. Depending on the magnitude of the local stresses and the local strength, various defects, microvoids or microcracks, can develop in the crack tip region. And, depending on the severity of these defects, crack growth behavior can be significantly affected. Therefore, to obtain a fundamental understanding of crack growth behavior in particulate composite materials, the effect of the defect on local fracture behavior near the crack tip needs to be determined. In recent years, a considerable amount of work has been done studying crack growth behavior in particulate composite materials. This work was based on linear fracture mechanics. The principles of classical fracture mechanics are well established for single-phase materials. However, experimental evidence indicates that linear fracture mechanics theories have been applied to particulate composite materials with varying degrees of success. In this study, pre-cracked specimens were used to study local damage near the crack tip in a solid propellant under a constant strain rate at room temperature, using biaxial strip specimens. The effect of local damage on crack growth rate also was investigated. The results indicate that, on a macroscale, the material can be considered a continuum, and plane strain fracture toughness may not exist for it. In the highly strained region at the crack tip, material may be damaged and voids may develop and the crack can grow by the coalescence of the voids with the crack tip. The crack-damage interaction is a contributing factor to the fluctuation of the crack growth behavior. Experimental results also indicate that crack tip blunting occurs during the loading

process, and that crack growth consists of a blunt-growth-blunt phenomenon that appears to be highly nonlinear. (6 figures, 8 refs.)
DTIC
Stress Analysis; Strain Rate; Solid Propellants; Crack Tips; Crack Propagation; Fracture Strength

20030034678 Air Force Research Lab., Edwards AFB, CA, USA
Basic and Applied Research on Hybrid Organic/Inorganic Materials for Propulsion and Space
Viers, Brent D.; Phillips, Shawn H.; Haddad, Timothy S.; Blanski, Rusty; Svcjda, Steve; Oct 2001; 26 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A410392; AFRL-PR-ED-TP-2001-218; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
DTIC
Spacecraft Propulsion; Oligomers; Synthesis (Chemistry); Siloxanes; Inorganic Materials; Organic Materials

20030034692 Air Force Research Lab., Edwards AFB, CA, USA
Estimating the Equivalent Initial Crack Size in a Particulate Composite Material Under a Multi-Axial Loading Condition
Liu, C. T.; Yang, J. N.; Smith, G.; Wickham, D.; May 22, 2002; 8 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410541; AFRL/PRSM-AFRL-PR-ED-TP-2002-126; No Copyright; Avail: CASI; A02, Hardcopy
In this study, the equivalent initial crack size, a*, in a particulate composite material under a multi-axial loading condition was predicted. The predicted a* compares well with the experimentally estimated one. And, tbe statistical distribution function of a* follows the Second Asymptotic Distribution of the Maximum Value.
DTIC
Size (Dimensions); Composite Materials; Cracks

20030034907 Lawrence Livermore National Lab., Livermore, CA
Ancient and Modern Laminated Composites; From the Great Pyramid of Gizeh to Y2K
Wadsworth, J.; Lesuer, D. R.; Mar. 14, 2000; 30 pp.; In English
Report No.(s): DE2002-791451; No Copyright; Avail: Department of Energy Information Bridge
In the present paper, the first section deals with the history of laminated composites. In particular, examples of their existence, composition, and structure are detailed. Extra emphasis is given to the Japanese sword both because of its complexity as a laminate at several levels, and its relatively well-documented history and the technical details that accompany that history. Included at the end of the section are some comments on modern knives that duplicate, in part, the ancient weapons. The second section of the paper first describes modern engineering applications of LMCs. Scientific and engineering studies on laminated composites are then presented - in some cases at the very thin-layer level, and in others at layer thicknesses that were close to those found in ancient laminates. Processing methods, as well as strength, durability, toughness, and damping properties, are discussed. The mechanisms of improving toughness by lamination are described in detail. Where possible, the mechanisms leading to improved properties of modern engineered laminated composites are linked back to ancient artifacts.
NTIS
Laminates; Steels

20030036917 Iowa State Univ., Ames. Dept. of Materials Science and Engineering
Study of Selected Properties and Applications of AlMgB(sub 14) and Related Composites: Ultra-hard Materials
Lewis, T. L.; 2001; 184 pp.
Report No.(s): DE2002-803740; No Copyright; Avail: Department of Energy Information Bridge
Contents include the following: Chapter 1: Introduction; Chapter 2: Industrial Applications; Chapter 3: Understanding Hardness; Chapter 4: Previous and Published Research; Chapter 5: Thermal Characterization; Chapter 6: Further Characterization; Chapter 7: The Effects of Additives; Chapter 8: Hot Isostatic Pressing Versus Hot Uniaxial Pressing, and Chapter 9: Conclusions and Future Suggestions.
NTIS
Composite Materials; Additives; Characterization

20030037016 Lawrence Livermore National Lab., Livermore, CA

High-Speed, Three-Dimensional Object Composition Mapping Technology

Armstrong, P.; Ishikawa, M.; Stuart, B.; Wood, L.; Wynne, A.; Feb. 14, 2001; In English

Report No.(s): DE2002-15002234; UCRL-ID-142551; No Copyright; Avail: National Technical Information Service (NTIS)

This document overviews an entirely new approach to determining the composition - the chemical-elemental, isotopic and molecular make-up - of complex, highly structured objects, moreover with microscopic spatial resolution in all 3 dimensions. The front cover depicts the new type of pulsed laser system at the heart of this novel technology under adjustment by Alexis Wynne, and schematically indicates two of its early uses: swiftly analyzing the 3-D composition governed structure of a transistor circuit with both optical and mass-spectrometric detectors, and of fossilized dinosaur and turtle bones high-speed probed by optical detection means. Studying the composition-cued 3-D micro-structures of advanced composite materials and the microscopic scale composition-texture of biological tissues are two near-term examples of the rich spectrum of novel applications enabled by this field- opening analytic tool-set.

NTIS

Composition (Property); Composite Materials; Body Composition (Biology); Tissues (Biology); Three Dimensional Composites; Dimensional Analysis

20030037169 Tuskegee Inst., AL, USA

Survivability of Affordable High Temperature Polymer Matrix Composites for Propulsion Engine Components

Dean, Derrick; Haque, Anwar; Vaidya, Uday; Meador, Michael A., Technical Monitor; April 2003; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG3-2654; WU 708-87-23-00

Report No.(s): NASA/CR-2003-212192; NAS 1.26:212192; E-13795; No Copyright; Avail: CASI; A03, Hardcopy

PMR-type polyimides are regarded as state of the art high temperature polymers, due to their excellent thermo-mechanical properties and thermo-oxidative stability. One of their drawbacks, however is the inability to process them using cost-effective processing methods such as Resin Transfer Molding (RTM) and Resin Film Infusion (RFI). Development of low viscosity, high temperature polymers has been the subject of intense research. Recently, a new generation of low viscosity polyimides were synthesized by the introduction of twisted biphenyl or binapthyl groups into the backbone. This report details the progress for Year 1, which has involved acquiring samples and initiating Phases I and II of the proposed research. Specifically, studies of the process-property relationships of a series of polymers using oligomers based on 2,3,3' ,4'-biphenyltertracarboxylic dianhydride (PBDA) and a mixture of a diamine, BAX and a triamine, 1,3,5-Tris (4-aminophenoxybenzene), TAB, where the amount of TAB was varied have been initiated. The sample containing 10 percent TAB possesses a slightly higher degree of crystalline order versus that of the 20 percent TAB sample, based on x-ray diffraction studies of the b-staged oligomers. Both systems lose all of the crystalline order upon curing, however. The chemorheology has been studied as a function of the TAB content. While the magnitude of the viscosity is essentially the same for both systems, the cure kinetics of the 10 percent TAB system is faster than that for the 20 percent TAB system. The sample exhibits a melting-recrystallization-remelting behavior before the crosslinking commences. Correlation of other kinetic parameters, such as the activation energies for curing, the Tg and mechanical properties to the structure of these systems is underway. Future studies will involve characterization of mechanical and thermal properties of the pure resins and the fabrication of fiber reinforced composites using these materials.

Author

Polymer Matrix Composites; Polyphenyls; Crystallinity; Mechanical Properties; Oligomers; Polyimides

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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*.

20030032379 Air Force Research Lab., Edwards AFB, CA, USA

Decomposition Mechanism and Kinetics Research and Energetic Molecules

Alfano, Angelo; April 22, 1999; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409525; AFRL-PR-ED-TP-FY99-0084; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available

Semiconductor Devices; Pulsed Lasers; Infrared Lasers; Vapor Pressure; Explosives

20030032996 Air Force Research Lab., Edwards AFB, CA, USA
Are 19F NMR Shifts a Measure for the Nakedness of Fluoride Ions?
Gerken, M.; Boatz, J. A.; Kornath, A.; Haiges, R.; Christe, K. O.; March 13, 2002; 32 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A410513; AFRL-PR-ED-TP-2002-055; No Copyright; Avail: CASI; A03, Hardcopy

The solvent dependency of the 19F NMR shifts of the fluoride anion in CH3OH, H2O, CH3OCH3 CHCl3, CHCl2, CHF3 CH3CN, CH3NO2, (CH3)2SO and CH3COCH3 solutions was studied by theoretical calculations at the MP2/6-31++G(d,p) and B3LYP/6-31++G(d,p) levels of theory and compared to the experimental values. It is shown that the free gaseous fluoride anion is most shielded. The stepwise build-up of a solvation sphere was modeled for the F/nH2O system and results in a progressive deshielding of the F nucleus with an increasing number of water ligands in the first solvation sphere. Theoretical calculations predict the first solvation sphere of F to be comprised of six or seven monodentate water molecules. The F-H bond distances increase from 1.42 A in the monohydrate to 1. 69 - 1.87 A and 1.82 A in the penta- and hexa-hydrates, respectively, and the transfer of negative charge from F to the water ligands reaches its maximum for the tetrahydrate.
DTIC
Nuclear Magnetic Resonance; Chemical Reactions

20030033020 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Polynitrogen Chemistry and the Pursuit of New High Energy Density Materials
Christe, Karl O.; Wilson, William W.; Vij, Ashwani; Vij, Vandana; Sheehy, Jeffrey A.; April 13, 2001; 3 pp.; In English
Contract(s)/Grant(s): AF Proj. 2303
Report No.(s): AD-A410568; AFRL-PR-ED-TP-2001-084; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this AFOSR program is the synthesis of novel polynitrogen-derived HEDM compounds, exploiting the synergism between theory and synthesis. Under combined DARPA, AFOSR and NSF sponsorship, we have discovered in 1999 the novel polynitrogen compound, N5(+)AsF6(-). The N5(+) cation is only the third known, homoleptic polynitrogen species that can be prepared and isolated in bulk, the other two being N2 and the azide anion. N5(+)AsF6(-) was found to be only marginally stable. During the past year, the N5(+) cation has successfully been tamed by preparing the stable fluoroantimonate salts. N5(+)SbF6(-) and N5(+)Sb2F11(-). The former is surprisingly stable (up to 70 deg C) and, according to drop weight tests, is essentially insensitive. The crystal structure of N5(-)Sb2F11(-) was determined, and the geometry of N5(+) was found to be in excellent agreement with that predicted by our theoretical calculations. A considerable amount of effort was spent on improving the syntheses of the precursors for the N5(+) salts. This work resulted in the discovery of a new cis-trans isomerization process for N2F2, a disproportionation reaction of N2F2 to give NF4(+)Sb3F16(-) under mild conditions, and several new crystal structures for salts that contain nitrogen fluoride cations. Also, a safer method for producing N5(+) salts was developed to overcome a series of explosions, encountered in the N5SbF6 synthesis. Metathetical reactions were carried out in SO2 and anhydrous HF solutions between N5(+)SbF6(-) and alkali metal azides, perchlorates, and nitrates, in pursuit of N5N3, N5ClO4, and N5N02, respectively. It was also found that the N3(-) anion reacts with S02 under formation of the novel SO2N3(-) anion that was characterized by its crystal structure, vibrational spectroscopy, and theoretical calculations.
DTIC
Nitrogen Compounds; Crystal Structure

20030033058 Air Force Research Lab., Edwards AFB, CA, USA
Partial Wetting of Non-Smooth Surfaces and Shaped Microchannels
Wapner, Phillip G.; Hoffman, Wesley P.; April 13, 2001; 19 pp.; In English
Contract(s)/Grant(s): AF Proj. 2306
Report No.(s): AD-A410545; AFRL/PRS-ED-TP-2001-086; No Copyright; Avail: CASI; A03, Hardcopy

Increasing attention is being given to partial wetting of micro-channels in MEMS micro-fluidic devices, such as pressure sensors and accelerometers. The behavior of liquids that have contact angles with a solid surface greater than zero but less then 180 degrees is also relevant to many other technologies. Moreover, when the solid surface is not perfectly smooth, liquid contact with that surface is poorly understood and the subject of considerable misconception. When the contact angle is between zero and 90 degrees, the liquid is traditionally said to 'wet' the capillary wall and it will enter the capillary on its own accord. Pressure is then needed to expel it from the capillary. If the contact angle is between 90 degrees and 180 degrees, the fluid is termed 'non-wetting' and pressure is needed to force it into the capillary. When capillary geometry is allowed to vary, the traditional concepts of wetting and nonwetting must be carefully examined. The authors conducted an experiment to clarify this point. A drop of mercury was placed directly over the juncture of two horizontal glass plates. The plates were mounted

in an apparatus designed to keep their upper edges firmly together during rotation, thereby maintaining a sharp interstice. The mercury on the two plates formed a symmetric sessile drop having a contact angle of 140 degrees. When the right plate was rotated so that the angle between the two plates was 135 degrees, the outer surface of the mercury drop assumed a modified sessile-drop curvature, but the juncture between the two plates was still filled. When rotation continued until the included angle was 60 degrees, the outer surface was still asymmetric, but the interstice was no longer filled. The experiment was repeated with a mercury drop on a nonsmooth surface having a 110 degree included angle and with water on a surface having 50 degree and 8 degree included angles.
DTIC
Fluidics; Microelectromechanical Systems; Wetting; Microchannel Plates; Surface Properties; Asymmetry

20030033096 Air Force Research Lab., Edwards AFB, CA, USA
High-Resolution Spectroscopy of HCl and DCl Isolated in Solid pH2: Direct, Induced, and Cooperative IR Transitions in a Molecular Quantum Solid
Anderson, David T.; Hinde, Robert J.; Tam, Simon; Fajardo, Mario E.; July 24, 2001; 42 pp.; In English
Contract(s)/Grant(s): AF Proj. 2303
Report No.(s): AD-A410567; AFRL-PR-ED-TP-2001-169; No Copyright; Avail: CASI; A03, Hardcopy

The infrared spectroscopy and rovibrational dynamics of HCl and DCl dopants in solid parahydrogen (PH2) were investigated using high-resolution spectroscopic methods. The absorption spectra of HCl and DCl monomers in solid pH2 closely resemble the corresponding low temperature gas phase spectra, indicating that the gas phase vibrational and rotational quantum numbers of the impurity are conserved within the pH2 solid. Small deviations from gas phase behavior are observed, however, such as a reduced HCl rotational energy level spacing and splitting of the fivefold orientational degeneracy of HCl rotational states with J=2. In addition, the pure vibrational Q1(0) (nu=l left arrow 0, J=0 left arrow 0) H2 transition, which is infrared inactive pure solid pH2, is detected in the HCl doped sample. This transition is induced in pH2 molecules by neighboring HCl molecules through a weak 'overlap induction' mechanism. That is the only induction mechanism operative for J=0 impurities in pH2. Rovibrational transitions are also detected near the induced Q1(0) H2 absorption; these are attributed to cooperative transitions involving single photon excitation of pH2-HCl pairs. Detailed isotopic analysis reveals that these cooperative transitions involve pure vibrational excitation of the pH2 and pure rotational excitations of the HCl. Two-molecule transitions have long been studied for isotopic and rotational dopants (e.g., D2, HD, orthohydrogen) in solid pH2, but this is the first time such cooperative transitions have been attributed to a chemical impurity in pH2 matrices.
Derived from text
Crystal Structure; Infrared Spectroscopy; Hydrogen; Selection Rules (Nuclear Physics); Para Hydrogen

20030033099 Air Force Research Lab., Edwards AFB, CA, USA
New Multi-Functional Materials Using Versatile Hybrid (Inorganic/Organic) POSS Nanotechnology
Phillips, Shawn H.; Haddad, Timothy S.; Blanski, Rusty L.; April 19, 2001; 18 pp.; In English
Contract(s)/Grant(s): AF Proj. 1011
Report No.(s): AD-A410570; AFRL-PR-ED-VG-2001-096; No Copyright; Avail: CASI; A03, Hardcopy

The presentation slides for 'New Multi-Functional Materials Using Versatile Hybrid (Inorganic/Organic) POSS Nanotechnology' are presented.
DTIC
Solid Propellant Rocket Engines; Thermal Insulation; Hybrid Composites; Oligomers; Plastics; Copolymers; Nanostructures (Devices)

20030033844 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Gas-Solid Absorption Characteristics of Supramolecular Compounds Using a Hermetically Controlled Atmosphere Automated Absorption Balance (H-CAAAB)
Warrensford, Daniel E.; Nov 2002; 102 pp.; In English
Report No.(s): AD-A410639; CI02-850; No Copyright; Avail: CASI; A06, Hardcopy

Rigid supramolecular structures recently discovered present new options for those wishing to develop gravimetric humidity sensors. Although humidity sensors are an established technology, there is room to grow in this field. This thesis backgrounds the current state of the art in humidity sensing materials, but will concentrate on gravimetric humidity sensors. It details the benefits and drawbacks of current materials in use. Limitations of current sensing materials are explored. The advantages of using rigid porous supramolecular structures are explained. Using a Hermetically Controlled Atmosphere

Automated Absorption Balance, this work studied the absorption characteristics of some of the more promising supramolecular materials that have recently been developed in the Zaworotko research group.
DTIC
Controlled Atmospheres; Gas-Solid Interactions; Absorption; Molecular Structure; Detectors; Gravimetry; Automatic Control

20030033886 California Univ., Berkeley, CA
Studies of Transition States and Cluster-Induced Reactivity Via Negative Ion Photoelectron Spectroscopy
Neumark, Daniel M.; Jan. 2003; 9 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0145; AF Proj. 2303
Report No.(s): AD-A410333; Rept-011988-005; AFRL-SR-AR-TR-03-0013; No Copyright; Avail: CASI; A02, Hardcopy

Research during the last three years has focused on using negative ion photoelectron (PE) spectroscopy and zero electron kinetic energy (ZEKE) spectroscopy to probe the effects of clustering on the energetics, spectroscopy, and dynamics of ions and transition states, and to investigate the ground and excited electronic states of reactive free radicals. We have also developed a new spectroscopic method in which stimulated Raman pumping combined with PE spectroscopy is used to measure vibrational frequencies in negative ions. Results are summarized in more detail below.
DTIC
Chemical Reactions; Kinetic Energy; Photoelectron Spectroscopy

20030033913 Air Force Research Lab., Edwards AFB, CA, USA
First Principles Calculations of Nitro Compounds with the A1 (111) Surface. DoD UGC, 10-14 Jun 02, Austin, TX
Boatz, Jerry; June 14, 2002; 26 pp.; In English
Report No.(s): AD-A410652; AFRL-PR-ED-VG-2002-116; No Copyright; Avail: CASI; A03, Hardcopy

The objective of the research is to identify, develop and transition new propellants and advanced concepts for propulsion applications, such as hydrocarbon fuels for liquid boost, liquid and solid oxidizers for boost and upper stages, monopropellants for spacecraft and upper stages, cryogenic propellants for upper stages and laser light craft for microsatellite and other applications.
DTIC
Nitrogen Compounds; Spacecraft Propulsion; Propellants

20030033951 Air Force Research Lab., Edwards AFB, CA, USA
Computational Chemistry Studies of HEDM
Mar 2002; 10 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A410664; AFRL-PR-ED-VG-2002-068; No Copyright; Avail: CASI; A02, Hardcopy

The program objective is to identify and develop advanced chemical propellants for rocket propulsion applications. Computational chemistry plays a critical role in HEDM research. It guides the choice of target compounds and possible synthetic routes, and provides verification of successful synthesis. CC is addressing an ever wider range of Air Force applications. New methods are under development (e.g. modeling chemistry in solution or on surfaces). Parallel computing technology has greatly expanded the scope of problems which can be modeled.
DTIC
Computational Chemistry; Rocket Propellants; Chemical Propulsion; High Energy Propellants

20030033955 Air Force Research Lab., Edwards AFB, CA, USA
New Polynitrogen Molecules: Energetic Air as a Next-Generation Propellant?
Boatz, Jerry A.; Christe, Karl O.; April 29, 2002; 5 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; AF Proj. 1011
Report No.(s): AD-A410666; AFRL/PRS-ED-TP-2002-089; No Copyright; Avail: CASI; A01, Hardcopy

The identification, development, and formulation of new energetic materials for advanced rocket propulsion applications is an area of long-standing interest to the Air Force. The performance limits of currently used propellants have been reached, so new energetic compounds are required to significantly improve the ability of the warfighter to access and control space. Polynitrogen species such as the recently discovered N5+ cation are of interest as potential energetic ingredients in new propellant formulations. Conventional techniques for characterizing polynitrogens have relied heavily on costly and

time-consuming experimental synthesis and characterization. The availability of HPC resources has significantly lessened the need for these more empirical approaches by enabling the application of reliable high-level quantum chemical calculations to predict important properties such as heats of formation, stabilities, mechanisms of formation and decomposition, and spectroscopic constants. A key advantage of using HPC in this regard is the ability to efficiently 'screen' a large number of potential polynitrogen molecules and focus subsequent experimental efforts on just the most promising candidates. The structures, stabilities, vibrational frequencies, and infrared intensities of several potential synthetic precursors to new polynitrogen species have been computed using ab initio electronic structure theory, at the second order perturbation theory level (MP2, also known as MBPT(2)), using the 6-31G(d) valence double-zeta polarized basis set. Shown in the accompanying figure is the predicted structure of triphenylmethyldiazonium cation, also known as trityldiazonium, which is a possible precursor to new polynitrogen compounds such as pentazole, a 5-membered ring system. The calculated structure shows that this cation is unstable with respect to dissociation of N2. Therefore, these calculations predict that this cation is not a viable polynitrogen precursor.
DTIC
Molecules; Nitrogen Polymers; High Energy Propellants; Synthetic Fuels

20030034621 Westinghouse Savannah River Co., Aiken, SC
Characterization of Corrosion Products from Static Cell Testing of Al-SNF Forms
Adams, T.; Duncan, A.; Vinson, D.; 2002; 12 pp.; In English
Report No.(s): DE2002-801712; WSRC-MS-2002-00734; No Copyright; Avail: Department of Energy Information Bridge
Aluminum-based spent nuclear fuel from foreign and domestic research reactors is being consolidated at the Savannah River Site (SRS) for ultimate disposal in the Monitored Geologic Repository. The melt-dilute treatment technology has been developed to consolidate fuel assemblies by a melting/casting process in which depleted uranium is added to reduce enrichment below 20 percent 235-U. The melt-dilute product is essentially a binary uranium-aluminum alloy to which neutron absorber materials may be readily added.
NTIS
Corrosion; Aluminum Alloys; Nuclear Fuels; Uranium Alloys; Fissionable Materials

20030034624 Iowa State Univ., Ames. Dept. of Chemistry
Electrocatalytic Material and Techniques for the Anodic Oxidation of Various Organic Compounds
Treimer, S. E.; 2001; 122 pp.
Report No.(s): DE2002-803741; No Copyright; Avail: Department of Energy Information Bridge
Contents include the following: General Introduction; A Consideration of the Application of Koutecky-Levich Plots in the Diagnosis of Charge-Transfer Mechanisms at Rotated Disk Electrodes; Simplified Model for Anodic Oxygen-Transfer Reactions Without and With Weak Reactant Adsorption; Voltammetric Response of Toluene and Xylenes Are Compared at Iron(III)-Doped, Bismuth(V)-Doped and Undoped-lead Dioxide Film Electrodes in 0.50 M H(Sub 2)So(Sub 4); Electrochemical Incineration of Selected Organic Compounds; Photo Assisted Electrochemical Incineration of Selected Organic Compounds; Electrochemical Conversion of Phenol to Acetic Acid, and General Conclusions.
NTIS
Electrocatalysts; Organic Compounds; Oxidation

20030034651 Southern Co., Services, Inc., Wilsonville, AL
Power Systems Development Facility. Technical Progress Report Gasification Test Run GCT3
May 2002; In English
Report No.(s): DE2002-802581; No Copyright; Avail: National Technical Information Service (NTIS)
This report discusses test campaign GCT3 of the Halliburton KBR transport reactor train with a Siemens Westinghouse Power Corporation (Siemens Westinghouse) particle filter system at the Power Systems Development Facility (PSDF) located in Wilsonville, Alabama. The transport reactor is an advanced circulating fluidized-bed reactor designed to operate as either a combustor or a gasifier using one of two possible particulate control devices (PCDs). The transport reactor was operated as a pressurized gasifier during GCT3.
NTIS
Potassium Bromides; Combustion Chambers; Research Facilities

20030034664 Lawrence Livermore National Lab., Livermore, CA

Core-Level Satellites and Outer Core-Level Multiplet Splitting in Mn Model Compounds

Nelson, A. J.; Reynolds, J. G.; Roos, J. W.; Oct. 18, 1999; 24 pp.; In English

Report No.(s): DE2002-791460; No Copyright; Avail: Department of Energy Information Bridge

We report a systematic study of the Mn 2p, 3s and 3p core-level photoemission and satellite structures for Mn model compounds. Charge-transfer from the ligand state to the 3d metal state is observed and is distinguished by prominent shake-up satellites. We also observe that the Mn 3s multiplet splitting becomes smaller as the Mn oxidation state increases, and that 3s-3d electron correlation reduces the branching ratio of the (sup 7)S:(sup5)S states in the Mn 3s spectra. In addition, as the ligand electronegativity decreases, the spin state purity is lost in the 3s spectra as evidenced by peak broadening. Our results are best understood in terms of the configuration-interaction (CI) model including intrashell electron correlation, charge-transfer and final-state screening.

NTIS

Photoelectric Emission; Manganese; Satellite Configurations; Cores; Configuration Interaction

20030034677 Air Force Research Lab., Edwards AFB, CA, USA

Methyl Tin(IV) Derivatives of HOTeF5 and HN(SO2CF3)2: A Solution Multi-NMR Study and X-ray Crystal Structures of (CH3)2SnC1(OTeF5) and (CH3)3Sn(H2O) 2N(SO2CF3)2

Vij, Ashwani; Wilson, William W.; Vij, Vandana; Corley, Robert C.; Tham, Fook S.; Jan 2003; 53 pp.; In English

Contract(s)/Grant(s): Proj-DARP

Report No.(s): AD-A410495; AFRL-PR-ED-TP-2002-306; No Copyright; Avail: CASI; A04, Hardcopy

The new tin(IV) species, (CH3)2SnCl(OTeF5), was prepared via solvolysis of (CH3)3SnCl in HOTeF5 or from the reaction of (CH3)3SnCl with ClOTeF5 and was characterized by NMR and vibrational spectroscopy, mass spectrometry, and single crystal X-ray diffraction. (CH3)2SnCl(OTeF5) crystallizes in the monoclinic space group P2(sub 1)/n (a = 5. 8204(8) A, b =10.782(1) A, c =15.493(2) A, beta=91.958(2), V =971.7(2) A (exp 3), Z = 4). NMR spectroscopy of (CH3)3SnX, prepared from excess Sn(CH3)4 and HX (X = OTeF5 or N(SO2CF3)2), revealed a tetracoordinate tin environment using (CH3)3SnX as a neat liquids or in CH2Cl2 solutions In acetone and CH3CN solution, the tin atom in (CH3)3SnOTeF5 was found to extend its coordination number to five by adding one solvent molecule. In the strong donor solvent, DMSO, the Sn-OTeF5 bond is broken and the (CH3) 3Sn(O=S(CH3)2)2+ cation and the OTeF5(-) anion are formed. (CH3)3SnOTeF5 and (CH3)3SnN(SO2CF3)2 show different reactivity with water. While the OTeF5 group of (CH3)3SnOTeF5 undergoes complete hydrolysis, (CH3)3SnN(SO2CF3)2 forms the stable hydrate salt, (CH3)3Sn(H2O)2N(SO2CF3)2. This salt crystallizes in the monoclinic space group P2(sub 1)/c (a = 7.3072(1) angstroms, b =13.4649(2) A, c =16.8?1(2) A, beta= 98.705(1)', V =1636.00(3) A(exp 3), Z = 4) and was also characterized by NMR and vibrational spectroscopy

DTIC

Crystal Structure; Mass Spectroscopy; Nuclear Magnetic Resonance

20030034680 Air Force Research Lab., Edwards AFB, CA, USA

Aluminum Doped Parahydrogen Solids

Fajardo, Mario E.; DeRose, Michelle E.; Tam, Simon; September 12, 2001; 3 pp.; In English

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A410498; AFRL-PR-ED-AB-2001-187; No Copyright; Avail: CASI; A01, Hardcopy

During the past year we focused our efforts towards the production and characterization of gram-scale cryogenic parahydrogen (pH2) solids doped with large (- 1\%) concentrations of Al atoms. We incorporated into our apparatus a commercially available effusive Al atom source capable of delivering Al atom fluxes in excess of 10(exp 17) #/sq cm-s to the sample deposition substrate, enabling the deposition of heavily-doped millimeters-thick samples on an ^1 hour timescale.

DTIC

Aluminum; Doped Crystals; Solids; Cryogenics; Para Hydrogen

20030034681 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA

CO VUV-Visible Emissions During Laser Photolyis of Ketene in the Presence of Excess O-atoms

Vaghjiani, Ghanshyam L.; May 2001; 3 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A410494; AFRL-PR-ED-AB-2001-117; No Copyright; Avail: CASI; A01, Hardcopy

The interactions of carbonaceous combustion species in rocket plumes with the atmosphere are thought to play an

important role in the production of ultraviolet, visible, and infrared radiation signatures at high altitudes. A detailed understanding of the pertinent chemical reactions that produce the electronically excited species, and of the competing quenching reactions that remove the internal energy in radiation-less processes is needed to accurately calculate short wavelength plume spectral signatures and absolute radiances and their temporal/spatial evolution in the high atmosphere. To facilitate these efforts, we are currently carrying out laboratory investigations to elucidate the reaction mechanism(s) in the oxidation of CH, CH2, C2H, and C2O with O-atoms and O2. Sufficient exothermicity in CH, CH2, and C2H reactions (except C2H + O) is available to produce CO in one or more of the triplet states (a, a', and d). Even more reaction enthalpy is available in C2O reaction(s) to produce higher excited states of CO (e, A, I, and D). Other excited species such as CH(A(exp 2) Delta) in C2H plus O or O2, and OH(A(exp 2)Sigma+) in CH + O2 reactions are also possible. CO-uv chemiluminescence has previously been identified in C2H + O2 reaction and both CO-uv and CO-vuv in the C2O + O reaction. However, no information is available on the product branching ratios of the excited CO states responsible for the emission. Estimates of the branching ratio of CH(A(exp 2)Delta) formation in the reactions of C2H with O and O2 can be found in the literature. To our knowledge, triplet CO formation in CH and CH2 reactions has not yet been positively identified. Fast discharge-flow tube and pulsed-laser photolysis methods have been employed in this work to study the reaction kinetics and chemiluminescence in these and C2O reactions. The experimental approach and results of these studies will be presented.
DTIC
Excitation; Photolysis; Oxygen; Carbon Monoxide; Chemiluminescence; Ketenes

20030034682 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Polyhedral Oligomeric Silsesquioxanes Surfactants
Viers, Brent D.; Esker, Alan; Farmer, Katie; Jan. 2001; 3 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A410399; AFRL-PR-ED-TP-2001-029; No Copyright; Avail: CASI; A01, Hardcopy

There has been recent interest in using polyhedral oligomeric silsesquioxanes (POSS) as the smallest particles of silica for reinforcement of polymers. These materials are monodisperse, have tailored functionality (including a hydrophobic coating) and should thus act as model nanoparticulate filler. Feher et al have shown that sol-gel condensation into cage compounds can yield two thermodynamically stable main isolates: a fully condensed R8T8 cube and an incompletely condensed R7T4D3(OH)3 trisilanol. (T refers to a SiO3/2 and D is a SiO2/2 moiety in a silicate framework) There are large differences in the solubility of POSS in common organic solvents based on the substitution of the cages. For example, a fully condensed iBu8T8 cube is more soluble than a similar cyclohexyl Cy8T8 cube which in turn is more soluble than a cyclopentyl Cp8T8 substituted cube. Furthermore the breaking of symmetry in the incompletely condensed cubes could also be expected to enhance solubility/compatibility. The dispersion of POSS will likely determine how well the material can act as a 'nanofiller.' Farmer et. al. have recently performed molecular dynamics simulations which suggest that POSS molecules have no tendency for aggregation in a polymeric matrix if they are originally well dispersed.
DTIC
Polymers; Surfactants; Cyclohexane; Clathrates; Nanoparticles

20030034683 Air Force Research Lab., Edwards AFB, CA, USA
Hybrid Inorganic-Organic Performance Fluids Based on Polyhedral Oligomeric Silsesquioxanes (POSS)
Blanski, Rusty; Leland, Justin; Viers, Brent; Phillips, Shawn; Dec 2001; 3 pp.; In English
Contract(s)/Grant(s): Proj-1011
Report No.(s): AD-A410400; AFRL-PR-ED-AB-2001-243; No Copyright; Avail: CASI; A01, Hardcopy

Performance fluids that operate at high temperature can be useful for many applications including highly efficient automobile engines and jet turbines. One challenging aspect to this project is to increase the use temperature of the performance fluid while maintaining low temperature pourability. One possible solution to this hurdle is to combine the high temperature stability of a silsesquioxane framework with the lubricity of hydrocarbons. Data will be presented on a wide variety of POSS alkyls were synthesized to test the various POSS frameworks for temperature stability and pourability at lower temperatures. Thermal and viscosity data will also be discussed.
DTIC
Polyhedrons; Oligomers

20030034684 Air Force Research Lab., Edwards AFB, CA, USA
Observation of the Cyclic Water Hexamer in Solid Parahydrogen
Fajardo, Mario E.; Tam, Simon; Jul 2001; 6 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A410499; AFRL-PR-ED-TP-2001-167; No Copyright; Avail: CASI; A02, Hardcopy

We present infrared (IR) absorption spectra of cryogenic parahydrogen solids doped with small water clusters. We observe a sequence of peaks shifted to the red by approx. 15/cm from the absorptions of cyclic water clusters in liquid helium droplets K. Nauta and R.E. Miller Science 287 293(2000); this sequence includes the peak due to the cyclic isomer of the water hexamer: cyc-(H2O)6. We believe this is only the second spectroscopic observation of isolated cyc-(H2O)6, and the first report of the IR spectrum of the isolated cluster in the solid phase.
DTIC
Infrared Absorption; Infrared Spectra; Para Hydrogen; Solid Cryogens; Water; Cyclic Compounds

20030034685 Air Force Research Lab., Edwards AFB, CA, USA
Single and Double Infrared Transitions in Rapid Vapor Deposited Parahydrogen Solids: Application to Sample Thickness Determination and Quantitative Infrared Absorption Spectroscopy
Tam, Simon; Fajardo, Mario E.; Apr 2001; 43 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A410500; AFRL-PR-ED-TP-2001-074; No Copyright; Avail: CASI; A03, Hardcopy

We present a convenient method for determining the thickness of a cryogenic parahydrogen (pH2) solid from its infrared (IR) absorption spectrum. Millimeters-thick pH2 solids of exceptional optical clarity can be produced by the rapid vapor deposition method. Doping of these pH2 solids is readily accomplished by co-deposition of the desired impurities, making them excellent hosts for high- resolution matrix isolation spectroscopy. The intensities of the IR 'double' transitions Q1(0)+S0(0) and S1(0)+S0(0) of the pH2 host are insensitive to the matrix microstructure and to the presence of dopants, so these absorptions are especially well suited for thickness determinations. We calibrate the integrated absorption intensities of these two bands against the sample thicknesses determined from transmission interference fringes appearing in the same experimental spectra; we report: aQ1(0)+S0(0) = 4.84(+ or -0.l3)xl0(exp -14) cu cm/s, and aS1(0)+S0(0) = 0.35(+ or -0.02)xl0(exp -14) cu cm/s (95\% confidence). We also discuss several other advantages of rapid vapor deposited pH2 solids as hosts for quantitative IR absorption spectroscopy of dopant species.
DTIC
Para Hydrogen; Spectroscopy; Vapor Deposition; Additives; Infrared Spectra; Rocket Propellants

20030034710 Oak Ridge National Lab., TN, Lockheed Martin Energy Research, Corp., Oak Ridge, TN
Very Appoximate Theory for Gas Transport in a Polymer Foam
Kirkpatrick, J. R.; Dec. 1999; 36 pp.; In English
Report No.(s): DE2002-750985; No Copyright; Avail: Department of Energy Information Bridge

The author is involved with a project that requires calculation of the flow of gas through thin sheets of a flexible polymer foam. Essentially, the foam is a collection of interconnected spherical holes in the polymer matrix. When the material is made, its porosity is in the range of 60 - 70\%. Initially, the sheets are roughly a millimeter thick. In the application, the sheets are compressed between solid surfaces so that their thickness is reduced to approximately 50 - 75\% of the original (thereby reducing the porosity to as low as 20\%). The project requires calculating gas transport in the longitudinal direction (in other words, parallel to the thin section of the sheets and perpendicular to the direction of compression). The transport calculations must be done in three different flow regimes. First, with gas pressures high enough so that the gas in the pores is in the continuum regime and thus the transport is governed by the usual equations for flow of a compressible gas in a porous medium. Second, with gas pressures low enough so that the flow is in the free molecular region. In the third regime, the foam is filled with a carrier gas (with pressure high enough to be in continuum) and the flow of interest is that of a small amount of an additional gas. In this third regime, the driving force is diffusion of the trace gas in the carrier.
NTIS
Gas Transport; Foams

20030034711 Air Force Research Lab., Edwards AFB, CA, USA
New Materials Design
Boatz, Jerry; May 2002; 37 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A410667; AFRL-PR-ED-VG-2002-118; No Copyright; Avail: CASI; A03, Hardcopy

This report discusses high energy density matter: polyhedral oligomeric silsesquioxanes (POSS), non-linear optical materials. Also, theoretical methods and benchmarks are discussed: ab initio electronic structure theory, nuclear-electronic orbital approach, and centroid molecular dynamics.
DTIC
Molecular Dynamics; Rocket Propellants

20030034908 Lawrence Livermore National Lab., Livermore, CA
Kinetic Study of the Combustion of Phosphorus Containing Species
Glaude, P. A.; Curran, H. J.; Pitz, W. J.; Westbrook, C. K.; Oct. 22, 1999; 20 pp.; In English
Report No.(s): DE2002-791455; No Copyright; Avail: Department of Energy Information Bridge

The combustion of organophosphorus compounds is of great interest for the incineration of chemical warfare agent and their use in flame inhibition as halon replacement. The thermochemical data of these species and the reactions involved at high temperature are not well known, despite some recent experimental studies. With BAC-MP4 ab initio estimations as a basis and semi-empirical estimations for many new compounds, the thermochemistry of organophosphorus compounds is studied. New group additivity values are proposed for enthalpies of formation at 298K, entropies and heat capacities of species involving pentavalent phosphorus bonded to carbon, hydrogen, oxygen, fluorine, nitrogen and sulfur atoms. The kinetic of unimolecular elimination is investigated by modeling pyrolysis experiments of DEMP, TEP and DIMP. A new combustion mechanism is described and applied to the modeling of DMMP reaction in a H2/O2, flame.
NTIS
Combustion; Phosphorus Compounds; Oxidation-Reduction Reactions; Reaction Kinetics; Organic Compounds

20030037012 Lawrence Livermore National Lab., Livermore, CA
Prediction of Carbon Monoxide and Hydrocarbon Emissions in Isooctane HCCI Engine Combustion Using Multi-Zone Simulations
Flowers, D. L.; Aceves, S. M.; Martinez-Fias, J.; Dibble, R. W.; May 02, 2002; 30 pp.; In English
Report No.(s): DE2002-15002362; UCRL-JC-148209; No Copyright; Avail: Department of Energy Information Bridge

Homogeneous Charge Compression Ignitions (HCCI) engines show promise as an alternative to Diesel engines, yet research remains: development of practical HCCI engines will be aided greatly by accurate modeling tools. A novel detailed chemical kinetic model that incorporates information from a computational fluid mechanics code has been developed to simulate HCCI combustion. This model very accurately predicts many aspects of the HCCI combustion process. High-resolution computational grids can be used for the fluid mechanics portion of the simulation, but the chemical kinetics portion of the simulation can be reduced to a handful of computational zones (for all previous work 10 zones have been used). While overall this model has demonstrated a very good predictive capability for HCCI combustion, previous simulations using this model have tended to underpredict carbon monoxide emissions by an order of magnitude. A factor in the underprediction of carbon monoxide may be that all previous simulations have been conducted with 10 chemical kinetic zones. The chemistry that results in carbon monoxide emissions is very sensitive to small changes in temperature within the engine. The resolution in temperature is determined directly by the number of zones. This paper investigates how the number of zones (i.e. temperature resolution) affects the model's prediction of hydrocarbon and carbon monoxide emissions in an HCCI engine. Simulations with 10, 20, and 40 chemical kinetic zones have been conducted using a detailed chemical kinetic mechanism (859 species, 3606 reactions) to simulate an isooctane fueled HCCI engine. The results show that 10-zones are adequate to resolve the hydrocarbon emissions, but a greater numbers of zones are required to resolve carbon monoxide emissions. Results are also presented that explore spatial sources of the exhaust emissions within the HCCI engine combustion chamber.
NTIS
Carbon Monoxide; Hydrocarbons; Prediction Analysis Techniques; Emission; Combustion Chambers

20030037020 National Renewable Energy Lab., Golden, CO
Issues associated with the Use of Higher Ethanol Blends (E17-E24)
Hammel-Smith, C.; Fang, J.; Powers, M.; Aabakken, J.; Oct. 2002; In English
Report No.(s): DE2002-15000996; No Copyright; Avail: National Technical Information Service (NTIS)

This report reviews the issues associated with utilizing higher ethanol blends (E17-E24), and is intended to advise the Department of Energy (DOE) on factors that might encourage or constrain the integration of such blends into the marketplace. Subjects include technical vehicle issues, emissions and emissions testing, infrastructure, market issues, and regulatory and policy considerations. These subjects are examined in relation to both the changes needed to accommodate higher ethanol

blends and the effect of higher ethanol blends on current systems. A full account of the key issues and conclusions and recommendations pertaining to blends in general (ranging from E10-E85), are presented in the Summary, Conclusions, and Recommendations sections. The purpose of this Executive Summary, however, is to focus on key conclusions related to the use of higher ethanol blends. The following are the key conclusions reached in this report.
NTIS
Fuels; Ethyl Alcohol; Mixtures

20030037059 Clark Atlanta Univ., GA
Study of the Effects of Ambient Conditions Upon the Performance of Fan Powered, Infrared, Natural Bas Burners
Dec. 2002; 68 pp.; In English
Report No.(s): DE2002-805233; No Copyright; Avail: Department of Energy Information Bridge
The final report describes work performed under DOE Grant No. DE-FG22-94MT94011 during the period September 1, 1994 to May 28, 1997. The objective of this investigation is to characterize the operation of a fan-powered, infrared burner (IR burner) at various gas compositions and ambient conditions, develop numerical model to simulate the burner performances, and provide design guidelines for appliances containing PIR burners for satisfactory performance.
NTIS
Natural Gas; Burners; Ambient Temperature

20030037100 Westinghouse Savannah River Co., Aiken, SC
Behavior of Pu and Gd Mixtures Under Simulated SRAT Conditions (U)
Bibler, N. E.; Bronikowski, M. G.; Gray, J. H.; Hill, B. C.; May 13, 2002; 40 pp.
Report No.(s): DE2002-805603; No Copyright; Avail: Department of Energy Information Bridge
A mechanism was found for separating Pu from Gd in the SRAT cycle. The separation could not be spatially quantified by SEM due to being at or below the LOD of the method. From solubility only 2.6\% of the Gd is solubilized at normal SRAT conditions. Pu solubility, as expected, is very low, ranging from 0.32\% to 10\% in the bounding conditions studied. The Gd solubility appears to be dependent on the relative amount of the more soluble sludge components. In the pH and concentration range studied here, the amount of Gd that is solubilized ranges from 13\% to 47\% with sludge and essentially 100\% in the absence of sludge.
NTIS
Sludge; Tanks (Containers); Waste Management; Radioactive Wastes

20030037129 National Inst. of Standards and Technology, Gaithersburg, MD, Laboratoire de Mineralogie-Cristallographie, Paris (France)
X-Ray-Absorption Edge Separation Using Diffraction Anomalous Fine-Structure
Ravel, B.; Bouldin, C. E.; Renevier, H.; Hodeau, J. L.; Berar, J. F.; Dec. 24, 1998; 14 pp.; In English
Report No.(s): PB2003-102684; No Copyright; Avail: CASI; A03, Hardcopy
When two or more absorption edges in a material are sufficiently close in energy, Extended X-ray Absorption Fine-Structure (EXAFS) spectroscopy is of limited utility as the usable data range above the lower energy edge is truncated by the higher energy edge. Energy or wavelength discriminating detection methods may fail to resolve fluorescence lines which are very close in energy. In this paper we present a novel solution to this problem using the resolution in momentum transfer of Diffraction Anomalous Fine-Structure (DAFS) to separate the fine structure signals from elements with closely spaced fluorescence lines. We demonstrate our technique by isolating the titanium edge signal from DAFS measurements.
NTIS
Diffraction; Fine Structure; X Ray Absorption; Anomalies; X Ray Spectroscopy

20030037168 Lawrence Livermore National Lab., Livermore, CA
Shock Induced Birefringence in Lithium Fluoride
Nguyen, J. H.; Holmes, N. C.; Jun. 01, 2001; In English
Report No.(s): DE2002-15002087; UCRL-JC-145221; No Copyright; Avail: National Technical Information Service (NTIS)
We have used an ellipsometer to measure the birefringence of lithium fluoride in shock compression experiments. In previous x-ray diffraction experiments, single crystal has been reported to remain cubic at moderate pressures.
NTIS
Birefringence; Ellipsometers; Lithium Fluorides; Shock Loads

20030037175 Air Products and Chemicals, Inc., Allentown, PA

Engineering Development of Slurry Bubble Column Reactor (SBCR) Technology

2002; 58 pp.; In English

Report No.(s): DE2002-803205; No Copyright; Avail: Department of Energy Information Bridge

The major technical objectives of this program are threefold: (1) to develop the design tools and a fundamental understanding of the fluid dynamics of a slurry bubble column reactor to maximize reactor productivity, (2) to develop the mathematical reactor design models and gain an understanding of the hydrodynamic fundamentals under industrially relevant process conditions, and (3) to develop an understanding of the hydrodynamics and their interaction with the chemistries occurring in the bubble column reactor. Successful completion of these objectives will permit more efficient usage of the reactor column and tighter design criteria, increase overall reactor efficiency, and ensure a design that leads to stable reactor behavior when scaling up to large diameter reactors.

NTIS

Bubbles; Reactor Design; Reactor Technology; Slurries; Chemical Reactors

20030037184 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA

Nanoporous Silicon Carbide for Nanoelectromechanical Systems Applications

Hossain, T.; Khan, F.; Adesida, I.; Bohn, P.; Rittenhouse, T.; Lienhard, Michael, Technical Monitor; April 2003; 17 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG3-2661; WU 708-87-23

Report No.(s): NASA/CR-2003-212198; NAS 1.26:212198; E-13801; No Copyright; Avail: CASI; A03, Hardcopy

A major goal of this project is to produce porous silicon carbide (PSiC) via an electroless process for eventual utilization in nanoscale sensing platforms. Results in the literature have shown a variety of porous morphologies in SiC produced in anodic cells. Therefore, predictability and reproducibility of porous structures are initial concerns. This work has concentrated on producing morphologies of known porosity, with particular attention paid toward producing the extremely high surface areas required for a porous flow sensor. We have conducted a parametric study of electroless etching conditions and characteristics of the resulting physical nanostructure and also investigated the relationship between morphology and materials properties. Further, we have investigated bulk etching of SiC using both photo-electrochemical etching and inductively-coupled-plasma reactive ion etching techniques.

Author

Nanostructure (Characteristics); Porous Silicon; Silicon Carbides; Nanotechnology; Crystal Morphology

20030038817 NASA Glenn Research Center, Cleveland, OH, USA

Transient Evolution of a Planar Diffusion Flame Aft of a Translating Flat Plate

Gokoglu, Suleyman A.; April 2003; 17 pp.; In English; Second Mediterranean Combustion Symposium, 6-9 Jan. 2002, Sharm El-Sheikh, Egypt; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-101-42-02

Report No.(s): NASA/TM-2003-212107; NAS 1.15:212107; E-13762; No Copyright; Avail: CASI; A03, Hardcopy

The high degree of spatial symmetry of a planar diffusion flame affords great simplifications for experimental and modeling studies of gaseous fuel combustion. Particularly, in a microgravity environment, where buoyancy effects are negligible, an effectively strain-rate-free, vigorous flame may be obtained. Such a flame can also provide long residence times and large length scales for practical probing of flame structures and soot processes. This 2-D numerical study explores the feasibility of establishing such a planar diffusion flame in an enclosed container utilizing a realistic test protocol for a microgravity experiment. Fuel and oxygen mixtures, initially segregated into two half-volumes of a squat rectangular container by a thin separator, are ignited as soon as a flammable mixture is formed in the wake of the separator withdrawn in the centerplane. A triple-flame ensues that propagates behind the trailing edge of the separator. The results of calculations show that the mechanically- and thermally-induced convection decays in about two seconds. The establishment of a planar diffusion flame after this period seems feasible in the central region of the container with sufficient quantities of reactants left over for subsequent studies. An analysis of the flame initiation and formation process suggests how the feasibility of creating such a flame can be further improved.

Author

Diffusion Flames; Flat Plates; Fuel Combustion; Combustion Physics; Flame Stability; Flame Propagation

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METALS AND METALLIC MATERIALS

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

20030032265 Pennsylvania State Univ., University Park, PA, USA
3D Finite Element Analysis of Particle-Reinforced Aluminum
Shen, H.; Lissenden, C. J.; February 01, 2002; 6 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-848; RTOP 706-85-24
Report No.(s): E-13677; No Copyright; Avail: CASI; A02, Hardcopy

Deformation in particle-reinforced aluminum has been simulated using three distinct types of finite element model: a three-dimensional repeating unit cell, a three-dimensional multi-particle model, and two-dimensional multi-particle models. The repeating unit cell model represents a fictitious periodic cubic array of particles. The 3D multi-particle (3D-MP) model represents randomly placed and oriented particles. The 2D generalized plane strain multi-particle models were obtained from planar sections through the 3D-MP model. These models were used to study the tensile macroscopic stress-strain response and the associated stress and strain distributions in an elastoplastic matrix. The results indicate that the 2D model having a particle area fraction equal to the particle representative volume fraction of the 3D models predicted the same macroscopic stress-strain response as the 3D models. However, there are fluctuations in the particle area fraction in a representative volume element. As expected, predictions from 2D models having different particle area fractions do not agree with predictions from 3D models. More importantly, it was found that the microscopic stress and strain distributions from the 2D models do not agree with those from the 3D-MP model. Specifically, the plastic strain distribution predicted by the 2D model is banded along lines inclined at 45 deg from the loading axis while the 3D model prediction is not. Additionally, the triaxial stress and maximum principal stress distributions predicted by 2D and 3D models do not agree. Thus, it appears necessary to use a multi-particle 3D model to accurately predict material responses that depend on local effects, such as strain-to-failure, fracture toughness, and fatigue life.
Author
Aluminum Alloys; Finite Element Method; Strain Distribution; Triaxial Stresses; Stress-Strain Relationships; Tensile Stress; Computerized Simulation; Elastic Deformation

20030032927 NASA Glenn Research Center, Cleveland, OH, USA
Specific Hardening Function Definition and Characterization of a Multimechanism Generalized Potential-Based Viscoelastoplasticity Model
Arnold, S. M.; Saleeb, A. F.; February 2003; 38 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-808; 22-713-82-35
Report No.(s): NASA/TM-2003-212219; NAS 1.15:212219; E-13833; No Copyright; Avail: CASI; A03, Hardcopy

Given the previous complete-potential structure framework together with the notion of strain- and stress-partitioning in terms of separate contributions of several submechanisms (viscoelastic and viscoplastic) to the thermodynamic functions (stored energy and dissipation) a detailed viscoelastoplastic multimechanism characterization of a specific hardening functional form of the model is presented and discussed. TIMETAL 21S is the material of choice as a comprehensive test matrix, including creep, relaxation, constant strain-rate tension tests, etc. are available at various temperatures. Discussion of these correlations tests, together with comparisons to several other experimental results, are given to assess the performance and predictive capabilities of the present model particularly with regard to the notion of hardening saturation as well as the interaction of multiplicity of dissipative (reversible/irreversible) mechanisms.
Author
Elastoplasticity; Viscoelasticity; Viscoplasticity; Hardening (Materials); Models; Thermodynamics; Titanium Alloys

20030033070 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The FERRUM Project: Experimental Transition Probabilities of [Fe II] and Astrophysical Applications
Hartman, H.; Derkatch, A.; Donnelly, M. P.; Gull, T.; Hibbert, A.; Johannsson, S.; Lundberg, H.; Mannervik, S.; Norlin, L. -O.; Rostohar, D.; November 16, 2002; 8 pp.; In English
Contract(s)/Grant(s): GR/L20276; HST-7302; Copyright; Avail: CASI; A02, Hardcopy

We report on experimental transition probabilities for thirteen forbidden [Fe II] lines originating from three different metastable Fe II levels. Radiative lifetimes have been measured of two metastable states by applying a laser probing technique on a stored ion beam. Branching ratios for the radiative decay channels, i.e. M1 and E2 transitions, are derived from observed

intensity ratios of forbidden lines in astrophysical spectra and compared with theoretical data. The lifetimes and branching ratios are combined to derive absolute transition probabilities, A-values. We present the first experimental lifetime values for the two Fe II levels a(sup 4)G(sub 9/2) and b(sup 2)H(sub 11/2) and A-values for 13 forbidden transitions from a(sup 6)S(sub 5/2), a(sup 4)G(sub 9/2) and b(sup 4)D(sub 7/2) in the optical region. A discrepancy between the measured and calculated values of the lifetime for the b(sup 2)H(sub 11/2) level is discussed in terms of level mixing. We have used the code CIV3 to calculate transition probabilities of the a(sup 6)D-a(sup 6)S transitions. We have also studied observational branching ratios for lines from 5 other metastable Fe II levels and compared them to calculated values. A consistency in the deviation between calibrated observational intensity ratios and theoretical branching ratios for lines in a wider wavelength region supports the use of [Fe II] lines for determination of reddening.
Author
Astrophysics; Experimentation; Iron; Forbidden Transitions; Metastable State; Stellar Spectra

20030033831 Naval Undersea Warfare Center, Newport, RI
A Method for Estimating the Mechanical Properties of a Solid Material Subjected to Insonification - Part 1: Theory
Hull, Andrew J.; Dec 2002; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410618; NUWC-NPT-TR-11404; No Copyright; Avail: CASI; A03, Hardcopy

A theoretical inverse method is develop to measure the complex, frequency deponent dilatational and shear wavespeeds that are present in isotropic thick plates. Once this wavespeeds are identified, the complex, frequency dependent Young's and shear moduli and complex, frequency-dependent Poisson's ratio can he estimated. Simulations are presented both with and without noise to show how the method works and how the measurement error affect the analysis results.
DTIC
Mechanical Properties; Slabs; Structural Members

20030033952 Lawrence Livermore National Lab., Livermore, CA
Microstructural Evolution in the 2219 Aluminum During Sever Plastic Deformation
Kaibyshev, R. O.; Safarov, I. M.; Lesuer, D. R.; Mar. 29, 2000; 12 pp.; In English
Report No.(s): DE2002-792652; No Copyright; Avail: Department of Energy Information Bridge

The objective of the present work is to examine the microstructure evolution during severe plastic deformation of a 2219 aluminum alloy. Specific attention is given to the mechanism of ultrafine grain formation as a result of severe plastic deformation.
NTIS
Aluminum; Aluminum Alloys; Microstructure; Plastic Deformation

20030033953 Air Force Research Lab., Edwards AFB, CA, USA
ALCAN Viewgraph
Huff, Rob; Apr 2002; 3 pp.; In English
Contract(s)/Grant(s): F04611-02-C-0001; Proj-4847
Report No.(s): AD-A410665; AFRL/PRS-ED-VG-2002-072; No Copyright; Avail: CASI; A01, Hardcopy

The Advanced Lightweight Chamber and Nozzle (ALCAN) program is focused on achieving IHPRPT Phase 2 goals for 25 percent reduced cost, 60 percent increased thrust/weight, and up to 15 percent improved performance of the current state of the art in rocket engines. The overwrapped formed platelet inner chamber will reduce parts count and improve chamber cooling and life. Channel wall technology and advanced materials used in the nozzle will contribute to major reductions in weight, and altitude-compensating technology will increase mission average performance. (1 viewgraph)
DTIC
Rocket Engines; Exhaust Nozzles; Walls; Technology Utilization; Combustion Chambers

20030036910 Westinghouse Savannah River Co., Aiken, SC
Characterization of Corrosion Damage on Aluminum Fuel Assemblies in Basin Storage
Andes, T. C.; Large, W. S.; Castle, T. B.; Louthan, M. R.; Valdes, V. S.; 2002; 14 pp.; In English
Report No.(s): DE2002-801711; WSRC-MS-2002-00732; No Copyright; Avail: Department of Energy Information Bridge

This paper summarizes the inspections and inspection results in conjunction with the corrosion experience of aluminum-clad SNF in basin storage.
NTIS
Aluminum; Corrosion; Fuel Systems

20030036950 Helsinki Univ. of Technology, Espoo (Finland)
Effect of Dissolved Ozone on the Corrosion Behavior of Some Stainless Steels
Pehkonen, A.; Dec. 2001; 122 pp.
Report No.(s): PB2003-102635; TKK-MK-97; Copyright; Avail: National Technical Information Service (NTIS)

The corrosion behavior of some stainless steels and pure metals has been investigated in solutions with dissolved ozone. The pH of the test solution was 1, 2, 3 and neutral (adjusted by H2SO4). 2.3 and 23 g/l Na2SO4 was added to increase the conductivity in anodic and cathodic polarisation measurements. The temperature of the test solution was 20, 50 and 75 degrees C. Test materials were four different stainless steels: ferritic stainless steel Polarit 815 and austenitic stainless steels Polarit 720, Polarit 752 and Ralloy 654MO. Also Armco iron, pure Mo, Ni and Cr were tested. The general electrochemical behavior of stainless steels and pure metals was studied with potentiodynamic cyclic polarization experiments at scanning rates 1, 10 and 100 mV/min and pitting behavior at 10 mV/min. Potentiostatic experiments were also used. Immersion tests were also carried out mainly to produce test samples for surface examination but also to measure the weight losses. The structure and thickness of the oxidized surfaces were examined and analysed using optical microscope, SEM, GDOS, ESCA and X-ray diffractometer methods. Dissolved ozone increases the redox-potential of test solutions to about +1200 mV vs. SCE and the corrosion potential of stainless steel to the transpassive region, below the oxygen evolution potential. The current densities of stainless steels in this region increase as the amount of alloying elements increases. On the other hand, dissolved ozone increases current densities only slightly compared to oxygen bubbled solution. Higher ozone concentration obtained under high pressure has no effect on the corrosion behavior of stainless steels.
NTIS
Corrosion; Ozone; Stainless Steels

20030037003 National Renewable Energy Lab., Golden, CO
Cu(In,Ga)Se(2) Thin-Film Evolution During Growth: A Photoluminescense Study
Keyes, B. M.; Dippo, P.; AbuShama, J.; Noufi, R.; May 2002; In English
Report No.(s): DE2002-15000986; No Copyright; Avail: National Technical Information Service (NTIS)

This conference paper describes the in-depth understanding of the defect formation and resulting changes in material quality occurring during the Cu(In, Ga)Se2 growth process is vital to the successful and widespread use of this photovoltaic material. In an attempt to develop such an understanding, we investigated the growth of Cu(In,Ga)Se2 thin-films from (In,Ga)2Se3 precursors. This was achieved by using energy- and time-resolved photoluminescence spectroscopies to characterize a series of thin-films, each removed at a different point along the reaction pathway of the 'three-stage' growth process. The resulting thin-films are representative of the absorber layer as it proceeds from a Cu-rich to In(Ga)-rich state. The experimental results support a growth model incorporating defect changes in the dominant defect states and improvement in the recombination lifetime during this final stage of the growth process as the material transitions to a Cu-poor phase.
NTIS
Growth; Photoluminescence; Defects; Thin Films; Copper Alloys

20030037011 Lawrence Livermore National Lab., Livermore, CA
Microstructure Evolution in Irradiated Materials
Caturla, M. J.; Nov. 30, 1999; 12 pp.; In English
Report No.(s): DE2002-15002353; UCRL-ID-136990; No Copyright; Avail: Department of Energy Information Bridge

We will study the interaction of defects produced during irradiation or deformation of a metal with the microstructure of that particular material, such as dislocations and grain boundaries. In particular we will study the interaction of dislocation with interstitial loops and stacking fault tetrahedral, and the production of displacement cascades close to dislocations and grain boundaries. The data obtained from these simulations will be used as input to diffusion models and dislocation dynamics models.
NTIS
Microstructure; Irradiation; Radiation Effects

20030037128 Geological Survey, Reston, VA
Cobalt Recycling in the USA in 1998
Shedd, K.; 2002; 22 pp.
Report No.(s): PB2003-102704; USGS-OFR-02-299; No Copyright; Avail: CASI; A03, Hardcopy

This report is one of a series of reports on metals recycling. It defines and quantifies the 1998 flow of cobalt-bearing materials in the USA, from imports and stock releases through consumption and disposition, with particular emphasis on the recycling of industrial scrap (new scrap) and used products (old scrap). Because of cobalts many and diverse uses, numerous types of scrap were available for recycling by a wide variety of processes. In 1998, an estimated 32 percent of U.S. cobalt supply was derived from scrap. The ratio of cobalt consumed from new scrap to that from old scrap was estimated to be 50:50. Of all the cobalt in old scrap available for recycling, an estimated 68 percent was either consumed in the USA or exported to be recycled.
NTIS
Cobalt; Recycling; Scrap

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*.

20030032312 NASA Glenn Research Center, Cleveland, OH, USA
NMR Guided Design of Endcaps With Improved Oxidation Resistance
Meador, Mary Ann B.; Frimer, Aryeh A.; [2002]; 2 pp.; In English; 2002 Spring National ACS Meeting, 23-28 Mar. 2003, New Orleans, LA, USA
Contract(s)/Grant(s): WBS 22-708-31-13; Copyright; Avail: CASI; A01, Hardcopy

A polyimide is a polymer composed of alternating units of diamine and dianhydride, linked to each other via an imide bond. PMR polyimides, commonly used in the aerospace industry, are generally capped at each end by a norbornene endcap which serves a double function: (1) It limits the number of repeating units and, hence, the average molecular weight of the various polymer chains (oligomers), thereby improving processibility; (2) Upon further treatment (curing), the endcap crosslinks the various oligomer strands into a tough heat-resistant piece. Norbornenyl-end capped PMR polyimide resins' are widely used as polymer matrix composite materials for aircraft engine applications,2 since they combine ease of processing with good oxidative stability up to 300 C. PMR resins are prepared by a twestep approach involving the initial formation of oligomeric pre-polymers capped at both ends by a latent reactive end cap. The end cap undergoes cross-linking during higher temperature processing, producing the desired low density, high specific strength materials, as shown for PMR-15.
Author
Nuclear Magnetic Resonance; Oxidation Resistance; Polyimides; Oligomers; Degradation; Polymers

20030032382 Florida Univ., Gainesville, FL
Synthesis and In-Situ Atomic Oxygen Erosion Studies of Space-Survivable Hybrid Organic/Inorganic Polyhedral Oligomeric Silsesquioxane Polymers
Gonzalez, Rene I.; Jan. 2002; 202 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AF Proj. 2303
Report No.(s): AD-A410101; AFRL-PR-ED-TP-2002-064; No Copyright; Avail: CASI; A10, Hardcopy

Polymeric materials offer many advantages for low Earth orbit applications including ease of processing and reduced payload-to-orbit costs derived from a reduction in weight. However, over the last two decades it has been well established that polymers used in the construction of space vehicles undergo severe degradation resulting in reduced spacecraft lifetimes. These materials degrade because spacecraft surfaces must endure a high atomic oxygen (AO) flux, bombardment by low and high-energy charged particles, and thermal cycling along with the full spectrum of solar radiation. Many studies have been conducted in an effort to determine the mechanism of degradation primarily caused by surface reactions with oxygen atoms. Unfortunately, these studies have all been carried out after exposing these highly reactive surfaces to air prior to analysis, thus introducing artifacts that do not represent the true effect of the space environment.
DTIC
Polymers; Surface Reactions; Oxygen Atoms

20030032413 NASA Langley Research Center, Hampton, VA, USA
Electrospinning of a Micro-air Vehicle Wing Skin
Pawlowski, K. J.; Belvin, H. L.; Raney, D. L.; Su, J.; Harrison, J. S.; Siochi, E. J., Elsevi; Polymer; 2003; ISSN 0032-3861; Volume 44, pp. 1309-1314; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

Electrospinning was utilized to create lightweight, electrically responsive wing skins for micro-air vehicle (MAV) wing frame designs. Various compositions of an electroactive polymer were investigated to determine the appropriate electrospinning conditions for these materials. Electrospun mats of these materials were characterized via optical microscopy and scanning electron microscopy. Tensile properties of the electrospun fibers were also measured. An optimal polymer composition was electrospun onto MAV wing frames to create a bird wing-like texture. Preliminary testing of electroactivity of these prototype MAV wings is reported here.
Author
Electroactive Polymers; Textures; Wings; Weight Reduction

20030033090 Air Force Research Lab., Edwards AFB, CA, USA
Thin Film Properties of POSS
Viers, Brent; April 24, 2002; 20 pp.; In English
Contract(s)/Grant(s): AF Proj. 4847
Report No.(s): AD-A410420; AFRL-PR-ED-VG-2002-087; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available.
Thin Films; Organic Materials; Inorganic Materials

20030033105 Army Research Lab., Aberdeen Proving Ground, MD
Current Progress on the Study of Model, Polystyrene-Based, Polymer-Layered Silicate Nanocomposites
Beyer, Frederick L.; Madison, Phil; Kurian, Mary; Dasgupta, Arnab; Galvin, Mary E.; Jan. 2003; 14 pp.; In English
Contract(s)/Grant(s): Proj-AH42
Report No.(s): AD-A410597; ARL-TN-195; No Copyright; Avail: CASI; A03, Hardcopy

The morphological behavior of a series of polystyrene-based, polymer-layered silicate nanocomposites is being studied. The materials and parametric variations were designed to probe the Balazs model, which predicts that under certain circumstances, a homopolymer can intercalate or even exfoliate a modified layered silicate clay mineral at thermodynamic equilibrium. At the current time, the morphological and mechanical behaviors of two new series of samples are being characterized. These results are presented here.
DTIC
Polystyrene; Polymers; Silicates

20030033107 Stanford Univ., Stanford, CA
Mechanisms of Photorefractivity in Polymeric Materials
Moerner, W. E.; Twieg, R. J.; December 31, 2002; 38 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0038; AF Proj. 2303
Report No.(s): AD-A410600; AFRL-SR-AR-TR-03-0016; No Copyright; Avail: CASI; A03, Hardcopy

This grant features a dual-edged effort of physical measurement (at Stanford) and synthesis (at the Kent State subcontractor) to develop new photorefractive polymers, demonstrate previously unobserved physical effects, and most importantly, to understand the mechanisms controlling the performance. This collaboration between Stanford and Kent, has successfully developed several new classes of materials which have been explored in detail using thermal, optical, electrical, and photorefractive measurements. Using our faster materials, we have demonstrated two new applications for photorefractive polymers: image amplification/novelty filtering, near-infrared response in a glassy photorefractive, and adaptive beamsplitting for detection of laser-generated ultrasound.
DTIC
Polymers; Photorefractivity

20030033874 Air Force Research Lab., Edwards AFB, CA, USA
Hybrid Inorganic-Organic Performance Fluids Based on Polyhedral Oligomeric Silsesquioxanes (POSS)
Blanski, Rusty; Leland, Justin; Viers, Brent; Phillips, Shawn H.; April 15, 2002; 29 pp.; In English
Report No.(s): AD-A410360; AFRL-PR-ED-VG-2002-082; No Copyright; Avail: CASI; A03, Hardcopy

Hybrid Performance Fluids are fluids that can operate at elevated temperatures under extreme conditions for a variety of applications such as hydraulic and transmission fluids as well as lubricants. One area the Air Force is interested in is high temperature lubricants.
DTIC
High Temperature Lubricants; Hydraulic Fluids; Oligomers; Hybrid Structures

20030033876 Air Force Research Lab., Edwards AFB, CA
Investigating Cumulative Damage in a Highly Filled Polymeric Material
Liu, C. T.; January 22, 2001; 3 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410245; AFRL-PR-ED-AB-2001-021; No Copyright; Avail: CASI; A01, Hardcopy

When a highly filled polymeric material consisting of many fine particles is stretched, the sizes and distribution of the filler particles, the crosslinking density of the polymer chains, and the variation of the bond strength between the particles and binder can produce highly nonhomogeneous local stress and strength fields. Because of the particle's high rigidity relative to the binder, the local stress is significantly higher than the applied stress, especially when the particles are close to each other. Since local stress and strength vary in a random fashion, the failure site in the material also varies randomly and does not necessarily coincide with the maximum stress location. The damage may appear in the form of microcracks and microvoids in the binder, or in the form of particle binder separation known as dewetting. With time, additional particle binder separation and vacuole formation takes place. In this study, a damage parameter based on linear cumulative theory was used to determine the damage state in a highly filled polymeric material under constant strain rate and dual-strain rate loading conditions. During the tests, volume dilatations were measured. Relationships among the damage parameter, volume dilatation, and the constitutive behavior of the material were investigated. In addition, ultrasonic techniques were used to measure the relative ultrasonic attenuation coefficient, alpha, as a function of the applied strain under constant strain rates and cyclic loading conditions. The characteristics of internal damage, measured in terms of alpha, were determined. Also, a time-dependent cumulative damage model under constant strain rate condition was developed and the applicability of using this model to predict damage was discussed.
DTIC
Cumulative Damage; Polymer Blends; Composite Materials; Microcracks; Fillers

20030033881 Air Force Research Lab., Edwards AFB, CA, USA
Polystyrenes Modified with Silsesquioxanes
Haddad, Timothy S.; Phillips, Shawn H.; Mather, Patrick T.; May 04, 2001; 3 pp.; In English
Contract(s)/Grant(s): AF Proj. 2303
Report No.(s): AD-A410327; AFRL-PR-ED-AB-2001-111; No Copyright; Avail: CASI; A01, Hardcopy

We are continuing a program to design and synthesize well-defined, linear polyhedral oligomeric silsesquioxane (POSS) polymers to further develop the structure/property relationships of this important class of technologically useful compounds. A typical POSS-monomer, R7P(Si8O12), is a well-defined octomer.containing a single 'P' functionality for polymerization and seven 'R' groups to solubilize and compatibilize the inorganic filler with the organic matrix. Previously, we have reported the synthesis and characterization of a variety of POSS-styrene copolymers wherein the POSS unit dangles from the main chain in a pendant fashion. We have noted that the POSS cages appear to generate a reversible network material, and the strength of this network is strongly influenced by the seven 'R' groups. This work summarizes and compares the effects of four different R groups: cyclopentyl, cyclohexyl, isobutyl and phenyl.
DTIC
Polyhedrons; Oligomers; Phenyls; Polymers

20030034588 Air Force Research Lab., Edwards AFB, CA, USA
Synthesis and Characterization of a New (Tetrasilanol) Cyclosiloxane
Haddad, Timothy S.; Moore, Brian M.; Phillips, Shawn H.; January 22, 2001; 3 pp.; In English
Contract(s)/Grant(s): AF Proj. 2303
Report No.(s): AD-A410685; AFRL/PRS-ED-TP-2001-022; No Copyright; Avail: CASI; A01, Hardcopy

There has been recent interest in using incompletely condensed silsesquioxanes as molecular building blocks in many polymer systems. This interest is driven by significant property enhancements imparted by inclusion of a nanosized inorganic particulate into an organic matrix. Most of the work to date has focused on thermoplastic hybrid inorganic/organic copolymers

derived from either a triol- or a diol-silsesquioxane. There is a need for the development of other incompletely condensed silsesquioxanes useful in both thermoplastics and thermosets. The authors have been studying the isolation and chemistry of a new cyclosiloxane containing four silanol functionalities. This tetrasilanol is tentatively assigned the structure shown which is analogous to the known phenyl(2) and isopropyl(3) derivatives. Results of this experiment show that the hydrolytic condensation of cyclopentyltrichlorosilane in refluxing 80\% acetone and water produces a high yield of the trisilanol shown, a small amount of a fully condensed octamer, along with some resinous polymer. A change in the solvent composition can result in significant changes to the product distribution. An attempt to produce a tetrasilanoldisiloxane, (C5H9) Si(OH)22O analogous to a cyclohexyl derivative reported by Brown using about 10\% acetone and 90\% water yielded a mixture of resinous products. However, the authors found that if the reaction was allowed to proceed for a longer time, a single major product, 1, was produced along with smaller amounts of other partially condensed silsesquioxanes. This major product can be isolated in about 50\% yield. NMR spectroscopy reveals it to be a high symmetry compound containing a single silanol group per silicon. The three reasonable structures that fit all the available data are shown in Figure 3. Thus, a new completely condensed silsesquioxane tetraol has been synthesized and characterized.
DTIC
Polymers; Composite Materials; Silicon Compounds

20030034591 Air Force Research Lab., Edwards AFB, CA, USA
Hybrid Inorganic/Organic Reactive Polymers for Severe Environment Protection
Phillips, Shawn; April 12, 2002; 14 pp.; In English
Contract(s)/Grant(s): AF Proj. 2303
Report No.(s): AD-A410241; AFRL-PR-ED-VG-2002-081; No Copyright; Avail: CASI; A03, Hardcopy
Significant advances in materials and processing technologies have made within AFRL/PRSM: demonstrated ceramic char layer of POSS-insulation, synthesized POSS-Kapton (up to 20 wt% POSS), demonstrated significant (9x) atomic oxygen survivability and formation of ceramic SiO2 layer. Basic (6.1) and Applications (6.2) research have been successfully integrated in Air Force Propulsion Programs: successful technology transfer of POSS nanotechnology, POSS nanotechnology on critical and high risk path for the Air Force.
DTIC
Environment Protection; Nanotechnology; Reactivity; Hybrid Structures; Polymers

20030034595 Air Force Research Lab., Edwards AFB, CA, USA
Molecularly Reinforced Polymers
Blanski, Rusty L.; Haddad, Tim; Viers, Brent; Gonzalez, Rene; Moore, Brian; February 22, 2002; 51 pp.; In English
Contract(s)/Grant(s): AF Proj. 4847
Report No.(s): AD-A410430; AFRL-PR-ED-VG-2002-037; No Copyright; Avail: CASI; A04, Hardcopy
No abstract available
DTIC
Polymers; Ablative Materials; Reinforcing Materials; Molecular Structure; Oligomers

20030034611 Air Force Research Lab., Edwards AFB, CA, USA
Effects on Processing by Drop-In Modifiers in Nano-Composite Polymers
Ruth, Patrick; Viers, Brent; Blanski, Rusty; Lee, Andre; April 16, 2002; 22 pp.; In English
Report No.(s): AD-A410334; AFRL-PR-ED-VG-2002-083; No Copyright; Avail: CASI; A03, Hardcopy
These viewgraphs discuss what POSS is, the anatomy of the molecule, blending into plastics, how it is chemically incorporated into plastics, processing parameters, etc.
DTIC
Nanotechnology; Polymers; Composite Materials; Oligomers

20030034904 Department of the Navy, Washington, DC
Ceramic Coating Method
Li, Chou H., Inventor; 27 pp.; In English
Patent Info.: Filed: 8 Jun. 1995, Patented 2 Jul. 2002; US-Patent-Appl-SN-08482199
Report No.(s): AD-D020047; PATENT-6 413 589 B1; No Copyright; Avail: US Patent and Trademark Office
A method of coating a ceramic and bonding ceramic onto a substrate for practical uses over 630 degrees C. includes

forming a brazed bonding layer at a contact area between the ceramic and the substrate by fluidic reaction and causing the bonding layer to wet both the ceramic and substrate with a wetting angle of 0-5 degrees to thereby coat and bond the ceramic onto bond the substrate over the entire contact area with a continuous, essentially 100\% dense bonding layer. The bonding layer is so free of bonding defects that the resulting bonded product can withstand repeated thermal shocks by quenching 0 degrees ice water from a temperature in the range of 630-980 degrees C.
DTIC
Ceramic Coatings; Thermodynamic Properties; Fluidics; Bonding

20030037037 Lawrence Livermore National Lab., Livermore, CA
Plutonium Immobilization Project Baseline Formulation (U)
Ebbinghaus, B.; Feb. 1999; 70 pp.
Report No.(s): DE2002-792655; No Copyright; Avail: Department of Energy Information Bridge

A key milestone for the Immobilization Project (AOP Milestone 3.2a) in Fiscal Year 1998 (FY98) is the definition of the baseline composition or formulation for the plutonium ceramic form. The baseline formulation for the plutonium ceramic product must be finalized before the repository- and plant-related process specifications can be determined. The baseline formulation that is currently specified is given in this document. In addition to the baseline formulation specification, this report provides specifications for two alternative formulations, related compositional specifications (e.g., precursor compositions and mixing recipes), and other preliminary form and process specifications that are linked to the baseline formulation.
NTIS
Plutonium; Immobilization

20030037103 Westinghouse Savannah River Co., Aiken, SC, Pacific Northwest National Lab., Richland, WA
Development of High Waste Loading Glasses for Advanced Melter Technologies
Peeler, D. K.; Edwards, T. B.; Herman, C. C.; Workman, R. J.; Reamer, I. A.; Sep. 15, 2002; In English
Report No.(s): DE2002-805616; No Copyright; Avail: National Technical Information Service (NTIS)

The vitrification programs at Hanford and Savannah River may benefit from higher temperature glass formulations that are processable in advanced melters e. g., induction-heated, cold-crucible melter (ICCM) or by changing the current liquidus temperature (TL) limit for Joule heated ceramic melters (JHCM). The focus of this report was on the glass formulation activities in support of the ICCM and JHCM demonstrations with C-106/AY-102 simulant.
NTIS
Chemical Composition; Ceramics

20030037115 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD
Materials Science and Engineering Laboratory, Ceramics Division, FY 2002 Programs and Accomplishments
Sep. 2002; In English
Report No.(s): PB2003-102200; NISTIR-6904; No Copyright; Avail: National Technical Information Service (NTIS)

Division scientists have been able to characterize the structure and composition of the nanometer scale silicon oxide-nitride-oxide layers, which are of high current interest as possible charge storage structures in non-volatile memory devices. As a result of this research, nanoparticles can now be placed into chemically and structurally well-defined environments on silicon substrates. Other Highlights in the Report include both experimental and theoretical investigations. Studies were made of high-speed contact at the head-disk interface in a magnetic disk hard drive, and exciting new first principles calculations were made of properties from atomic scale structure of microwave dialectrics. In addition to these new selected Highlights, we report numerous other significant accomplishments in our projects under the 9 Programs in the Materials Science and Engineering Laboratory. These brief reports provide a fairly comprehensive synopsis of the breadth and depth of research conducted in our Division.
NTIS
Ceramics; Materials Science; Data Processing

20030038816 Lawrence Livermore National Lab., Livermore, CA
Technical Progress Report on Single Pass Flow Through Tests of Ceramic Waste Forms for Plutonium Immobilization
Zhao, P.; Roberts, S.; Bourcier, W.; Dec. 03, 2000; 30 pp.
Report No.(s): DE2002-802610; No Copyright; Avail: Department of Energy Information Bridge

This report updates work on measurements of the dissolution rates of single-phase and multi-phase ceramic waste forms in flow-through reactors at Lawrence Livermore National Laboratory. Previous results were reported in Bourcier (1999). Two types of tests are in progress: (1) tests of baseline pyrochlore-based multiphase ceramics; and (2) tests of single-phase pyrochlore, zirconolite, and brannerite (the three phases that will contain most of the actinides).
NTIS
Ceramics; Plutonium; Waste Utilization

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*.

20030032941 Defence Science and Technology Organisation, Edinburgh, Australia
Composite Propellants with Bi-Plateau Burning Behaviour
Ide, Kym M.; November 2002; 28 pp.; In English
Report No.(s): DSTO-GD-0344; DODA-AR-012-509; Copyright; Avail: Other Sources

The literature describing the mechanism of combustion in composite rocket propellants exhibiting bi-plateau burning has been reviewed. A wide distribution of AP particle size in a definite coarse/fine ratio is required to ensure adequate interstitial spacing resulting in abnormally depressed burning due to interference of the fine AP fraction combustion by the binder melt layer. Titanium dioxide added to the formulation acts to increase the binder melt layer viscosity restoring normal burning at low and high pressures, leaving abnormal burning and a plateau or mesa effect at intermediate pressures. The use of dimeryl-diisocyanate curative produces a unique plateau at lower pressures due to increased binder liquefaction. Formulation variables can be adjusted to tailor the pressure levels and bum rates of the plateaus formed.
Author
Rocket Propellants; Burning Rate; Combustion; Composite Propellants; Diisocyanates

20030033841 National Inst. of Standards and Technology (TS), Gaithersburg, MD
Uniform Laws and Regulations in the Area of Legal Metrology and Engine Fuel Quality as Adopted by the 87th National Conference on Weights and Measures 2002
Coleman, T.; Grimes, T. L.; Dec. 2002; 292 pp.; In English
Report No.(s): PB2003-102251; NIST/HB-130/2003; No Copyright; Avail: CASI; A13, Hardcopy

This handbook compiles the latest Uniform Laws and Regulations and related interpretations and guidelines adopted by the National Conference on Weights and Measures, Inc. (NCWM). At the 1983 Annual Meeting, the NCWM voted to change the title of Handbook 130 and the titles of the Laws and Regulations compiled in this handbook. The former title of the handbook was 'Model State Laws and Regulations.' 'Model State' was to be changed to 'Uniform' in the titles to reflect that these Laws and Regulations are (1) intended to be standards rather than just guidelines, and (2) intended for adoption by political subdivisions other than States when deemed appropriate. The compilation itself was endorsed by the NCWM in 1979. This edition includes amendments approved at the Annual Meetings in 2002. The Conference recommends adoption and promulgation by weights and measures jurisdictions of these Uniform Laws and Regulations as updated in this handbook.
NTIS
Weight Measurement; Handbooks; Automobile Fuels; Standardization

20030033887 Eltron Research, Inc., Boulder, CO, Oak Ridge National Lab., TN
Advanced Hydrogen Transport Membranes for Vision 21 Fossil Fuel Plants
Roark, S. E.; Sammells, A. F.; Mackay, R. A.; Pitzman, L. Y.; Zirbel, T. A.; Jul. 30, 2002; In English
Report No.(s): DE2002-802163; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of this project is to develop an environmentally responsible, cost-effective, and efficient method for separating hydrogen from gas mixtures produced during industrial processes, such as coal gasification. This objective will be accomplished by employing dense ceramic membranes based in part on Eltron-patented materials with a demonstrated ability for rapid proton and electronic conduction. The primary technical challenges in achieving the goals of this project are to optimize the composition and microstructure of ceramic materials for conductivity and stability, and to develop thin film ceramic structures that enable hydrogen separation rates in excess of 10 ml/min/cm(sub 2). Other key aspects of this

technology R&D program include catalysis, ceramic processing methods, and the design of a separation unit operating under high pressure. Multiphase materials with maximum ambipolar conductivity will be developed and supported thin film membranes of promising materials will be fabricated and tested. Conductivity characteristics and hydrogen separation rates will be determined for selected membrane structures and candidate compositions will be employed in laboratory-scale high-pressure hydrogen separation units. Information gained during laboratory testing will be used to develop a prototype hydrogen separation unit and generate a strategy for scale-up.
NTIS
Fossil Fuels; Hydrogen; Gas Mixtures; Membranes; Separators

20030033909 Air Force Research Lab., Edwards AFB, CA, USA
Energy Conversion in Laser Propulsion III
Larson, C. W.; Mead, F. B., Jr.; Kalliomaa, Wayne M.; Feb. 2002; 15 pp.; In English
Contract(s)/Grant(s): AF Proj. 1011
Report No.(s): AD-A410650; AFRL-PR-ED-TP-2002-038; No Copyright; Avail: CASI; A03, Hardcopy

Conversion of pulses of CO2 laser energy (18 microsecond pulses) to propellant kinetic energy was studied in a Myrabo Laser Lightcraft (MLL) operating with laser heated STP air and laser ablated delrin propellants. The MLL incorporates an inverted parabolic reflector that focuses laser energy into a toroidal volume where it is absorbed by a unit of propellant mass that is subsequently expanded in the geometry of the plug nozzle aerospike. With Delrin propellant, measurements of the coupling coefficients and the ablated mass as a function of laser pulse energy showed that the efficiency of conversion of laser energy to propellant kinetic energy was ^54\%. With STP air, direct experimental measurement of efficiency was not possible because the propellant mass associated with measured coupling coefficients was not known. Thermodynamics predicted that the upper limit of the efficiency of conversion of the internal energy of laser heated air to jet kinetic energy, alpha, is ^0.30 for EQUILIBRIUM expansion to 1 bar pressure. For FROZEN expansion alpha ^0.27. These upper limit efficiencies are nearly independent of the initial specific energy from 1 to 110 MJ/kg. With heating of air at its Mach 5 stagnation density (5.9 kg/m3 as compared to STP air density of 1.18kg/m3) these efficiencies increase to about 0.55 (equilibrium) and 0.45 (frozen). Optimum blowdown from 1.18 kg/m3 to 1 bar occurs with expansion ratios ^1.5 to 4 as internal energy increases from 1 to 100 MJ/kg. Optimum expansion from the higher density state requires larger expansion ratios, 8 to 32. Expansion of laser ablated Delrin propellant appears to convert the absorbed laser energy more efficiently to jet kinetic energy because the effective density of the ablated gaseous Delrin is significantly greater than that of STP air.
DTIC
Thermodynamics; Laser Applications; Rocket Propellants

20030034688 Air Force Research Lab., Edwards AFB, CA, USA
Predicting the Initial Crack Length in a Solid Propellant
Liu, C. T.; Kwon, Y. G.; Hendrickson, T. L.; Mar 2001; 11 pp.; In English
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A410508; AFRL-PR-ED-VG-2001-049; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
DTIC
Crack Propagation; Solid Propellants; Mathematical Models; Mechanical Properties

20030034696 Air Force Research Lab., Edwards AFB, CA, USA
Energy Conversion in Laser Propulsion
Larson, C. W.; Mead, F. B., Jr.; Jan. 2001; 23 pp.; In English
Contract(s)/Grant(s): AF Proj. 1011
Report No.(s): AD-A410649; AFRL-PR-ED-TP-2001-003; No Copyright; Avail: CASI; A03, Hardcopy

Analysis of energy conversion in laser propulsion is reported and compared to experimental studies of a laboratory scale propulsion device that absorbs laser energy and converts that energy to propellant kinetic energy. The propellants studied were air and Delrin, a solid with the composition of formaldehyde H2CO that vaporizes cleanly upon laser irradiation. The Myrabo Laser Lightcraft (MLL) was studied. It incorporates an inverted parabolic reflector that focuses laser energy into a toroidal volume where it is absorbed by a unit of propellant mass that is subsequently expanded in the geometry of the plug nozzle aerospike. The results showed that between 30 and 50\% of the incident laser energy is converted to propellant kinetic energy. This overall absorption/expansion efficiency was examined in terms of the thermodynamic predictions of conversion of

propellant internal energy to propellant kinetic energy. Expansion of a propellant mass that was heated at constant volume was examined under conditions where either chemical equilibrium or frozen composition was maintained. For expansion with an effective area ratio of ^4, which is appropriate for the MLL, a maximum of 25 to 50\% of the internal energy is predicted to be convertible to propellant kinetic energy, based on the minimization of the entropy gain of the blowdown process. With the small effective area ratio ^4, equilibrium expansion was only slightly more efficient than frozen expansion. Heating of propellant to highly ionized states resulted in lower efficiency energy conversion but higher exit velocity. The thermodynamic limitations are illustrated by process representations of blowdown in the Mollier plane (enthalpy vs entropy diagram for air). The analysis captures the equation of state of the partially ionized propellant under conditions of chemical equilibrium.
DTIC
Kinetic Energy; Laser Propulsion; Aerospike Engines; Solid Rocket Propellants; Energy Conversion Efficiency

20030034708 Lawrence Livermore National Lab., Livermore, CA
Tracing Fuel Component Carbon in the Emissions from Diesel Engines
Buchholz, B. A.; Muleller, C. J.; Martin, G. C.; Cheng, A. S.; Dibble, R. W.; Oct. 14, 2002; 20 pp.
Report No.(s): DE2002-15002020; No Copyright; Avail: Department of Energy Information Bridge

The addition of oxygenates to diesel fuel can reduce particulate emissions, but the underlying chemical pathways for the reductions are not well understood. While measurements of particulate matter (PM), unburned hydrocarbons (HC), and carbon monoxide (CO) are routine, determining the contribution of carbon atoms in the original fuel molecules to the formation of these undesired exhaust emissions has proven difficult. Renewable bio-derived fuels (ethanol or bio-diesel) containing a universal distribution of contemporary carbon are easily traced by accelerator mass spectrometry (AMS). These measurements provide general information about the emissions of bio-derived fuels. Another approach exploits synthetic organic chemistry to place 14C atoms in a specific bond position in a specific fuel molecule. The highly labeled fuel molecule is then diluted in 14C-free petroleum-derived stock to make a contemporary petroleum fuel suitable for tracing. The specific 14C atoms are then traced through the combustion event to determine whether they reside in PM, HC, CO, CO2, or other emission products. This knowledge of how specific molecular structures produce certain emissions can be used to refine chemical-kinetic combustion models and to optimize fuel composition to reduce undesired emissions. Due to the high sensitivity of the technique and the lack of appreciable 14C in fossil fuels, fuels for AMS experiments can be labeled with modern levels of 14C and still produce a strong signal. Since the fuel is not radioactive, emission tests can be conducted in any conventional engine lab, dynamometer facility, or on the open road. The methods described below for tracing fuel components in diesel engine emissions can be applied to any combustion system. The low level of 14C needed for AMS quantification allows tracing in conventional engine labs, dynamometer facilities, or the open road. Our objectives here are to describe basic methods and present early data on the partitioning of oxygenate-derived carbon in PM and CO2 emissions.
NTIS
Exhaust Emission; Diesel Fuels; Combustion; Carbon 14; Radioactive Isotopes; Oxygenation

20030036914 North Dakota Univ., Grand Forks. Energy and Environmental Research Center, National Energy Technology Lab., Pittsburgh, PA
Lignite Testing in an Advanced High-Temperature, High-Pressure, High-Pressure Transport Reactor Gasifier
Swanson, M. L.; Aug. 2002; In English
Report No.(s): DE2002-803710; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of the proposed scope of work is to evaluate the performance of lignite fuels in a highly efficient advanced transport reactor integrated gasification combined-cycle (IGCC) system. Specific technical issues include determining the effects of transport reactor development unit (TRDU) operating conditions on carbon conversion and product gas yields and quality while monitoring for the increased ash agglomeration and deposition potential of the lignite fuels. Variable operating conditions include air or oxygen/coal, steam/coal, sorbent/coal ratios, and the operating temperature of the mixing zone of the gasifier. A specific objective of this test was to operate the TRDU in both air-blown and oxygen-blown mode on the three North Dakota lignite coals.
NTIS
Lignite; Coal

20030037031 Department of Energy, Washington, DC
Environmental Benefits of Advanced Oil and Gas Exploration and Production Technology
2002; In English
Report No.(s): DE2002-771125; No Copyright; Avail: National Technical Information Service (NTIS)

In the past three decades, the petroleum business has transformed itself into a high-technology industry. Dramatic advances in technology for exploration, drilling and completion, production, and site restoration have enabled the industry to keep up with the ever-increasing demand for reliable supplies of oil and natural gas at reasonable prices. The productivity gains and cost reductions attributable to these advances have been widely described and broadly recognized. But public awareness of the significant and impressive environmental benefits from new exploration and production (E&P) technology advances remains limited. The U.S. Department of Energy is responsible for achieving national objectives in the fields of energy and the environment. We believe it is important to tell this remarkable story of environmental progress in E&P technology. Greater awareness of the industry's achievements in environmental protection will provide the context for effective policy, and for informed decision making by both the private and public sectors.
NTIS
Environment Protection; Oil Exploration; Fuel Production

20030037035 General Electric Energy and Environmental Research Corporation
Fuel-Flexible Gasification-Combustion Technology for Production of H(2) and Sequestration-Ready CO(2)
Rizeq, G.; West, J.; Frydman, A.; Subia, R.; Zamansky, V.; Jul. 2002; In English
Report No.(s): DE2002-801723; No Copyright; Avail: National Technical Information Service (NTIS)
It is expected that in the 21st century the Nation will continue to rely on fossil fuels for electricity, transportation, and chemicals. It will be necessary to improve both the thermodynamic efficiency and environmental impact performance of fossil fuel utilization. This is the seventh quarterly technical progress report for the Vision-21 AGC program supported by U.S. DOE NETL (Contract: DE-FC26-00FT40974). This report summarizes program accomplishments for the period starting April 1, 2002 and ending June 30, 2002. The report includes an introduction summarizing the AGC concept, main program tasks, and program objectives; it also provides a summary of program activities covering program management and progress in tasks including lab-/bench-scale experimental testing and pilot-scale design.
NTIS
Fossil Fuels; Fuel Combustion; Gasification; Fuel Cells; Hydrogen Production

20030037038 North Dakota Univ., Grand Forks. Energy and Environmental Research Center
Cofiring of Biomass at the University of North Dakota
Hutton, P. N.; Jan. 2002; In English
Report No.(s): DE2002-802151; No Copyright; Avail: National Technical Information Service (NTIS)
A project funded by the U.S. Department of Energys National Energy Technology Laboratory was completed by the Energy & Environmental Research Center to explore the potential for cofiring biomass at the University of North Dakota (UND). The results demonstrate how 25\% sunflower hulls can be cofired with subbituminous coal and provide a 20\% return on investment or 5-year payback for the modifications required to enable firing biomass.
NTIS
Biomass; Firing (Igniting)

20030037040 National Energy Technology Lab., Pittsburgh, PA
Early Entrance Co-Production Plant Decentralized Gasification Cogeneration Transportation Fuels and Steam From Available Feedstocks
Jun. 2002; 46 pp.; In English
Report No.(s): DE2002-802157; No Copyright; Avail: Department of Energy Information Bridge
Waste Processors Management, Inc.(WMPI), along with its subcontractors Texaco Power & Gasification (now ChevronTexaco), SASOL Technology Ltd., and Nexant Inc. entered into a Cooperative Agreement DE-FC26-00NT40693 with the U.S. Department of Energy (DOE), National Energy Technology Laboratory (NETL) to assess the techno-economic viability of building an Early Entrance Co-Production Plant (EECP) in the USA to produce ultra clean Fischer-Tropsch (FT) transportation fuels with either power or steam as the major co-product. The EECP design includes recovery and gasification of low-cost coal waste (culm) for physical coal cleaning operations and will assess blends of the culum with coal or petroleum coke. The project has three phases. Phase I is the concept definition and engineering feasibility study to identify areas of technical, environmental and financial risk. Phase II is an experimental testing program designed to validate the coal waste mixture gasification performance. Phase III updates the original EECP design based on results from Phase II, to prepare a preliminary engineering design package and financial plan for obtaining private funding to build a 5,000 barrel per day (BPD)

coal gasification/liquefaction plant next to an existing co-generation plant in Gilberton, Schuylkill County, Pennsylvania.
NTIS
Fossil Fuels; Automobiles; Feasibility Analysis; Boilers

20030037041 Masada Resource Group, LLC, Birmingham, AL
Quarterly Report for the Conceptual Design Assessment for the Cofiring of Biorefinery Supplies Lignin Project
Webster, D. J.; Ranney, J. T.; Broder, J. G.; Jul. 2002; 16 pp.
Report No.(s): DE2002-802159; No Copyright; Avail: Department of Energy Information Bridge

The major aspects of this project are proceeding toward completion. Prior to this quarter, design criteria, tentative site selection, facility layout, and preliminary facility cost estimates were completed. Processing of biosolids and pilot facility hydrolysis production have been completed to produce lignin for cofire testing. EERC had received all the biomass and baseline coal fuels for use in testing. All the combustion and fuel handling tests at EERC have been completed. During fuel preparation EERC reported no difficulties in fuel blending and handling. Preliminary cofire test results indicate that the blending of lignin and biosolids with the Colbert coal blend generally reduces NOx emissions, increases the reactivity of the coal, and increases the ash deposition rate on superheater surfaces. Deposits produced from the fuel blends, however, are more friable and hence easier to remove from tube surfaces relative to those produced from the baseline Colbert coal blend. A draft of the final cofire technical report entitled 'Effects of Cofiring Lignin and Biosolids with Coal on Fireside Performance and Combustion Products' has been prepared and is currently being reviewed by project team members. A final report is expected by mid-third quarter 2002.
NTIS
Lignin; Industrial Plants; Ethyl Alcohol

20030037043 Westinghouse Savannah River Co., Aiken, SC, Lawrence Berkeley National Lab., CA, Florida State Univ., Tallahassee. Inst. for International Cooperative Environmental Research
Bioremediation of Petroleum Hydrocarbon-contaminated Soils Comprehensive Report
Dec. 1999; In English
Report No.(s): DE2002-803751; No Copyright; Avail: National Technical Information Service (NTIS)

The US Department of Energy and the Institute for Ecology of Industrial Areas (IETU), Katowice, Poland have been cooperating in the development and implementation of innovative environmental remediation technologies since 1995. A major focus of this program has been the demonstration of bioremediation techniques to cleanup the soil and sediment associated with a waste lagoon at the Czechowice Oil Refinery (CZOR) in southern Poland. After an expedited site characterization (ESC), treatability study, and risk assessment study, a remediation system was designed that took advantage of local materials to minimize cost and maximize treatment efficiency. U.S. experts worked in tandem with counterparts from the IETU and CZOR throughout this project to characterize, assess and subsequently, design, implement and monitor a bioremediation system.
NTIS
Contamination; Ecology; Hydrocarbons; Soils; Crude Oil; Environmental Cleanup; Sediments

20030037055 Department of Energy, Tulsa, OK
Development of Improved Oil Field Waste Injection Disposal Techniques
Nov. 2002; 152 pp.; In English
Report No.(s): DE2002-805007; No Copyright; Avail: Department of Energy Information Bridge

Slurry Fracture Injection (SFI) is a waste disposal technology in which petroleum exploration and production wastes, such as produced sand, drill cuttings, tank bottoms, and pit sludge are mixed with water into a slurry and injected into deep unconsolidated sandstone formations above fracturing pressure. The solids are permanently emplaced within hydraulic fractures generated during the pumping process, and the carrying fluid subsequently drains into the high permeability formation. The mechanics governing the fracturing of unconsolidated sandstone formations remain poorly understood, and as a result there are few guidelines available to optimize the SFI process. This Final Report summarizes Terralog's efforts and results for the project 'development of Improved Fracture Injection Disposal Techniques for Oilfield Waste', completed under DOE Contract DE-AC-2699BC15222. The goals of this project have been to assemble and analyze a comprehensive database of past waste injection operations; develop improved diagnostic techniques for monitoring fracture growth and formation

changes; develop operating guidelines to optimize daily operations and ultimate storage capacity of the target formation; and to apply these improved models and guidelines in the field.
NTIS
Oil Fields; Waste Disposal; Wells; Fracture Mechanics

20030037119 Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering
Diesel Aerosol Sampling Methodology (CRC-E-43) Executive Summary, Technical Summary and Conclusions
Kittelson, D.; Aug. 19, 2002; 34 pp.; In English
Report No.(s): PB2003-102418; CRC-E-43-EX-SUMM; No Copyright; Avail: CASI; A03, Hardcopy

The University of Minnesota and research partners West Virginia University, Carnegie Mellon University, Tampere University, Paul Scherrer Institute, University of California at Riverside, Caterpillar, Inc., and Cummins, Inc. undertook the study titled Diesel Aerosol Sampling Methodology to sample, characterize and quantify particles in Diesel exhaust. The goal of this project (E-43) was to develop Diesel aerosol sampling methods for the laboratory that would produce particle size distributions similar to those obtained under real-world roadway conditions.
NTIS
Aerosols; Diesel Engines; Methodology; Air Pollution; Air Sampling; Diesel Fuels

20030038791 Lawrence Livermore National Lab., Livermore, CA
U. S. Energy Flow: 2000
Kaiper, G. V.; Feb. 01, 2002; In English
Report No.(s): DE2002-15002144; UCRL-ID-129990-00; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available
NTIS
Flow Charts; Energy Consumption; Electric Power Supplies

20030038800 Lawrence Livermore National Lab., Livermore, CA
Certification Testing and Demonstration of Insulated Pressure Vessels for Vehicular Hydrogen and Natural Gas Storage
Aceves, S. M.; Martinez-Frias, J.; Espinosa-Loza, F.; Schaffer, R.; Clapper, W.; May 22, 2002; 16 pp.
Report No.(s): DE2002-15002156; UCRL-JC-148472; No Copyright; Avail: Department of Energy Information Bridge

We are working on developing an alternative technology for storage of hydrogen or natural gas on light-duty vehicles. This technology has been titled insulated pressure vessels. Insulated pressure vessels are cryogenic-capable pressure vessels that can accept either liquid fuel or ambient-temperature compressed fuel. Insulated pressure vessels offer the advantages of cryogenic liquid fuel tanks (low weight and volume), with reduced disadvantages (fuel flexibility, lower energy requirement for fuel liquefaction and reduced evaporative losses). The work described in this paper is directed at verifying that commercially available pressure vessels can be safely used to store liquid hydrogen or LNG. The use of commercially available pressure vessels significantly reduces the cost and complexity of the insulated pressure vessel development effort. This paper describes a series of tests that have been done with aluminum-lined, fiber-wrapped vessels to evaluate the damage caused by low temperature operation. All analysis and experiments to date indicate that no significant damage has resulted. Future activities include a demonstration project in which the insulated pressure vessels will be installed and tested on two vehicles. A draft standard will also be generated for obtaining insulated pressure vessel certification.
NTIS
Certification; Tests; Automobiles; Fuel Tanks; Renewable Energy

20030038809 Lawrence Livermore National Lab., Livermore, CA
Small-Scale Safety Test for Initiation Components
Cutting, J. L.; Chow, C.; Chau, H.; Hodgin, R. L.; Lee, R. S.; Apr. 22, 2002; 12 pp.
Report No.(s): DE2002-15002226; UCRL-JC-147144; No Copyright; Avail: Department of Energy Information Bridge

We have developed a small-scale safety test for initiation train components. A low-cost test was needed to assess the response of initiation components to an abnormal shock environment and to detect changes in the sensitivity of initiation

components as they age. The test uses a disk of Detasheet to transmit a shock through a PMMA barrier into a the test article. NTIS

Circuits; Shock Tests; Initiators (Explosives)

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*.

20030032425 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

Journal of the Chinese Institute of Engineers, Volume 26, No. 1, January 2003

Chen, Shun-Tyan, Editor, Chines; January 2003; ISSN 0253-3839; 125 pp.; In English; Original contains color illustrations; Copyright; Avail: Other Sources

This journal issue contains full papers with the following titles: (1) Car-Like Robot Motion Planning Based on Grey Relational Pattern Analysis; (2) Two-Dimensional Adaptive Beamforming in DS-CDMA Communication with Local Scattering Channels; (3) Applications of Model-Free Estimators to the Stock Market with the Use of Technical Indicators and Non-Deterministic Features; (4) Loss-Minimization Control of Vector-Controlled Induction Motor Drives; (5) The Dynamic Behavior of the Coherent Flow Between Shrouded Co-Rotating Disks; (6) Sequential Simulated Annealing for Multimodal Design Optimization; (7) Tomographic Flow Structures of a Round Jet in a Crossflow .

CASI

Mechanical Engineering; Dynamic Characteristics; Computerized Simulation; Applications Programs (Computers); Mathematical Models; Applications Of Mathematics; Design Optimization

20030033882 Carnegie-Mellon Univ., Pittsburgh, PA, Oak Ridge National Lab., TN

Energy Savings Potential of Flexible and Adaptive HVAC Distribution Systems for Office Buildings

Loftness, V.; Brahme, R.; Mondazzi, M.; Vineyard, E.; MacDonald, M.; Jun. 2002; In English

Report No.(s): DE2002-795647; No Copyright; Avail: National Technical Information Service (NTIS)

Energy efficient office buildings must be easily reconfigurable, including their mechanical and electrical infrastructures, to maintain maximum occupant productivity in an increasingly competitive global market for office space. There have been several innovations in engineering practice towards delivering flexible, user-based services for air quality, thermal comfort, lighting comfort and network access, predominantly using raised floors to move beyond embedded technologies in buildings to end-user technologies. The goal of this research effort is to document the state-of-the-knowledge, engineering diversity, and performance of recent developments in flexible and adaptive distribution systems in office buildings. Despite the need to resolve the inevitable field errors of innovative components and assemblies, the introduction of flexible and adaptive HVAC systems such as underfloor air, is approaching 10\% of the new construction market, and will continue to grow because of performance gains, including: equal or lower first costs, significant churn savings, measured thermal comfort and indoor air quality gains, and 20-35\% energy savings.

NTIS

Air Conditioning; Space Heating (Buildings); Ventilation; Energy Conservation; Environmental Engineering

20030033947 Kyoto Univ., Japan

Kogaku Kenkyu - Summaries of Research Activities, Volume 65

October 2002; In English; In Japanese; CD-ROM contains full text document presented in HTML file format; Copyright; Avail: Other Sources

This CD-ROM lists the faculty and academic departments at the Graduate School of Engineering at Kyoto University for 2001. It contains bibliographies for original articles, review articles and books published by the faculty during that year, and lists research funded by grants from the Japanese government.

CASI

Universities; Research; Engineering; Bibliographies

20030034642 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD, USA
Characteristics and Sampling Efficiency of PHTLAAS(TM) Air Sampler
Kesavan, Jana; Carlile, Donna; Sutton, Tiffany; Hottell, K. A.; Doherty, Robert W.; Nov. 2002; 19 pp.; In English
Contract(s)/Grant(s): Proj. 622384/ACB2
Report No.(s): AD-A410301; ECBC-TR-267; No Copyright; Avail: CASI; A03, Hardcopy

This study was conducted to characterize three configurations of Portable High-Throughput Liquid-Absorption Air Sampler (PHTLAAS)(TM) (Zaromb Research Corporation, Hinsdale, IL). This is a light-weight, high-volume sampler that has a wetted wall cyclone as the aerosol collector. Three configurations of the PHTLAAS(TM) were tested: (1) the cyclone with a slit opening off axis to the center of the cyclone without liquid recirculation, (2) the cyclone with a circular inlet opening off axis to the cyclone without liquid recirculation, and (3) the cyclone with a slit opening off axis to the center of the cyclone with a liquid recirculation to wet the cyclone walls continuously. The sampling efficiency of the PHTLAAS(TM) was determined by fluorometer analysis of sampled monodisperse fluorescent polystyrene latex microspheres and sodium fluorescein tagged oleic acid particles. Results show the collection efficiency is relatively high (greater than 62\% for 1-10 micrometer particles with a peak of 84\% for 4 micrometer particles). The power consumption of the Configuration 3 sampler is 85.3 watts during sampling.
DTIC
Air Sampling; Cyclones; Fluorescence

20030036918 Lawrence Berkeley National Lab., CA
Practical Diagnostics for Evaluating Residential Commissioning Metrics
Wray, C.; Walker, I.; Siegel, J.; Sherman, M.; Jul. 2002; In English
Report No.(s): DE2002-803752; LBNL-45959; No Copyright; Avail: National Technical Information Service (NTIS)

In this report, we identify and describe 24 practical diagnostics that are ready now to evaluate residential commissioning metrics, and that we expect to include in the commissioning guide. Our discussion in the main body of this report is limited to existing diagnostics in areas of particular concern with significant interactions: envelope and HVAC systems. These areas include insulation quality, windows, airtightness, envelope moisture, fan and duct system airflows, duct leakage, cooling equipment charge, and combustion appliance backdrafting with spillage. Appendix C describes the 83 other diagnostics that we have examined in the course of this project, but that are not ready or are inappropriate for residential commissioning. Combined with Appendix B, Table 1 in the main body of the report summarizes the advantages and disadvantages of all 107 diagnostics.
NTIS
Space Heating (Buildings); Diagnosis

20030036919 Lawrence Berkeley Lab., CA
Simulations of Sizing and Comfort Improvements for Residential Forced-Air Heating and Cooling Systems
Walker, I.; Degenetais, G.; Siegel, J.; May 2002; In English
Report No.(s): DE2002-803755; No Copyright; Avail: National Technical Information Service (NTIS)

This report summarizes the simulation tool and discusses the significant developments that allow the use of this tool to perform detailed residential HVAC system simulations. The simulations have been verified by comparison to measured results in several houses over a wide range of weather conditions and HVAC system performance. After the verification was completed, more than 350 cooling and 450 heating simulations were performed. These simulations covered a range of HVAC system performance parameters and California climate conditions (that range from hot dry deserts to cold mountain regions). The results of the simulations were used to show the large increases in HVAC system performance that can be attained by improving the HVAC duct distribution systems and by better sizing of residential HVAC equipment. The simulations demonstrated that improved systems can deliver improved heating or cooling to the conditioned space, maintain equal or better comfort while reducing peak demand and the installed equipment capacity (and therefore capital costs).
NTIS
Space Cooling (Buildings); Space Heating (Buildings); Cooling Systems; Air Flow

20030036923 Lawrence Berkeley Lab., CA
Study of Pressure Losses in Residential Air Distribution Systems
Abushakra, B.; Walker, I. S.; Sherman, M. H.; 2003; 18 pp.
Report No.(s): DE2002-803766; No Copyright; Avail: Department of Energy Information Bridge

An experimental study was conducted to evaluate the pressure drop characteristics of residential duct system components that are either not available or not thoroughly (sometimes incorrectly) described in existing duct design literature. The tests were designed to imitate cases normally found in typical residential and light commercial installations. The study included three different sizes of flexible ducts, under different compression configurations, splitter boxes, supply boots, and a fresh air intake hood. The experimental tests conformed to ASHRAE Standard 120P - Methods of Testing to Determine Flow Resistance of HVAC Air Ducts and Fittings. The flexible duct study covered compressibility and bending effects on the total pressure drop, and the results showed that the available published references tend to underestimate the effects of compression in flexible ducts that can increase pressure drops by up to a factor of nine.
NTIS
Air Flow; Space Heating (Buildings); Compressibility Effects

20030036929 National Inst. of Standards and Technology (BFRL), Gaithersburg, MD
Potential Benefits of Smart Refrigerant Distributors
Payne, W. V.; Domanski, P. A.; Jan. 2003; 204 pp.; In English
Report No.(s): PB2003-102248; No Copyright; Avail: CASI; A10, Hardcopy

The main goal of this study was to investigate the benefits possible for finned tube refrigerant evaporators when refrigerant distribution was precisely controlled to produce a desired equal superheat in each circuit. This goal was accomplished by examining three different finned tube evaporators; a wavy fin, wavy-lanced fin, and a wavy-lanced fin evaporator with tube sheet separated. The effects of non-uniform airflow on capacity were also examined while superheat was controlled in each evaporator circuit. In parallel with the experimental effort, a modeling program was implemented and validated with the experimental results and then used to determine the savings in evaporator core volume possible if refrigerant distribution was controlled by a smart distributor. In extreme cases, the savings in core volume could be as much as 40\%.
NTIS
Evaporators; Refrigerating Machinery

20030037022 RAND Corp., Arlington, VA, National Renewable Energy Lab., Golden, CO
Industrial Materials for the Future R & D Strategies: A Case Study of Boiler Materials for the Pulp and Paper Industry
Howell, D. R.; Silberglitt, R.; Norland, D.; Oct. 2002; In English
Report No.(s): DE2002-15002203; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes a case study performed by RAND and NREL of government-industry research and development (R&D) aimed at solving materials problems encountered by the pulp and paper industry. Paper plants recycle chemicals used to process wood into the pulp used to make paper. The heart of the chemical-pulping process is the recovery boiler that provides these recycled chemicals and produces a significant fraction of the process steam and electricity needed by the plant. Recovery boilers are such critical plant components that the industry estimates that, on average, for each day a recovery boiler is shut down, the plant loses $300,000.
NTIS
Industries; Research And Development; Boilers; Wood

20030037024 National Renewable Energy Lab., Golden, CO
Quantifying Potential of Integrated Energy Systems with a Varying Level of Nationwide Deployment
Jalazadeh-Azar, A.; Nov. 2000; In English
Report No.(s): DE2002-15002204; No Copyright; Avail: National Technical Information Service (NTIS)

This study presents a parametric assessment of the energy-saving potential resulting from a nationwide deployment of DER/IES technologies for building applications. Three hypothetical IES scenarios are evaluated to demonstrate the sensitivity of the national energy consumption to the IES system configuration with respect to the buildings' electrical and thermal equipment compositions. A variable for implementation level of DER is incorporated to examine the impact of incremental transformation of the existing centralized energy resources to a fully decentralized model on the national primary energy consumption. To accommodate the continuing advancement of prime movers, a wide range of fuel-to-electricity conversion efficiency is considered for both centralized and decentralized power generation systems. The fact that the demands for electricity and thermal energy in buildings are not always congruent, and implementation of thermal energy storage technology is uncertain is acknowledged by incorporating a variable waste heat utilization index.
NTIS
Integrated Energy Systems; Energy Distribution

20030037136 Department of Commerce, Washington, DC

U.S. Corporate R and D Investment, 1994-1999 with Advance Estimates for 2000

Oct. 15, 2001; In English

Report No.(s): PB2003-102720; No Copyright; Avail: National Technical Information Service (NTIS)

The U.S. Corporate R&D data series is derived, in part, from Standard and Poor's Compustat database, which in turn is based on financial statements filed with the Securities and Exchange Commission (SEC). Compustat includes 10,000 actively-traded U.S. corporations (and 11,000 no longer active corporations) of which approximately one-third report R&D in a given year. Based on analysis of SEC filings and other sources, the Office of Technology Policy (OTP) substantially adjusts raw Compustat data to remove R&D double counts and write-offs of acquired in-process R&D4 that are largely associated with firm acquisitions and mergers. To more accurately depict levels of corporate R&D, this is the first OTP report to be based on the North American Industry Classification System (NAICS) rather than the decades-old Standard Industrial Classification (SIC). The U.S. Corporate R&D data series now includes nine major sectors that conduct R&D, which are subdivided into 63 detailed sectors.

NTIS

Research And Development; Investments; Organizations; Industries

20030037138 Hawaii Dept. of Business, Economic Development and Tourism, Honolulu

Sea Water District Cooling Feasibility Analysis for the State of Hawaii

Oct. 2002; In English

Report No.(s): PB2003-102714; No Copyright; Avail: National Technical Information Service (NTIS)

This study is an evaluation of the potential for using cold seawater to provide air conditioning for areas in Hawaii that have high demand concentrations. Presently air conditioning (A/C) is provided in these areas by conventional cooling systems (CCSs) that use electric power to chill water that is distributed throughout the building to pick up heat and transfer it to the outside air. The conventional A/C system consumes around 40\% of the total electrical power used in such buildings. A seawater A/C district cooling system (SDC) consists of a cold seawater supply line, a heat exchanger (at the shoreline), and a closed cycle fresh water distribution system, all with appropriate pumps. The electrical energy required by an SDC system is only to run the pumps. This amounts to about 10\%, or less, of what is needed for the conventional A/C system.

NTIS

Sea Water; Air Conditioning; Hawaii

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*.

20030032271 NASA Glenn Research Center, Cleveland, OH, USA

An overview of NASA Glenn Research Center's Antenna R&D and Technology Efforts

Miranda, Felix A.; September 30, 2002; 45 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): RTOP 755-08-0B; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides an overview of antenna research and design efforts being performed at NASA's Glenn Research Center. The following type of antenna research projects are discussed: phased array antennas, thin film ferroelectric reflectarray antenna, microelectromechanical systems (MEMs) based antennas and multi-beam antennas. Project overviews, design issues and research problems for each type of antenna system are covered. Additional topics reviewed included: communication systems of the future and a facility description.

Author

Antenna Arrays; Multibeam Antennas; Antenna Design; Reflector Antennas; Phased Arrays; Research And Development

20030032376 New Mexico State Univ., Las Cruces, NM

3 Corner Satellite

Horan, Stephen; Nov 2002; ISBN0309084997; 52 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-99-1-0194

Report No.(s): AD-A410185; NMSU-ECE-02-005; No Copyright; Avail: CASI; A04, Hardcopy

As part of the overall 3 Corner Satellite (3CS) project within the University Nanosat Program, the development and testing of a communications subsystem for the satellite was undertaken at New Mexico State University in conjunction with the other team members. This report describes the overall satellite project and the details of the development of the flight radio system for 3C5. This report also documents the preliminary design of the LabVIEW software for linking the university ground communications network.
DTIC
Communication Networks; Communication Satellites; Satellite Communication; Radio Communication

20030032415 Patent and Trademark Office, Washington, DC, USA
Secure Wireless Communication User Identification By Voice Recognition
Ulvinen, Vesa, Inventor; Paloniemi, Jari, Inventor; May 21, 2002; 10 pp.; In English; Original contains color illustrations
Patent Info.: Filed: 7 Jun. 1999, Patented 21 May 2001; US-Patent-Appl-SN-326717
Report No.(s): AD-A406396; PATENT-6 393 305; No Copyright; Avail: US Patent and Trademark Office

A method to authorize or authenticate a user of a wireless telecommunication system (32), and includes steps of (a) selecting a word at random from a set of reference words, or synthesizing a reference word; (b) prompting the user to speak the reference word; and (c) authenticating the user to operate in, or through, or with a resource reachable through the wireless telecommunication system, only if the users speech characteristics match pre-stored characteristics associated with the reference word. In one embodiment the steps of selecting or synthesizing, prompting, and authenticating are performed in a mobile station (10) having a speech transducer (19) for inputting the user's speech, while in another embodiment at least one of the steps of selecting or synthesizing, prompting, and authenticating are performed in a wireless telecommunications network (32) that is coupled between the mobile station and a telephone network (35). In yet another embodiment at least one of these steps are performed in a data communications network resource (38) that is coupled through a data communications network (37), such as the Internet, and the wireless telecommunications network to the mobile station. The step of prompting may include a step of displaying alphanumeric text and/or a graphical image to the user using a display (20) of the mobile station.
DTIC
Speech Recognition; Communication Networks; Radiotelephones; Voice Communication; Inventions

20030032972 Army Aeromedical Research Lab., Fort Rucker, AL
Power Measurements for Microvision, Inc., Aircrew Integrated Helmet System Scanning Laser Helmet-Mounted Display
Rash, Clarence E.; Stelle, Jessica A.; Harding, Thomase H.; Nov. 2002; 15 pp.; In English
Report No.(s): AD-A410457; USAARL-2003-03XA; No Copyright; Avail: CASI; A03, Hardcopy

Program Manager, Aircrew Integrated Systems (PM-ACIS) is developing a new helmet-mounted display (HMD) technology based on scanning lasers. Under this program, Microvision, Inc., Bothell, Washington, has developed a scanning laser HMD prototype for use with the Aircrew Integrated Helmet System (AIHS) Helmet Gear Unit - 56/P (HGU-56/P). As part of a comprehensive laser safety evaluation plan, power measurements of the prototype system were made at the design eye position for both normal and failure modes. For normal operation, right eye and left eye measurements of 1.48 and 1.58 microwatts were obtained. For total scanner failure, a value of 77 microwatts was obtained.
DTIC
Helmet Mounted Displays; Computer Systems Design; Systems Integration

20030032983 Brunel Univ., Uxbridge
Advances in Telemedicine Using Mobile Communications
Istepanian, R. S. H.; Woodward, B.; Richards, C. I.; Oct 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410376; No Copyright; Avail: CASI; A01, Hardcopy

Future telemedicine systems will exploit mobile communications technology so that patients who are free to move around at home or at work, or in emergency medical situations, can be monitored in a hospital. At present, the GSM mobile telephone cellular network is limited to 9.6 kbps, but with the introduction of the third generation (3G) network, data rates of 144 kbps will be available, giving scope for the transmission of much more biomedical data as well as voice and video data if required. The paper discusses some of the issues involved and outlines the types of systems that will be viable with the new technology.
DTIC
Mobile Communication Systems; Telemedicine; Biomedical Data; Technologies

20030033053 Genoa Univ., Genoa, Italy

Validation of the European Prototype for Integrated Care at Municipal Level in Savona: Updating and Maintenance

Giacomini, M.; Peragallo, I.; Bertone, S.; Ruggiero, C.; October 25, 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410542; No Copyright; Avail: CASI; A01, Hardcopy

A European Prototype for Integrated Care (EPIC) was set up in the early nineties within one of the programs sponsored by the European Commission. The system mainly consists of a shared care database in which each groups of facilities is supported by a local area network (LAN). Each LAN is connected over a wide area network to a central node. The system can manage telemedicine tools such as telealarm and telecardiology equipment. One of the validation site of EPIC was established in Savona (Italy). Subsequently the system in Savona has gone through successful validation and increasing integration with the region's health and social care system. Maintenance and updating criteria of the system for a routine use are described.

DTIC

Information Transfer; Medical Services; Information Management

20030033065 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Does Network News Coverage of Legislation in Congress Show Signs of Partisan Bias?

Knapp, Colin A.; Dec. 2002; 53 pp.; In English

Report No.(s): AD-A410553; CI02-807; No Copyright; Avail: CASI; A04, Hardcopy

Television news plays a large role in shaping the general public's opinion of politics. Therefore, coverage tainted by bias can influence how people think and eventually choose the politicians who represent them. Such a great amount of time has been spent by journalists, politicians and scholars on the subject of media bias, that it is easy to cite sources supporting almost any position. Unfortunately, much of this work has relied on anecdotal evidence and subjective content analysis. Studies using more sophisticated statistical techniques often do not properly specify the empirical models that are eventually chosen. This makes the results of such studies questionable. This study measures the effect of party affiliation on the amount of news coverage given to legislation voted on in Congress. By recording the amount of coverage on ABC, CBS and NBC, on the days before, on and after a vote is taken in Congress, this effect can be estimated using several fixed effects regression models. Although empirical results showed no consistent signs of bias, they did suggest that, under certain circumstances, television networks do consider party affiliation when allocating airtime. This is important in showing that television networks are not always objective and viewers need to consider this as they watch the nightly news.

DTIC

Media; Law (Jurisprudence); Broadcasting

20030033074 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Wireless Sensors Network (Sensornet)

Perotti, J.; [2003]; 4 pp.; In English; Propulsion Measurement Sensor Development Workshop, 13-15 May 2003, Huntsville, AL, USA; Original contains black and white illustrations

Report No.(s): KSC-2003-051; No Copyright; Avail: CASI; A01, Hardcopy

The Wireless Sensor Network System presented in this paper provides a flexible reconfigurable architecture that could be used in a broad range of applications. It also provides a sensor network with increased reliability; decreased maintainability costs, and assured data availability by autonomously and automatically reconfiguring to overcome communication interferences.

Derived from text

Communication Networks; Wireless Communication; Sensors; Reconfigurable Hardware; Systems Engineering

20030033888 Chung Yuan Christian Univ., Chung-Li, Taiwan, Province of China

Transmitting SPIHT Compressed ECG Data Over a Next-Generation Mobile Telecardiology Testbed

Huang, Chia-Yuan; Miaou, Shaou-Gang; October 25, 2001; 5 pp.; In English

Report No.(s): AD-A410434; No Copyright; Avail: CASI; A01, Hardcopy

Recently, the set partitioning in hierarchical tree (SPIHT) was shown to be an excellent algorithm for ECG compression. However, how it performs in a cellular phone based wireless environment for telemedicine applications is not known. In this paper, a joint design for SPIHT-based ECG data compression method over a next-generation mobile telecardiology testbed based on the 3G cellular phone standard is proposed and the performance of the testbed for the compressed ECG data segments

selected from the MIT-BIH arrhythmia database is evaluated in terms of BER (bit error rate), PRD (percent of root-mean-square difference), compression ratio (CR), transmission time, and diagnostic quality. The simulation results show that during the successful transmission of compressed ECG (when BER is less than 10(-5), a CR of 8:1 provides a 87.5\% reduction in total transmission time and a higher CR up to 20 can reduce up to 95\% of the required time to transmit the ECG. Furthermore, most characteristics of the received ECG waveform, such as P wave, QRS complex, and T wave, can be reserved with clinically acceptable quality.
DTIC
Data Compression; Telemedicine

20030033898 Patras Univ., Greece
A New Methodology to Design Distributed Medical Diagnostic Centers
Baziana, P. A.; Karavatselou, E. I.; Lymberopoulos, D. K.; Serpanos, D. N.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410378; No Copyright; Avail: CASI; A01, Hardcopy

In a Distributed Diagnostic Center (DDC), patients' examinations (exams) are performed in Remote Units (RUs) and the collected data (images, lab exams, etc) are sent to expertise Diagnostic Units (DUs) for evaluation. The DDC's quality of service per exam is considered through several factors, such as patient's wailing time, RU-DU communicating load, expert's occupancy, priority, administrative cost, etc. This paper introduces a new methodology for DDC design by controlling the above factors. We consider any RU through exams sources and any DU through exams' buffers and servers. Any exam created by a RU source is temporarily stored into a DU buffer and then is evaluated by a DU server. The proposed methodology is based on a buffers' model that evaluates the total RU-DU exams' traffic load, taking into account the sources' productivity and the exams' priority. Simulating the exams' delay in the sources, buffers and servers we affect the DDC's performance. Simulating results, using real data acquired by Hellenic DDCs of private domain, are also demonstrated in this paper.
DTIC
Telemedicine; Data Transmission

20030033932 Helsinki Univ. of Technology, Espoo (Finland)
Power Control and Transmission Rate Management in Cellular Radio Systems
Jaentti, R.; Dec. 10, 1999; 118 pp.
Report No.(s): PB2003-102649; Copyright; Avail: National Technical Information Service (NTIS)

The scarce radio spectrum imposes hard limitations on design of cellular radio systems. To provide communication services with high capacity and good quality of service requires powerful methods for sharing the radio spectrum in most efficient way. In practice, all sharing methods introduce interference which is proportional to the transmitter powers. The transmitter power control is a key technique to balance the received signal strength and the interference power, which in turn enables more efficient sharing. Emerging multimedia service can be characterized by different quality of service requirements such as minimum transmission rates. For a real-time service, users must be guaranteed a tolerable minimum rate. However, non-real time applications, i.e. delay insensitive applications, may temporarily lower their transmission rates even to zero, utilizing any excess capacity that the system has. In this thesis, the transmitter power control and the transmission rate management problems are examined. For the fixed-rate systems, we show that considerable improvements in the convergence speed and energy efficiency can be achieved. For the multi-rate (multimedia) system, we examine certain class of combined transmitter power control and transmission rate management algorithms. In addition, implementations of these algorithms are briefly discussed.
NTIS
Wireless Communication; Transmission Rate (Communications); Telecommunication

20030034602 Pontificia Univ. Catolica, Brazil
Telemedicine System Based on Radio Cell Phone Technology
Cruz, F. P.; Neto, G. N.; Nohama, P.; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410530; No Copyright; Avail: CASI; A01, Hardcopy

This paper presents a system for transmitting ECG signals using recent cell phone technologies. The aim of the project is to give physicians and clinical staff the possibility to monitor homecare and emergency patients using telemetry. The acquired signals can be viewed at both ends of the system, i.e., transmitter and receiver. Before transmitting the signals, the system acquires them by using an acquisition board installed in a PC computer. The software for displaying these signals at

both ends of the system provides an easy-to-use interface. The cell phone used is able to transmit data information with short delay time and to operate in radio-like mode.
DTIC
Data Transmission; Radiotelephones

20030034712 Patent and Trademark Office, Washington, DC, USA
Secure Wireless Communication User Identification By Voice Recognition
Ulvinen, Vesa, Inventor; Paloniemi, Jari, Inventor; May 21, 2002; 10 pp.; In English; Original contains color illustrations
Patent Info.: Filed: 7 Jun. 1999, Patented 21 May 2001; US-Patent-Appl-SN-326717
Report No.(s): AD-A406396; PATENT-6 393 305; No Copyright; Avail: US Patent and Trademark Office

A method to authorize or authenticate a user of a wireless telecommunication system (32), and includes steps of (a) selecting a word at random from a set of reference words, or synthesizing a reference word; (b) prompting the user to speak the reference word; and (c) authenticating the user to operate in, or through, or with a resource reachable through the wireless telecommunication system, only if the users speech characteristics match pre-stored characteristics associated with the reference word. In one embodiment the steps of selecting or synthesizing, prompting, and authenticating are performed in a mobile station (10) having a speech transducer (19) for inputting the user's speech, while in another embodiment at least one of the steps of selecting or synthesizing, prompting, and authenticating are performed in a wireless telecommunications network (32) that is coupled between the mobile station and a telephone network (35). In yet another embodiment at least one of these steps are performed in a data communications network resource (38) that is coupled through a data communications network (37), such as the Internet, and the wireless telecommunications network to the mobile station. The step of prompting may include a step of displaying alphanumeric text and/or a graphical image to the user using a display (20) of the mobile station.
DTIC
Communication Networks; Wireless Communication; Internets; Speech Recognition; Voice Communication

20030034748 New South Wales Univ., Sydney, Australia
Home Telecare: System Architecture to Support Chronic Disease Management
Magrabi, Farah; Lovell, Nigel H.; Huynh, Khang; Cellar, Branko G.; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410704; No Copyright; Avail: CASI; A01, Hardcopy

A system architecture to support information transfer between hospital, general practitioner and the home is described in the context of a Home Telecare System (HTS). The HTS facilitates the acquisition, review, analysis and archiving of a longitudinal clinical record to support chronic disease management. The system allows the clinician to schedule for his/her patient the regular recording of clinical measurements (weight, temperature, lung function, blood pressure, single lead electro-cardiogram and ambulation). The patient has in their home a PC with a serially-connected clinical workstation. In addition, the HTS allows the scheduling of questionnaires, medication reminders and the monitoring of an emergency alarm button. The clinician's interface uses standard % Web browser technology to connect to a Web and database server. Use cases indicate that this configuration is not suitable for the patient interface in the home. In this case, a separate stand-alone application with a local subset of the database that periodically communicates with a central server is more appropriate to support a highly usable interface that can be easily customized and maintained.
DTIC
Architecture (Computers); Systems Engineering; Telemedicine; Clinical Medicine; Diseases; Chronic Conditions

20030037110 Helsinki Univ. of Technology, Espoo (Finland)
Evolutionary Approach to Organizing after Market Services for Mobile Phones in Asia Pacific
Linnarinne, H.; Nov. 2001; 166 pp.
Report No.(s): PB2003-101274; REPT-15; Copyright; Avail: National Technical Information Service (NTIS)

After market services for mobile phones has grown in size and importance, 'in the shadow' of the mobile phone business. Today it is both a significant motive in customer behavior and an immense cost factor to the mobile phone supplier. Nevertheless, after market services have not been given sufficient recognition in business concepts. Furthermore, there are only a limited number of studies done on after markets services in industrial environment. This study concentrates on the evolution in after market services in mobile phone business. The aim is to identify the optimal after market service approach in regard to the maturity of the mobile phone market.
NTIS
Commerce; Costs; Telecommunication

20030037157 National Telecommunications and Information Administration, Washington, DC
Electronic Signatures in Global and National Commerce Act. Section 105(a)
Jun. 2001; 26 pp.
Report No.(s): PB2003-102783; No Copyright; Avail: CASI; A03, Hardcopy

Section 105(a) of the Electronic Signatures in Global and National Commerce Act (ESIGN Act) directs the Department of Commerce (Department) to conduct an inquiry and report to Congress on the effectiveness of electronic mail in the delivery of records, as compared with the delivery of records via the USA Postal Service and private express mail services. While the term effectiveness is not defined in the ESIGN Act or its legislative history, the Department's analysis of public comments reveals specific distinctions between electronic and traditional mail delivery systems that impact the delivery of records. These distinguishing factors highlight four issues: universal access, reliability, authentication, and privacy and security.
NTIS
Signatures; Commerce; Internets; Computer Information Security

20030037158 National Telecommunications and Information Administration, Washington, DC
Assessment of the Viability of Accommodating Advanced Mobile Wireless (3G) Systems in the 1710-1770 MHz and 2110-2170 MHz Bands
Jul. 22, 2002; In English
Report No.(s): PB2003-102785; No Copyright; Avail: National Technical Information Service (NTIS)

Consideration for spectrum for advanced mobile wireless services started with the World Administrative Radio Conference (WARC) in 1992 and was further delineated at the World Radiocommunication Conference (WRC) in 2000. The quest for 3G spectrum in the U.S. began when the Federal Communications Commission (FCC) released their Spectrum Policy statement in 1999. In October 2000, the previous Administration directed that a plan be developed to select spectrum for 3G by October 20, 2000 that would result in the allocation of additional spectrum for 3G services by July 2001 and the auction for licensing 3G wireless providers by September 30, 2002. In December 2000, the FCC adopted a Notice of Proposed Rulemaking (ET Docket No. 00-258) to amend Part 2 of the Commission's rules to allocate spectrum below 3GHz for mobile and fixed services to support the introduction of new advanced wireless services including 3G based on the FCCs Spectrum Policy Statement and petitions from the Cellular Telecommunications and Internet Association (CTIA).
NTIS
Telecommunication; Wireless Communication; Policies

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*.

20030032267 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Heavy Ion Transient Characterization of a Photobit Hardened-by-Design Active Pixel Sensor Array
Marshall, Paul W.; Byers, Wheaton B.; Conger, Christopher; Eid, El-Sayed; Gee, George; Jones, Michael R.; Marshall, Cheryl J.; Reed, Robert; Pickel, Jim; Kniffin, Scott; July 19, 2002; 5 pp.; In English; 2002 IEEE Nuclear and Space Radiation Effects Conference (NSREC 02), 15-19 Jul. 2002, Phoenix, AZ, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

This paper presents heavy ion data on the single event transient (SET) response of a Photobit active pixel sensor (APS) four quadrant test chip with different radiation tolerant designs in a standard 0.35 micron CMOS process. The physical design techniques of enclosed geometry and P-channel guard rings are used to design the four N-type active photodiode pixels as described in a previous paper. Argon transient measurements on the 256 x 256 chip array as a function of incident angle show a significant variation in the amount of charge collected as well as the charge spreading dependent on the pixel type. The results are correlated with processing and design information provided by Photobit. In addition, there is a large degree of statistical variability between individual ion strikes. No latch-up is observed up to an LET of 106 MeV/mg/sq cm.
Author
Ions; Pixels; Arrays; Transient Response; Chips (Electronics)

20030032307 NASA Glenn Research Center, Cleveland, OH, USA

Presentation to Ohio State University Dept. of Electrical Engineering ElectroScience Laboratory

Fujikawa, Gene; November 14, 2002; 19 pp.; In English; Presentation at Ohio State University, Dept. of Electrical Engineering ElectroScience Laboratory, 14 Nov. 2002, Columbus, OH, USA; Original contains black and white illustrations

Contract(s)/Grant(s): RTOP 755-08-01; No Copyright; Avail: CASI; A03, Hardcopy

Presentation made during visit to The Ohio State University, ElectroScience Laboratory, on November 14, 2002. An overview of NASA and selected technology products from the Digital Communications Technology Branch (5650) for fiscal year 2003 are highlighted. The purpose of the meeting was to exchange technical information on current aeronautics and space communications research and technology being conducted at NASA Glenn Research Center and to promote faculty/student collaborations of mutual interest.

Author

Electrical Engineering; General Overviews; Technology Utilization; Communication Networks; Pulse Communication

20030032308 NASA Glenn Research Center, Cleveland, OH, USA

Ka-Band, RF MEMS Switches on CMOS Grade Silicon with a Polyimide Interface Layer

Ponchak, George E.; Varaljay, Nicholas C.; Papapolymerou, John; [2003]; 4 pp.; In English; IEEE MTT-S International Microwave Symposium, 8-13 Jun. 2003, Philadelphia, PA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

For the first time, RF MEMS switcbes on CMOS grade Si witb a polyimide interface layer are fabricated and characterized. At Ka-Band (36.6 GHz), an insertion loss of 0.52 dB and an isolation of 20 dB is obtained.

Author

Cmos; Extremely High Frequencies; Switches; Microelectromechanical Systems; Fabrication

20030032309 NASA Glenn Research Center, Cleveland, OH, USA

Improved Dielectric Properties of Heterostructured Ba2.5Sr0.5TiO3 Thin Film Composites for Microwave Dielectric Devices

Jain, M.; Majumder, S. B.; Katiyar, R. S.; Bhalla, A. S.; Agrawal, D. C.; Kulkarni, V. N.; VanKeuls, F. W.; Miranda, F. A.; Romanofsky, R. R.; Mueller, C. H.; November 26, 2002; 6 pp.; In English; 2002 Fall MRS Meeting, 2-6 Dec. 2002, Boston, MA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NCC5-518; NSF-INT-0097018; DOD N00014-02-15/01-1067; DABT 63-98-1-002; Copyright; Avail: CASI; A02, Hardcopy

In the present work we have deposited MgO and Ba(sub 0.5)Sr(sub 0.5)TiO(sub 3)(BST50) thin layers in different sequences to make MgO:BST50 hetero-structured thin films. These films were characterized by X-ray diffraction and Rutherford backscattering technique and found to be highly (100) textured. The figure of merit {(C(sub0)-C(sub v)/(C(sub0-tandelta)} of the hetero-structured films was found to be higher as compared to pure BST50 films measured at 1 MHz frequency with electric field of 25.3 kV/cm. These films were used to make eight element coupled micro-strip phase shifter and characterized in a frequency range of 13-15 GHz. The high frequency figure of merit (kappa factor, defined as the ratio of degree of phase shift per dB loss) measured at around 14 GHz with electric field of 333 kV/cm has been markedly improved (around 64.28 deg/dB for hetero-structured film as compared to 24.65 deg /dB for pure film). Improvement in dielectric properties in a wide frequency range in the MgO:BST are believed to be due to the higher densification of the hetero-structured films.

Author

Phase Shift; Ferromagnetic Materials; Thin Films; Figure Of Merit; Magnesium Oxides; Microwave Equipment; Dielectric Properties

20030032440 NASA Kennedy Space Center, Cocoa Beach, FL, USA, ASRC Aerospace Corp., Cocoa Beach, FL, USA

An Evaluation of Electronic Nose for Space Program Applications

Young, Rebecca C.; Linnell, Bruce R.; Buttner, William J.; Mersqhelte, Barry; [2003]; 9 pp.; In English; JANNAF Conference, 25-27 March 2003, Charlottesville, VA, USA; Original contains black and white illustrations

Report No.(s): KSC-2003-038; No Copyright; Avail: CASI; A02, Hardcopy

The ability to monitor air contaminants in the Shuttle and the International Space Station is important to ensure the health and safety of astronauts. Three specific space applications have been identified that would benefit from a chemical monitor: organic contaminants in crew cabins, propellant contaminants in the airlock, and pre-combustion fire detection. NASA has

assessed several commercial and developing electronic noses (e-noses) for these applications. A preliminary series of tests identified those e-noses that exhibited sufficient sensitivity to the vapors of interest. These e-noses were further tested to assess their ability to identify vapors, and in-house software has been developed to enhance identification. This paper describes the tests, the classification ability of selected e-noses, and the software improvements made to meet the requirements for these space program applications.
Author
Technology Utilization; Air Pollution; Monitors; Electronics; Space Programs; Detection

20030032494 NASA Langley Research Center, Hampton, VA, USA
InGaAsSb Detectors Characterization for 2-Micron CO2 Lidar/DIAL Applications
Refaat, Tamer F.; Abedin, M. Nurul; Koch, Grady J.; Singh, Upendra N.; January 02, 2003; 32 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WU 755-09-00-07
Report No.(s): NASA/TP-2003-212140; L-18243; NAS 1.60:212140; Copyright; Avail: CASI; A03, Hardcopy

Recent interest in monitoring atmospheric CO2 focuses attention on infrared remote sensing using the 2-micron lidar/differential absorption lidar (DIAL) technique. Quantum detectors are critical components in this technique, and many research efforts concentrate on developing such devices for the 2-micron wavelength. Characterization results of InGaAsSb quantum detectors for the 2-micron wavelength range are presented, including experimental setup and procedure. Detectors are prototype devices manufactured by using separate absorption and multiplication (SAM) structures. Characterization experiments include V-I measurements, spectral response and its variation with bias voltage and temperature, noise measurements, noise-equivalent-power (NEP) and detectivity calculations, and signal-to-noise ratio (SNR) estimation. A slight increase in the output signal occurred with increased bias voltage and was associated with a noise level increase. Cooling down the detectors reduces noise and shifts the cutoff wavelength to shorter values. Further improvement in the design and manufacturing process, by increasing the device gain and lowering its noise level, is necessary to meet the required CO2 lidar/DIAL specifications.
Author
Carbon Dioxide; Differential Absorption Lidar; Infrared Detectors; Optical Radar; Remote Sensing; Indium Gallium Arsenides; Avalanche Diodes; Antimony

20030032924 Massachusetts Inst. of Tech., Cambridge, MA
Development of a Wireless Brain Implant: The Telemetric Electrode Array System (TEAS) Project
Martel, S.; Hatsapoulos, N.; Hunter, I.; Donoghue, J.; Burgert, J.; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410593; No Copyright; Avail: CASI; A01, Hardcopy

The Telemetric Electrode Array System (TEAS) project aims at developing and embedding entirely into the head, a three-dimensional intracortical electrode array with all electronics required for signal acquisition, processing, and wireless communication. A general description of the system, the main design issues, and its capabilities are briefly described.
DTIC
Brain; Wireless Communication; Implanted Electrodes (Biology)

20030032990 Naval Postgraduate School, Monterey, CA
Effects of Ship Compartment Hydrocarbon Fuel Fire and Water Mist Fire Extinguishing on RF Propagation in the 2.4 GHz ISM Band
Lebaric, Jovian; Deyannis, Christos; Xifaras, Dimitrios; Jul 1999; 133 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410522; No Copyright; Avail: CASI; A07, Hardcopy

These viewgraphs show the effect of ship compartment hydrocarbon fuel fire and water mist fire extinguishing on RF Propagation.
DTIC
Fire Extinguishers; Hydrocarbon Fuels; Radio Frequencies; Propagation; Ships; Compartments; Mist

20030033009 Arizona State Univ., Tempe, AZ
Sub-Threshold Silicon MESFETs with 25 nm Gate Lengths for Ultra High Speed/ Low Power Information Processing
Thornton, Trevor; Vasileska, Dragica; Jun 2002; 6 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0672
Report No.(s): AD-A410672; DWA-0058; No Copyright; Avail: CASI; A02, Hardcopy

We have demonstrated a new sub-threshold MESFET architecture that we are calling a Schottky Junction Transistor (SJT). It requires no gate dielectric making it more radiation tolerant and easier to scale than a MOSFET. An input gate current IG controls a much larger channel current ID via a current gain, beta greater than 1. The operating mode resembles that of a bipolar junction transistor but the SJT is a majority carrier device. Data from prototype 2 micron devices agree well with numerical simulations. When extended to the deep sub-micron regime cut-off frequencies significantly higher than that expected from the ITRS Roadmap are predicted. We have developed an electron beam lithography process for 0.1 micron gate length SJTs. Results from these devices will be used to calibrate the numerical models before moving to sub-100 nm devices
DTIC
Field Effect Transistors; Low Frequencies

20030033016 California Univ., Davis, CA
Moderate-Perveance Cusp Electron Gun for High-Efficiency Harmonic Peniotrons
Luhmann, Neville C., Jr.; March 31, 2002; 13 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0220; AF Proj. 3484
Report No.(s): AD-A410634; AFRL-SR-AR-TR-02-0452; No Copyright; Avail: CASI; A03, Hardcopy

Two (2) moderate perveance cusp electron guns have been purchased from Northrup-Grumman Corporation for a total of $164,726.50. Both of these guns will be used in UCD research programs under the Vacuum Electronics MURI.
DTIC
Electron Guns; Harmonic Generations

20030033061 Pontificia Univ. Nacional Catolica del Peru, Lima, Peru
Flow Gas Transducer in Basis of a Hot Wire with a Nickel-Titanium Alloy its Flow Calibration System
Mugruza Vassallo, Carlos A.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410551; No Copyright; Avail: CASI; A01, Hardcopy

In our Latin American countries, people have rarely developed about medical control systems based in sensors (transducers) and actuator done in our environment. This has motivated the present work. In medical applications such as breathing systems the hot wire flow sensors are being used actually. Taking advantage of the sensor thermal convection, we can achieve a rapid operation using a smaller than 250 ms sampling time. This study was made based in stuff such as Nicrom (100 um), Nickel-Titanium alloy (37 and 100 um) and Platinum (21 um), that use the 'King's Law' that relates Thermal Convection with Electrical Power; this law may detect flow changes through voltage changes when the temperature is constant; showing successfully an alternative of flow sensing in any given conditions. The flow calibration system used in this work is based in the principle of the RC discharge, using the constant compliance of a rigid water column, where the pressure gets a lineal shape with a pressure step source and a 450 us sampling time for this two signals: flow and pressure.
DTIC
Actuators; Nickel Alloys; Titanium Alloys; Gas Flow; Transducers; Calibrating; Wire

20030033062 Chiba Univ., Chiba
Minimally Invasive Thermal Therapy for Cancer Treatment by Using Thin Coaxial Antennas
Ito, K.; Saito, K.; Taniguchi, T.; Okabe, S.; Yoshimura, H.; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410552; No Copyright; Avail: CASI; A01, Hardcopy

In recent years, various types of applications of electromagnetic techniques for microwave thermal therapy have been developed. Among them, minimally invasive microwave thermal therapies for cancer are of great interest. They are interstitial microwave hyperthermia and microwave coagulation therapy. In this paper, we describe the characteristics of thin coaxial antennas for those therapies.
DTIC
Hyperthermia; Microwaves; Cancer; Radiation Therapy

20030033092 Paul Scherrer Inst., Villigen, Switzerland
Bio-Functionalized Neurochips
Tiefenauer, L. X.; Sorribas, H.; Padeste, C.; Stricker, C.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410233; No Copyright; Avail: CASI; A01, Hardcopy

Arrays of gold microelectrodes have been generated on glass chips. Various adhesion molecules have then been covalently

bound to the surface. Micropatterns of adhesion molecules were generated using photolithographic techniques. Dissociated neurons from chicken dorsal root ganglia adhere selectively to the adhesion molecules and form networks. It could be demonstrated that a single neuron can be stimulated by an adjacent microelectrode. The neural outgrowth was much improved on the specific adhesion proteins axonin-1 and NgCAM, compared to surfaces treated with aminosilane. Furthermore, the distance of cell membrane to surface was at a minimum on these specific neural adhesion proteins. These results show that the quality of neuron cultures on chips can be improved if specific neural adhesion proteins are used.
DTIC
Glass; Gold; Neurons; Microelectronics; Electrodes; Chips (Electronics)

20030033103 Massachusetts Inst. of Tech., Cambridge, MA
A PC-Based Instrumentation Board That Overcomes Many Drawbacks of Typical Commercial Data Acquisition Systems for Electrophysiological Recording Applications
Martel, S.; Lafontaine, S.; Hunter, I.; Oct 2001; 5 pp.; In English
Report No.(s): AD-A410596; No Copyright; Avail: CASI; A01, Hardcopy

The accessibility of adequate instrumentation to conduct fundamental researches for the development of new diagnostic tools and methods in electrophysiology is essential. As such, many researchers develop proprietary instrumentation systems based on commercially available data acquisition boards. These boards are typically not designed for recording electrophysiological signals and as such, they may introduce significant error artifacts such as signal distortions, which in turn may lead to false interpretations. In this paper, we describe a data acquisition board that has the specifications required to adequately record many electrophysiological signals under difficult conditions, as it is often the case in a fundamental research environment. Furthermore, unlike other comparable in-house systems, it enables custom hardware functions to be implemented to support specific requirements encountered in a research environment. The card can also be installed directly in any modern personal computers offering an inexpensive, open, powerful, and very flexible system allowing researchers to easily take advantage of both commercial hardware and software to tailor the final system configuration for their particular needs.
DTIC
Data Acquisition; Circuits

20030033110 Massachusetts Inst. of Tech., Cambridge, MA
A Universal Front-End Stage for Electrophysiological Mappings
Martel, S.; Hunter, I.; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410598; No Copyright; Avail: CASI; A01, Hardcopy

This paper describes a front-end stage that has been implemented and embedded into instruments dedicated to a wide variety of electrophysiological mapping applications. Emphasis during the design phase has been put towards flexibility, simplicity, and performance in various environments.
DTIC
Circuits; Central Processing Units; Electrophysiology; Mapping

20030033112 Massachusetts Inst. of Tech., Cambridge, MA
A Mechanically Flexible, Battery-Powered, Differential Electrode Unit for Electrophysiological Recordings
Martel, S.; Jones, L.; Hunter, I.; Oct 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410601; No Copyright; Avail: CASI; A01, Hardcopy

This paper describes a new type of micro-powered electrode configuration. The circuit consists of an instrumentation amplifier and a special AC coupling configuration that maintains a high CMRR with a gain of a 1000. All electronics, including two lithium batteries, are mounted on a flexible circuit board (FPC). The single FPC has a special shape that allows differential recording at various distances between the electrodes. The whole circuit is typically popped onto EMG electrodes so that it can be re-used many times.
DTIC
Circuit Boards; Recording; Lithium Batteries; Electrodes; Electromyography; Electrophysiology

20030033119 Erlangen-Nuernberg Univ., Erlangen, Germany
Testing of Josephson Array Antennas and Trim Current Tuning
Abdumalikov, A. A.; Caputo, P.; Ustinov, A. V.; Sep. 2002; 31 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F61775-00-C-0004
Report No.(s): AD-A410720; EOARD-SPC-00-4046; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking University of Erlangen-Nuremberg as follows: contractor will investigate novel designs of triangular Josephson Junction arrays attempting to improve the high-frequency performance of the arrays in two ways; first, increase the operation frequencies and second, increase the output power of the millimeter-band radiation to level enabling practical application of the arrays. Three approaches will be investigated. First, trimming of currents at the array edges is expected to stabilize coherent oscillations and increase the operation margins (output power). Second, it appears promising to set up a traveling wave in a transmission line that contains an array comparable with the wavelength. Third, testing dipole-like active antennas to couple radiation out from arrays is a high priority task for emission in free space at high frequencies. The contractor will experimentally verify the above concepts by designing new circuits and performing experiments with Nb/AOx/Nb Josephson Junction arrays. For these experiments, the contractor will use a millimeter-wave band receiver as well an on-chip detection circuits up to 300 GHz. Spatially-resolved measurements using low temperature scanning laser microscopy will be performed in order to monitor array dynamics at the junction level. Furthermore, the contractor intends to design a dipole antenna and test it with an integrated receiver in 400-500 GHz frequency range. For this purpose, improvements for a flux-flow oscillator as a local oscillator may be needed. Finally, the contractor will perform experiments with shunted junction arrays in order to simulate intrinsically overdamped high-Tc junctions and explore a possibility of using high Tc layered junctions for oscillator application
DTIC
Josephson Junctions; High Frequencies

20030033120 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
Laboratory Astrophysics and Microanalysis with NTD-Germanium-Based X-Ray Microcalorimeter
Silver, E.; Schnopper, H.; Bandler, S.; Murray, S.; Madden, N.; Landis, D.; Beeman, J.; Haller, E.; Barbera, M.; Tucker, G.; Nuclear Instruments and Methods in Physics Research A; 2000; Volume 444, pp. 156-160; In English
Contract(s)/Grant(s): NAG5-5269; Copyright; Avail: CASI; A01, Hardcopy

With the ability to create cosmic plasma conditions in the laboratory it is possible to investigate the dependencies of key diagnostic X-ray lines on density, temperature, and excitation conditions that exist in astrophysical sources with X-ray optics and a high resolution x-ray microcalorimeter. The same instrumentation can be coupled to scanning electron microscopes or x-ray fluorescence probes to analyze the elemental and chemical composition of electronic, biological, geological and particulate materials. We describe how our microcalorimeter and x-ray optics provide significantly improved capabilities for laboratory astrophysics and microanalysis.
Author
Astrophysics; Calorimeters; Germanium; Microanalysis; X Ray Fluorescence

20030033845 State Research Center of Russia, Moscow, Russian Federation
Electromagnetic Fields and Human Health: Fundamental and Applied Research.
October 28, 2002; 187 pp.; In English
Contract(s)/Grant(s): F61775-02-WF056
Report No.(s): AD-A410642; No Copyright; Avail: CASI; A09, Hardcopy

The proceedings of the 3rd International Conference on Electromagnetic Fields and Human Health held in Moscow and St. Petersburg, 17-25 September 2002, have among the paper topics: interaction mechanisms of EMF; EMF effects in humans from acute and chronic exposure; experimental studies in vivo and in vitro; mobile communication - prospects of development and health of population; and EMF therapeutics. See the Conference Announcement & Program http:/www.who.int/peh-emf/meetings/russia sept02/en/
DTIC
Electromagnetic Fields; Conferences; Health Physics; Research And Development

20030033910 Helsinki Univ. of Technology, Espoo (Finland)
Fabrication and Modelling of SOI and GaAs MSM Photodetectors and a GaAs-Based Integrated Photoreceiver
Honkanen, K.; 2001; In English
Report No.(s): PB2003-102633; Copyright; Avail: National Technical Information Service (NTIS)

In this work metal semiconductor metal photodetectors (MSM PDs), pseudomorphic high electron mobility transistors (pHEMTs), and a monolithically integrated photorecevier are studied. The motivation for this work is to develop a solution for high-speed data transfer in telecommunication systems. The goals are to develop the fabrication technology using electron

beam (e-beam) lithography, and to achieve higher bandwidths for the detector, the transistor, as well as the photoreceiver, with submicron devices.
NTIS
Data Transmission; Transmission Rate (Communications); Miniaturization; Photometers; High Electron Mobility Transistors

20030033946 Massachusetts Inst. of Tech., Cambridge, MA
Use of Multi-Attribute Utility Theory to Quantify the Desirability of Boiling Water Reactor Hydraulic Control Unit Maintenance Options
Silsdorf, Maria E.; Sep. 2002; 162 pp.; In English
Contract(s)/Grant(s): N62271-97-G-0026
Report No.(s): AD-A410662; No Copyright; Avail: CASI; A08, Hardcopy

The role of maintenance in a nuclear power plant is to ensure that plant equipment is kept at a proper level of functionality, thus increasing the level of overall plant safety. In a deregulated electricity market, nuclear power plants must remain competitive with conventional utilities in the production of electricity. Consequently, nuclear utilities must find ways to improve their operations and reduce costs without sacrificing the level of overall plant safety and relationships with its stakeholders. One area of operations in which nuclear utilities can gain a competitive edge is in the maintenance of its power plants. By reducing the frequency of preventive maintenance and shifting the performance of selected maintenance items on-line, the utilities are able to reduce costs without significant impact to plant safety and relations to stakeholders. This study focuses on the maintenance of hydraulic control units (HCUs) in Tokyo Electric Power Company's (TEPCO) boiling water reactors (BWRs). Using Multi-Attribute Utility Theory (MAUT), TEPCO decision makers can obtain a rank-ordering of multiple decision options based on their current preferences toward safety, cost, and stakeholder relations. In the case of HCU maintenance, the decision options considered are performance of HCU maintenance in the following conditions: 1) on-line with outage duration unchanged, 2) off-line with outage duration unchanged, 3) on-line with outage duration shortened, and 4) off-line with outage duration shortened. Because these options could have varying effects on safety, cost, and stakeholder relations, the use of MAUT facilitates decision making by providing a methodology that considers the effect of multiple factors simultaneously.
DTIC
Boiling Water Reactors; Control Equipment; Hydraulic Control; Nuclear Power Plants; Preventive Maintenance; Electricity; Utilities

20030033954 Massachusetts Inst. of Tech., Cambridge, MA
Deterministic Casualty Analysis of the Pebble Bed Modular Reactor for use with Risk-Based Safety Regulation
Withee, Jon E.; Sep. 2002; 88 pp.; In English
Contract(s)/Grant(s): N6227-97-G-0026
Report No.(s): AD-A410663; No Copyright; Avail: CASI; A05, Hardcopy

The resurgence of interest in the use of nuclear technology for electrical power production has resulted in a desire to improve the existing licensing structure. Improving the licensing structure will result in reduced design time and cost for new reactor plants. An improved regulatory process is also necessary in order to license advanced reactors that are not light water technology. Risk based reactor licensing, which uses the Probabilistic Risk Assessment (PRA) to justify most licensing questions, is a proposed replacement for the current methods. This work further develops the risk-based regulatory process by analyzing a portion of a new reactor concept. A reactor similar to the Pebble Bed Modular Reactor (PBMR) is the design chosen for the analyses. The designers of the PBMR assert that the reactor's inherently safe design justifies the use of a non-standard containment system. This assertion can be treated as a design question to be justified using the risk-based approach. The effect of the changing the containment system is incorporated into the PRA for the PBMR. The contributions to the event and fault trees of the PBMR are determined for two casualties that affect the plants decay heat removal system. The initiating event for both of these casualties is assumed to be a beyond design basis earthquake.
DTIC
Electric Generators; Electric Power Supplies; Nuclear Energy; Engineering; Risk

20030033959 Zhejiang Univ., China
A Novel Microdialysis Glucose Sensor System Based on Co-immobilizing on AU Micro-Electrode by SOL-GEL Technique
Yu, Ping; Liu, Weiting; Chen, Yuquan; Li, Guang; Oct 2001; 4 pp.; In English
Report No.(s): AD-A410212; No Copyright; Avail: CASI; A01, Hardcopy

A microdialysis sensor system for continuous glucose measurements has been developed. The sensor is based on co_immobilizing glucose oxidase (COD) with the catalase by sol-gel technique on the surface of the silicon bases with two pattern of An microelectrodes. A graduated ('sandwich') immobilizing method is performed to improve the stability and the life time of the co_enzyme system. The response of the system was in good order. Above all, we developed a new geometry of bispiral microelectrode and numeric analysis its electrochemical character.
DTIC
Electrodes; Glucose

20030034590 Inje Univ., Kimhae, Korea, Republic of
Development of Wireless Bio-Telemetry System Using FM Stereo Method for Exercising Rehabilitation Patients
Kim, Youngsik; Cho, Jong M.; October 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410425; No Copyright; Avail: CASI; A01, Hardcopy

Development of a telemetry system using FM stereo method for exercising rehabilitation patients was performed in this study. The transmitting unit detects and sends two kinds of patient's vital signals, respiration and heart sound signal, simultaneously. The stationary receiving unit receives and analyzes the signals and alerts a nurse to the dangers of the patient if necessary. The system could be simplified and minimized in size by using commercialized electronic components. This system can be useful to monitor the exercising rehabilitation patients' vital signals and control patients' condition and the level of their exercise.
DTIC
Physical Exercise; Frequency Modulation; Wireless Communication; Radio Communication; Biotelemetry; Patients

20030034622 North Carolina State Univ., Raleigh, NC, USA
A Multi Channel Chopper Modulated Neural Recording System
Dagtekin, Mustafa; Liu, Wentai; Bashirullah, Rizwan; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410337; No Copyright; Avail: CASI; A01, Hardcopy

Presented herein is a fully integrated low-noise CMOS multi-channel amplifier for neural recording applications The circuit employs the chopper modulation technique to reduce the effect of flicker noise and DC offset, A reduced area design implementation is achieved by trading off the increased noise margin performance of the chopper modulator for minimal amplifier area and analog multiplexing of the recording sites, A fully differential topology is used for the signal path to improve noise immunity The analog amplifier exhibits 56 dB of gain with a 115 kHz bandwidth and a common mode rejection ratio (CMRR) of 80 dB. Simulation results show a total input referred noise less than 16 nV/ square root of Hz, The system power consumption is approximately 750 microWatts The fully integrated system was designed in ABN 1,6-um single poly n-well CMOS process
DTIC
Integrated Circuits; Amplifiers; Multiplexing

20030034646 Fraunhofer-Inst. for Biomedical Engineering, Sankt, Germany
Reducing Stiffness and Electrical Losses of High Channel Hybrid Nerve Cuff Electrodes
Schuettler, M.; Stieglitz, T.; Gross, M.; Altpeter, D.; Staiger, A.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410458; No Copyright; Avail: CASI; A01, Hardcopy

For restoration of grasp in disabled people by means of functional electrical stimulation of peripheral nerves, 18 polar Hybrid Cuff Electrodes were developed. These electrodes consisted of a micromachined polyimide-based thin-film structure with integrated electrode contacts and interconnection lines which was glued to a silicone cuff. Interconnection lines were made of only 300 nm of sputtered gold, which led to high line drops. Cold electroplating was used to thicken the lines to 3 microns, which reduced the mean track resistance from 480 ohms to 10 ohms. Furthermore, the electrode material was changed from sputtered platinum to electroplated platinum black in order to decrease the phase border impedance of stimulation sites. Applying these techniques, the overall electrode impedance could be reduced from 7.78 kilo ohms to 624 ohms (at 1 kHz). Additional to the electrical optimization of the cuff electrodes, mechanical properties were enhanced by changing the method of joining silicone and polyimide from using one part silicone adhesive to plasma activation of surfaces: Plasma-treated surfaces were simply pressed face to face. The result was a bondage without any additional layer of glue, which

led to a very high mechanical flexibility and higher yield of the overall Hybrid Cuff Electrode.
DTIC
Electrodes; Micromachining; Stiffness; Stimulation; Nerves; Cuffs; Transmission Loss

20030034726 Human Systems Information Analysis Center, Wright-Patterson AFB, OH, USA
Human Systgems IAC Gateway. Volume 11, Number 4, 2000
Hopper, Darrel G.; Kalmanash, Michael H.; Bartlett, C. T.; Cameron, A. A.; Jan. 2000; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410691; No Copyright; Avail: CASI; A03, Hardcopy

This newsletter contains information on advances in avionics Head-down displays, head-up and helmet mounted displays, decision support displays for military commands, and display technology overview. The newsletter also contains a calendar of upcoming, human systems events.
DTIC
Display Devices; Human Factors Engineering

20030034909 Lawrence Livermore National Lab., Livermore, CA
Design and Implementation of the Integrated Timing System to be Used in the National Ignition Facility
Coutts, G. W.; Wiedwald, J. D.; Sewall, N. R.; Lagin, L. J.; Dec. 07, 1999; 16 pp.; In English
Report No.(s): DE2002-791458; No Copyright; Avail: Department of Energy Information Bridge

The National Ignition Facility, or NIF, currently under construction at the Lawrence Livermore National Laboratory will contain the world's most powerful laser. By the year 2003 the NIF laser will be a research tool allowing scientists a glimpse into plasma interactions that are equivalent to those found in the center of the sun. Every eight hours the NIF will generate 1.8 MJ of 351-nm light carried by 192 pulsed laser beams and focus it onto a pea-sized target. This will result in a fusion reaction between two isotopes of hydrogen, creating for a few hundred picoseconds stellar conditions. Synchronizing the beams and diagnosing the fusion reaction requires generation and delivery of over 1000 precisely timed triggers to a multitude of systems. The NIF Integrated Timing System (ITS) was developed to provide reliable, accurately timed triggers that allow each client system to operate independently during periods of shot preparation and maintenance, yet be coordinated to a few tens of picoseconds during the experiment. The ITS applies technologies developed for fiber communications and Two-Way Time Transfer, and integrates them by way of a computer communications network to achieve distributed control, dynamically configurable coordination and independence among timing channels, and integrated self-diagnostics.
NTIS
Timing Devices; Systems Integration; Research Facilities; Ignition

20030036951 Helsinki Univ. of Technology, Espoo (Finland)
Topological Issues in Single-Phase Power Factor Correction
Grigore, V.; 2001; 118 pp.
Report No.(s): PB2003-102634; HUT-PUB-6; Copyright; Avail: National Technical Information Service (NTIS)

The equipment connected to an electricity distribution network usually needs some kind of power conditioning, typically rectification, which produces a nonsinusoidal line current due to the nonlinear input characteristic. With the steadily increasing use of such equipment, line current harmonics have become a significant problem. Their adverse effects on the power system are well recognized. They include increased magnitudes of neutral currents in three-phase systems, overheating in transformers and induction motors, as well as the degradation of system voltage waveforms. Several international standards now exist, which limit the harmonic content due to line currents of equipment connected to electricity distribution networks. As a result, there is the need for a reduction in line current harmonics, or Power Factor Correction - PFC. In this dissertation, we address several issues concerning the application to single-phase PFC of various high-frequency switching converter topologies.
NTIS
Power Conditioning; Topology; Rectification; Electricity

20030036952 Helsinki Univ. of Technology, Espoo (Finland)
Deposition of Binary and Ternary Oxide Thin Films of Trivalent Metals by Atomic Layer Epitaxy
Nieminen, M.; Dec. 2001; 62 pp.
Report No.(s): PB2003-102636; Copyright; Avail: National Technical Information Service (NTIS)

The atomic layer epitaxy (ALE) technique was used to grow thin films of binary metal oxides Al2O3, Ga2O3 and La2O3, and ternary metal oxides LaNiO3, LaCoO3, LaAlO3, and LaGaO3. In addition, another type of mixed-oxide, viz. phosphorus-doped Al2O3 was studied. The binary oxides Ga2O3 and La2O3 and all the ternary oxides were deposited by the ALE method for the first time. New ALE processes were developed for the undoped and doped Al2O3 films. The thin films were characterized by a wide range of methods for structural and surface analysis, including XRD, FTIR, XPS, AFM, XRF, RBS, TOF-ERDA, and SIMS. A review of previous work on these trivalent metal oxide thin films is presented by way of background.
NTIS
Deposition; Atomic Layer Epitaxy; Thin Films; Metals

20030036989 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evaluation of Data Retention and Imprint Characteristics of FRAMs Under Environmental Stresses for NASA Applications
Sharma, Asbok K.; Teverovsky, Alexander; Dowdy, Terry W.; Hamilton, Brett; [2002]; 8 pp.; In English; NVMTS 2002 Conference, 4-8 Nov. 2002, Honolulu, HI, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A major reliability issue for all advanced nonvolatile memory (NVM) technology devices including FRAMs is the data retention characteristics over extended period of time, under environmental stresses and exposure to total ionizing dose (TID) radiation effects. For this testing, 256 Kb FRAMs in 28-pin plastic DIPS, rated for industrial grade temperature range of -40 C to +85 C, were procured. These are two-transistor, two-capacitor (2T-2C) design FRAMs. In addition to data retention characteristics, the parts were also evaluated for imprint failures, which are defined as the failure of cells to change from a 'preferred' state, where it has been for a significant period of time to an opposite state (e.g., from 1 to 0, or 0 to 1). These 256 K FRAMs were subjected to scanning acoustic microscopy (C-SAM); 1,000 temperature cycles from -65 C to +150 C; high temperature aging at 150 C, 175 C, and 200 C for 1,000 hours; highly accelerated stress test (HAST) for 500 hours; 1,000 hours of operational life test at 125 C; and total ionizing dose radiation testing. As a preconditioning, 10 K read/write cycles were performed on all devices. Interim electrical measurements were performed throughout this characterization, including special imprint testing and final electrical testing. Some failures were observed during high temperature aging test at 200 C, during HAST testing, and during 1,000 hours of operational life at 125 C. The parts passed 10 Krad exposure, but began showing power supply current increases during the dose increment from 10 Krad to 30 Krad, and at 40 Krad severe data retention and parametric failures were observed. Failures from various environmental group testing are currently being analyzed.
Author
Ferroelectricity; Random Access Memory; Radiation Effects; Radiation Dosage; Ionizing Radiation; Radiation Tolerance; Microelectronics; Accelerated Life Tests

20030037007 National Renewable Energy Lab., Golden, CO
GaNPAs Solar Cells Lattice-Matched to GaP
Geisz, J. F.; Friedman, D. J.; Kurtz, S.; May 2002; 12 pp.; In English
Report No.(s): DE2002-15000994; No Copyright; Avail: Department of Energy Information Bridge

This conference paper describes the III-V semiconductors grown on silicon substrates are very attractive for lower-cost, high-efficiency multijunction solar cells, but lattice-mismatched alloys that result in high dislocation densities have been unable to achieve satisfactory performance. GaNxP1-x-yAsy is a direct-gap III-V alloy that can be grown lattice-matched to Si when y = 4.7x - 0.1. We propose the use of lattice-matched GaNPAs on silicon for high-efficiency multijunction solar cells. We have grown GaNxP1-x-yAsy on GaP (with a similar lattice constant to silicon) by metal-organic chemical vapor phase epitaxy with direct band-gaps in the range of 1.5 to 2.0 eV. We demonstrate the performance of single junction GaNxP1-x-yAsy solar cells grown on GaP substrates and discuss the prospects for the development of monolithic high efficiency multijunction solar cells based on silicon substrates.
NTIS
Semiconductors (Materials); Solar Cells; Substrates; Gallium Phosphides; Gallium Arsenides; Crystal Lattices

20030037053 National Renewable Energy Lab., Golden, CO
Deep-Level Transient Spectroscopy in InGaAsN Lattice-Matched
Johnston, S. W.; Ahrenkiel, R. K.; Friedman, D. J.; Kurtz, S. R.; May 2002; 12 pp.; In English
Report No.(s): DE2002-15000982; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
NTIS
Gallium Arsenides; Semiconductors (Materials)

20030037174 Lawrence Livermore National Lab., Livermore, CA
Estimated Costing of an EUV Mask Inspection Microscope. Report 4 for AIM Design Study
Barty, A.; Taylor, J. S.; Aug. 20, 2002; 14 pp.; In English
Report No.(s): DE2002-15002103; No Copyright; Avail: Department of Energy Information Bridge

This document is the fourth sub-report of the EUV AIM design study being conducted at LLNL on behalf of International SEMATECH (ISMT) and addresses the issue of preliminary system costing. The purpose of the LLNL study, as identified in section 1.2 of the statement of work, is to research the basic user requirements of an actinic defect characterization tool, potential design configurations and top-level specifications. The objectives of this design study specifically identified in section 1.3 of the statement of work were to 1. Determine the user requirements of an actinic defect characterization tool; 2. Determine if an EUV AIM tool is an appropriate platform for actinic defect characterization; 3. Determine possible design configurations and top-level performance specifications; 4. Identify potential technical issues and risks of different technical approaches; 5. Provide estimates of cost relating to different technical approaches; and 6. Provide simulated performance for key subsystems and the entire system. There are 10 subsections of the study; this report addresses item 8, system costing, and is provided as a separate report so that its content can be kept confidential at the discretion of ISMT. In this analysis we cost two systems - one based on normal-incidence multilayer-coated optics and another based on zone plate optics. The costing of these two systems are provided separately because the fabrication costs and technical challenges associated with each approach are different in areas relating to optics fabrication, and are highlighted by providing separate costing for the two approaches.
NTIS
Extreme Ultraviolet Radiation; Cost Estimates

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*.

20030032299 NASA Glenn Research Center, Cleveland, OH, USA, Washington State Univ., Pullman, WA, USA
Magnetic Damping of g-Jitter Induced Double-Diffusive Convection
Shu, Y.; Li, B. Q.; deGroh, H. C.; August 2001; 27 pp.; In English
Contract(s)/Grant(s): NCC8-92; RTOP 101-15-05; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes a numerical study of the g-jitter driven double diffusive convective flows, thermal and concentration distributions in binary alloy melt systems subject to an external magnetic field. The study is based on the finite element solution of transient magnetohydrodynamic equations governing the momentum, thermal and solutal transport in the melt pool. Numerical simulations are conducted using the synthesized single- and multi- frequency g-jitter as well as the real g-jitter data taken during space flights with or without an applied magnetic field. It is found that for the conditions studied, the main melt flow follows approximately a lineal- superposition of velocity components induced by individual g-jitter components, regardless of whether a magnetic field exists or not. The flow field is characterized by a recirculating double diffusive convection loop oscillating in time with a defined frequency equal to that of the driving g-jitter force. An applied magnetic field has little effect on the oscillating recirculating pattern, except around the moment in time when the flow reverses its direction. The field has no effect on the oscillation period, but it changes the phase angle. It is very effective in suppressing the flow intensity and produces a notable reduction of the solutal striation and time fluctuations in the melt. For a given magnetic field strength, the magnetic damping effect is more pronounced on the velocity associated with the largest g-jitter component present and/or the g-jitter spiking peaks. A stronger magnetic field is more effective in suppressing the melt convection and also is more helpful in bringing the convection in phase with the g-jitter driving force. The applied field is particularly useful in suppressing the effect of real g-jitter spikes on both flow and solutal distributions. With appropriately selected magnetic fields, the convective flows caused by g-jitter can be reduced sufficiently and diffusion dominant. solutal transport in the melt is possible.
Author
Numerical Analysis; Convective Flow; Finite Element Method; Binary Alloys; Melts (Crystal Growth); Magnetic Flux

20030032380 Air Force Research Lab., Edwards AFB, CA

Integrated Powerhead Demonstration's Oxidizer Turbopump Cold Flow Tests Completed

May 2002; ISBN0309084997; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410057; No Copyright; Avail: CASI; A01, Hardcopy

The Integrated Powerhead Demonstration (IPD) program successfully completed a series of cold flow tests on its oxidizer turbopump. This technology development turbopump demonstrated a number of innovative technologies: 1) A rotor fully supported by hydrostatic bearings and a balance piston; 2) A disk and turbine components designed to be compatible with a high-temperature oxygen-rich environment; 3) A back-up clutching bearing; and 4) A lift-off seal to separate the cryogenic and hot-gas regions of the pump.

DTIC

Cold Flow Tests; Oxidizers; Turbine Pumps; Seals (Stoppers)

20030032418 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA

Jet Noise Physics and Modeling Using First-Principles Simulations

Bridges, James E., Technical Monitor; Freund, Jonathan B.; February 2003; 47 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG3-2662; WBS 22-708-87-23

Report No.(s): NASA/CR-2003-212123; E-13775; NAS 1.26:212123; No Copyright; Avail: CASI; A03, Hardcopy

An extensive analysis of our jet DNS database has provided for the first time the complex correlations that are the core of many statistical jet noise models, including MGBK. We have also for the first time explicitly computed the noise from different components of a commonly used noise source as proposed in many modeling approaches. Key findings are: (1) While two-point (space and time) velocity statistics are well-fitted by decaying exponentials, even for our low-Reynolds-number jet, spatially integrated fourth-order space/retarded-time correlations, which constitute the noise 'source' in MGBK, are instead well-fitted by Gaussians. The width of these Gaussians depends (by a factor of 2) on which components are considered. This is counter to current modeling practice, (2) A standard decomposition of the Lighthill source is shown by direct evaluation to be somewhat artificial since the noise from these nominally separate components is in fact highly correlated. We anticipate that the same will be the case for the Lilley source, and (3) The far-field sound is computed in a way that explicitly includes all quadrupole cancellations, yet evaluating the Lighthill integral for only a small part of the jet yields a far-field noise far louder than that from the whole jet due to missing nonquadrupole cancellations. Details of this study are discussed in a draft of a paper included as appendix A.

Author

Direct Numerical Simulation; Jet Aircraft Noise; Mathematical Models; Aeroacoustics; Flow Distribution; Computational Fluid Dynamics

20030032919 American Univ., Beirut

The Geometric Conservation Based Algorithms For Multi-Fluid Flow At All Speeds

Moukalled, Fadl; Sep 2002; 91 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F61775-01-W-E005

Report No.(s): AD-A410325; EOARD-SPC-01-4005; No Copyright; Avail: CASI; A05, Hardcopy

This report results from a contract tasking American University of Beirut as follows: The proposed work involves implementing and (thoroughly) testing the Geometric Conservation Based family of Algorithms within a structured finite-volume framework. The convection terms along the control volume faces will be evaluated using a High Resolution scheme applied within the context of the Normalized Variable Formulation methodology. In order to accelerate the convergence rate and reduce the overall computational cost of the algorithm, the outer iterations will be accelerated by using a non-linear full multigrid method. The discretization scheme will be second-order accurate in space and first order accurate in time (even though extension to second order accuracy should be straightforward). The newly implemented algorithm will be tested by solving a variety of two-dimensional multifluid flow problems in the subsonic, transonic, and supersonic regimes. Examples include: 1) Phase separation in a duct (water-air); 2) Turbulent bubbly flow in a pipe; 3) Turbulent gas-solid flow in a curved duct; 4) Dusty flow over a flat plate at subsonic flow conditions (%incompressible); 5) Dusty flow in a converging-diverging nozzle, and 6) Any problem of interest to Dr. Sekar (AFRL/PR). A detailed report describing the work will be submitted at end of contract as specified in the schedule of supplies in the submitted proposal.

DTIC

Computational Fluid Dynamics; Multiphase Flow; Turbulent Flow; Flow Distribution

20030032944 NASA Glenn Research Center, Cleveland, OH, USA

Demonstration of Separation Delay With Glow-Discharge Plasma Actuators

Hultgren, Lennart S.; Ashpis, David E.; March 2003; 15 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS-22-708-28-13

Report No.(s): NASA/TM-2003-212204; NAS 1.15:212204; E-13807; AIAA Paper 2003-1025; No Copyright; Avail: CASI; A03, Hardcopy

Active flow control of boundary-layer separation using glow-discharge plasma actuators is studied experimentally. Separation is induced on a flat plate installed in a closed-circuit wind tunnel by a shaped insert on the opposite wall. The flow conditions represent flow over the suction surface of a modern low-pressure-turbine airfoil. The Reynolds number, based on wetted plate length and nominal exit velocity, is varied from 50; 000 to 300,000, covering cruise to takeoff conditions. Low (0.2\%) and high (2.5\%) free-stream turbulence intensities are set using passive grids. A spanwise-oriented phased-plasma-array actuator, fabricated on a printed circuit board, is surface-flush-mounted upstream of the separation point and can provide forcing in a wide frequency range. Static surface pressure measurements and hot-wire anemometry of the base and controlled flows are performed and indicate that the glow-discharge plasma actuator is an effective device for separation control.
Author

Flow Distribution; Active Control; Separated Flow; Actuators; Boundary Layer Separation

20030032995 Defence Science and Technology Organisation, Fishermans Bend, Australia

The Calculation of Hydrodynamic Coefficients for Underwater Vehicles

Jones, David A.; Clarke, David B.; Brayshaw, Ian B.; Barillon, Jean-Louis; Anderson, Brendon; July 2002; 41 pp.; In English

Report No.(s): DSTO-TR-1329; DODA-AR-012-417; Copyright; Avail: Other Sources

Maritime Platforms Division within DSTO is currently studying the emerging science and technology of autonomous underwater vehicles for defence applications. As part of an examination of the requirements for the hydrodynamics and maneuverability of these vehicles MPD has been tasked with the development of models to determine the hydrodynamic coefficients of simple and complex submerged bodies as a function of their shape. These coefficients are specific to the vehicle and provide the description of the hydrodynamic forces and moments acting on the vehicle in its underwater environment. This report provides a detailed discussion and evaluation of three of the existing methods which have been documented in the literature for the calculation of these coefficients. Sample calculations using some of these techniques are presented, and the accuracy and applicability of these calculational methods to the underwater vehicles of interest to the DSTO are described. It is concluded that none of the methods surveyed has the necessary generality to encompass all the shapes of interest to DSTO work, and alternative computational techniques are recommended which should allow the hydrodynamic coefficients of more complex underwater vehicles to be determined.
Author

Hydrodynamic Coefficients; Underwater Vehicles; Submerged Bodies; Mathematical Models; Maneuverability; Computation

20030033004 Southwest Research Inst., San Antonio, TX

Coupled Simulation of Vehicle Dynamics and Tank Slosh. Phase 1 Report. Testing and Validation of Tank Slosh Analysis

Wendel, Glenn R.; Green, Steven T.; Burkey, Russell C.; Sep. 2002; 59 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAE07-99-C-L053

Report No.(s): AD-A410686; IR-364; No Copyright; Avail: CASI; A04, Hardcopy

Computer simulation of vehicle dynamics has become a valuable tool in the design of vehicles. They are, however, unable to accurately simulate the complex dynamics of fluid 'sloshing' in a tank on the vehicle. Computational Fluid Dynamics (CFD) analysis software is available that can predict fluid slosh, however, the use of this software in accurately predicting fluid slosh for a military vehicle application has not been demonstrated. This is the first phase of a multiphase program to develop and demonstrate the use of CFD analysis, coupled with vehicle dynamics analysis, to more accurately predict the dynamics of a fluid transport system. The objective of this phase is to validate the CFD analysis in predicting slosh dynamics on a tank subjected to motions of a vehicle encountering typical maneuvers. To accomplish this, a one-quarter-scale model of a TOLD tank was constructed, as well as a test fixture to simulate a five-ton FMTV truck. The reaction forces and the fluid motions of the CFD analysis and the laboratory test were compared for six simulated vehicle maneuvers including lane changes and bumps. The CFD analysis was conducted with the commercially available software package, FLOW-3D-. The net fluid force and moment predictions were added to the force and moment predictions of a rigid body dynamic analysis of the empty tank alone to compare to the corresponding measured values for the test tank. Overall, the results show that CFD can successfully

be applied to the study of fluid motions and the fluid- structure interactions in truck-mounted water transport tanks. There is good correlation between the predicted and measured roll moment. Given the rapid turnaround time for the CFD simulations presented here, the outlook is encouraging for coupling a vehicle rigid body dynamics analysis to a fluid dynamics analysis for a high fidelity simulation of the complete vehicle response to maneuvers.
DTIC
Computational Fluid Dynamics; Vehicles; Liquid Sloshing

20030033019 Worcester Polytechnic Inst., MA, USA
Low-Dimensional Modeling of Flow-Induced Vibration with Coupled Map Lattices
Olinger, David J.; Demetriou, Michael A.; January 27, 2002; 10 pp.; In English
Contract(s)/Grant(s): N00014-96-1-0004
Report No.(s): AD-A410638; WPIAE-DJO-03-1; No Copyright; Avail: CASI; A02, Hardcopy

The overall objective of this project was to use tools from nonlinear chaos theory to gain a better fundamental understanding of vibrating cable flows. To accomplish this objective, low-order models based on iterative maps were developed. These models (or coupled map lattices) are highly efficient, and should have future application for flow control of vibrating cables. Specific capabilities developed during the course of the project include; 1) incorporation of self-learning features (neural networks) that allow the models to learn directly from a cable flow, 2) addition of control strategies into the models, and 3) integration of a structural dynamics model with the coupled map lattice. Numerical simulations and experiments on vibrating cables were also conducted to validate the models. At their current state of development, the models can predict certain observed features of cable flows, including cable vibration amplitudes and flow patterns. In addition, we studied an experimental technique that uses ultrasonic acoustic pulses to measure lift forces on vibrating structures.
DTIC
Hydrodynamics; Nonlinearity

20030033024 Aerospace Corp., El Segundo, CA
Aerodynamic Disturbances on Spacecraft in Free-Molecular Flow
Storch, J. A.; Oct 2002; 70 pp.; In English
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A410696; TR-2003(3397)-1; SMC-TR-03-06; No Copyright; Avail: CASI; A04, Hardcopy

This report presents a thorough development of the aerodynamic forces and moments exerted on spacecraft at altitudes where the atmosphere is best described by free molecular flow theory. The gas-surface interaction model is based upon a combination of specular and diffuse reflection as characterized by normal and tangential momentum accommodation coefficients, while the random thermal motion of the atmosphere is described by the Maxwell-Boltzmann distribution law. In the case of non-rotating bodies of arbitrary shape, general expressions in the form of surface integrals are given for the aerodynamic force and moment. Complications due to spin are investigated for the class of axisymmetric bodies rotating about their axis of symmetry but with arbitrary orientation relative to the incident molecular flow. For several simple geometric shapes, the quadratures are performed analytically, and closed-form expressions are given for the aerodynamic force and moment. Graphs are generated showing the variation of the forces and moments with selected parameters, including the errors incurred by neglecting the random motion of the atmosphere.
DTIC
Spacecraft Propulsion; Aerodynamic Forces; Free Molecular Flow

20030034614 Stanford Univ., Stanford, CA
Wall Modeling Techniques for Large-Eddy Simulation
Moin, Parviz; Templeton, Jeremy; Wang, Meng; Nicoud, Franck; Baggett, Jeffrey; Sep. 2002; 51 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0111
Report No.(s): AD-A410335; SPO-23089; AFRL-SR-AR-TR-03-0014; No Copyright; Avail: CASI; A04, Hardcopy

In the LES of high Reynolds number wall-bounded flows, wall modeling is needed to alleviate the severe near-wall resolution requirement. Simple algebraic models such as the instantaneous log-law are inadequate for predicting complex flows with strong pressure gradients and separation. We have explored two classes of wall models: those based on the turbulent boundary-layer (TBL) equations and those based on control theory. Recent application of the TBL equation model to LES of the flow over a cylinder at super-critical Reynolds number is discussed. The emphasis of the report is on control based wall modeling, in which sub-optimal control strategy is used to find the wall stresses that will force the outer LES toward a target

profile. Results from channel-flow simulation indicate that in order to obtain the correct mean velocity profile (the log law), the wall stresses must not only model the physics but also compensate for numerical and SGS modeling errors. The data generated by this sub-optimal control strategy are then used to derive a linear stochastic estimate model. The mathematical formulation and issues of key importance in control-based wall modeling are detailed. Efforts towards a predictive and inexpensive wall model in the control framework are detailed.
DTIC
Large Eddy Simulation; Mathematical Models; Stochastic Processes; Wall Flow; Fluid Mechanics

20030034665 National Taiwan Univ., Taipei, Taiwan, Province of China
Implementation of Noninvasive Flow Velocimetry Through Monte Carlo Simulation
Chien, Jen-Chien; Lin, Bor-Shyh; Lin, Bor-Shing; Wu, Shu-Mei; Chong, Fok-Ching; October 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410380; No Copyright; Avail: CASI; A01, Hardcopy

One of the most important mechanisms for maintaining the life of human beings is the human circulation system. This research focuses on a noninvasive technique that maintains high resolution and high precision of measuring photon in the blood stream. We hope to obtain important biomedical parameters valuable for pathological diagnosis. In phase I, a noninvasive optical flow velocimetry is implemented for detecting the human circulation system under the skin surface. The sonrce of the incidence photon is He-Ne laser. The signal is transmitted and detected via a Y-type optical fiber. Optical heterodyning is used to measure the frequency difference between the reflection wave and the original incidence laser wave. Then numerical simulation using Monte Carlo was used in the analysis to verify the result. In phase II, after a velocimetry specification was decided, it was modeled, tested and verified using Monte Carlo simulation. Then the apparatus were set up as directed in the model. The performance of this velocimetry is satisfaction and acceptable. This method of implementing a velocimetry is simple, convenience and fast. Thus, no prior clinical experiment is needed. Moreover, the best reading for the reflected wave is 45 degrees plus/minus 2.35 degrees. This is a realtime and continuous detecting blood flow velocimetry. We find that this is a reliable tool for doctors when doing clinical diagnosis.
DTIC
Blood Flow; Particle Image Velocimetry; Helium-Neon Lasers

20030034671 Air Force Research Lab., Edwards AFB, CA, USA
Fractal Geometry and Growth Rate Changes of Cryogenic Jets Near the Critical Point
Chehroudi, B.; Talley, D.; Coy, E.; June 14, 1999; 16 pp.; In English
Contract(s)/Grant(s): AF Proj. 2308
Report No.(s): AD-A410388; AFRL-PR-ED-TP-FY99-0146; No Copyright; Avail: CASI; A03, Hardcopy

Injection of several pure fluids into a chamber with different ambient gases under supercritical temperature but sub- to supercritical condition based on the injectant thermodynamic critical conditions resulted in the following: the jet exhibits classical liquid-like jet second wind-induced type breakup until chamber pressure reaches near the critical point of the jet substance beyond which gas-like visual behavior is observed and no drops are found. For the first time, these visual qualitative observations are verified quantitatively by agreement between the experimental growth rate of the jets reported here and those developed theoretically by D. Brown, D. Papamoschou and A. and Roshko, and P.E. Dimotakis for the incompressible variable-density mixing layers. This gas-like jet appearance is also confirmed quantitatively and for the first time by fractal analysis of the outer contour of the jet. The geometry of the jet interface shows a transition from Euclidean to a fractal interface with a fractal dimension near the values measured and reported by others for gaseous turbulent jets. Finally, based on a physical hypothesis implying that at the point where gas-like behavior appears, the value of the jet interface bulge separation/formation characteristic time should be near that of gasification, an 'intuitive/smart' equation is proposed for the growth rate that agrees well with the presented experimental data for a wide range of density ratios.
DTIC
Fractals; Turbulent Flow; Supercritical Flow; Liquid Rocket Propellants; Fluid Jets; Cryogenic Rocket Propellants

20030034675 Air Force Research Lab., Edwards AFB, CA, USA
Anatomical Changes of a Cryogenic Jet in Transition to the Thermodynamic Supercritical Condition
Chehroudi, B.; Talley, D.; Coy, E.; May 1999; 8 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A410389; AFRL-PR-ED-TP-FY99-0089; No Copyright; Avail: CASI; A02, Hardcopy

The high pressure supercritical facility at the Air Force Research Laboratory at Edwards Air Force Base is used to investigate the effects of chamber pressure (density) ranging from the thermodynamic subcritical to supercritical values at a supercritical chamber temperature. At subcritical pressures, the jets exhibit wave-like structures that amplify downstream and eventually break up into irregularly shaped small entities. The formation of many droplets is seen at higher pressures, resembling a second wind-induced liquid-jet breakup. Further increase of chamber pressure, near the critical condition, fails to induce the transition into a full liquid atomization regime. At this point, the jet anatomy changes abruptly to imitate turbulent gas jet injection. The jet initial growth rate is plotted against the chamber-to-injectant density ratio, along with available data on other liquid/gaseous jets and mixing layers, producing a unique and informative graph. For supercritical conditions, our measured growth rate agrees well with a theoretical equation proposed by Papamoschou and Roshko and closely follows the trend of Dimotakis for incompressible but variable-density gaseous turbulent mixing layers. Fractal analysis of the jet interface also shows a similarity to gas jet behavior with comparable fractal dimension. This is the first time quantitative evidence has been provided to support qualitative visualizations suggesting that supercritical jets appear to behave like conventional gas jets. (6 figures, 21 refs.)
DTIC
Fractals; Supercritical Pressures; Turbulent Mixing; Pressure Effects

20030034689 Instituto Politecnico Nacional, Mexico City, Mexico
First Approach of Pneumatic Anthropomorphic Hand
Jimenez, Omar; Leija, Lorenzo; Munyoz, Roberto; October 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410528; No Copyright; Avail: CASI; A01, Hardcopy

This work is a first approach of an articulated hand with the purpose of solving the basic needs of a hand-amputated person. The anthropomorphic hand has two active degrees of freedom and 6 passive actuated by a pneumatic system. The main objectives are simplicity low weight and minimum consumption minimum control and natural appearance.
DTIC
Human Body; Hand (Anatomy); Pneumatic Equipment; Prosthetic Devices

20030036932 Technische Univ. Delft (Netherlands)
Graded Sediment Transport by Non-Breaking Waves and a Current
Sistermans, P. G. J.; Dec. 17, 2002; 228 pp.; In English
Report No.(s): PB2003-101691; Copyright; Avail: National Technical Information Service (NTIS)

This thesis focuses on the modeling of time-averaged sediment concentration and velocity profiles as a result of the action of waves and a current. An important investigated aspect is the effect of the grading of the sediment bed on the resulting sediment transport. This thesis has two main objectives. The first objective is to increase insight into the effect of hydraulic parameters, such as the wave height, the wave period, the mean current velocity and the water depth, on time-averaged sediment concentration and velocity profiles. The second objective is to study the effect of the grading of the sediment bed on these profiles.
NTIS
Sediment Transport; Water Waves; Ocean Currents

20030036959 Center for Mathematics and Computer Science, Amsterdam
Numerical Solution of Steady Free-Surface Navier-Stokes Flow. Modelling, Analysis and Simulation
van Brummelen, E. H.; Jun. 30, 2000; 40 pp.
Report No.(s): PB2003-102639; MAS-R0018; Copyright; Avail: National Technical Information Service (NTIS)

Numerical solution of flows that are partially bounded by a freely moving boundary is of great practical importance, e.g., in ship hydrodynamics. The usual time integration approach for solving steady viscous free surface flow problems has several drawbacks. Instead, we propose an efficient iterative method, which relies on a different but equivalent formulation of the free surface flow problem, involving a so-called quasi free-surface condition. It is shown that the method converges if the solution is sufficiently smooth in the neighborhood of the free surface. Details are provided for the implementation of the method in parnax. Furthermore, we present a method for analyzing properties of discretization schemes for the free-surface flow equations.
NTIS
Navier-Stokes Equation; Surfaces

20030037165 Pacific Northwest National Lab., Richland, WA

Version 2.0 Visual Sample Plan (VSP): Models and Code Verification

Gilbert, R. O.; Wilson, J. E.; O'Brien, R. F.; Carlson, D. K.; Bates, D. J.; Aug. 2002; 112 pp.; In English

Report No.(s): DE2002-15001019; No Copyright; Avail: Department of Energy Information Bridge

Visual Sample Plan (VSP) is a software tool under development at the Pacific Northwest National Laboratory (PNNL) with support from the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Defense (DoD). VSP is used to select the right number and location of environmental samples in order to achieve various sampling objectives with required performance. Version 2.0 of VSP provides formulas and statistical algorithms to compute the number of samples needed for specific statistical tests, estimations, an, evaluations appropriate for the following environmental sampling goals: comparing an average or proportion to a fixed threshold value; comparing an average or proportion to a reference area average or proportion; constructing a confidence interval on a mean; estimating a mean or a proportion within specified cost and variance; constraints; locating a hot spot; and finding a UXO target area (not yet peer-reviewed).

NTIS

Software Engineering; Program Verification (Computers); Computer Systems Programs; Mathematical Models; Information Management

20030037178 Lawrence Livermore National Lab., Livermore, CA

Calculation of Shock Hugoniot Curves of Precompressed Liquid Deuterium

Militzer, B.; Nov. 18, 2002; In English

Report No.(s): DE2002-15002120; UCRL-JC-150587; No Copyright; Avail: National Technical Information Service (NTIS)

Path integral Monte Carlo simulations have been used to study deuterium at high pressure and temperature. The equation of state has been derived. A series of shock Hugoniot curves is computed for different initial compressions in order to compare with current and future shock wave experiments using liquid deuterium samples precompressed in diamond anvil cells.

NTIS

Deuterium; Hugoniot Equation Of State; High Pressure

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*.

20030032268 George Washington Univ., Washington, DC, USA

Preliminary Design and Analysis of the GIFTS Instrument Pointing System

Zomkowski, Paul P.; January 2003; 133 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NCC1-01017; RTOP 755-03-00-03

Report No.(s): NASA/CR-2003-211937; NAS 1.26:211937; No Copyright; Avail: CASI; A07, Hardcopy

The Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS) Instrument is the next generation spectrometer for remote sensing weather satellites. The GIFTS instrument will be used to perform scans of the Earth s atmosphere by assembling a series of field-of- views (FOV) into a larger pattern. Realization of this process is achieved by step scanning the instrument FOV in a contiguous fashion across any desired portion of the visible Earth. A 2.3 arc second pointing stability, with respect to the scanning instrument, must be maintained for the duration of the FOV scan. A star tracker producing attitude data at 100 Hz rate will be used by the autonomous pointing algorithm to precisely track target FOV s on the surface of the Earth. The main objective is to validate the pointing algorithm in the presence of spacecraft disturbances and determine acceptable disturbance limits from expected noise sources. Proof of concept validation of the pointing system algorithm is carried out with a full system simulation developed using Matlab Simulink. Models for the following components function within the full system simulation: inertial reference unit (IRU), attitude control system (ACS), reaction wheels, star tracker, and mirror controller. With the spacecraft orbital position and attitude maintained to within specified limits the pointing algorithm receives quaternion, ephemeris, and initialization data that are used to construct the required mirror pointing commands at a 100 Hz rate. This comprehensive simulation will also aid in obtaining a thorough understanding of spacecraft disturbances and other sources of pointing system errors. Parameter sensitivity studies and disturbance analysis will be used to obtain limits of operability for the GIFTS instrument. The culmination of this simulation development and analysis will be

used to validate the specified performance requirements outlined for this instrument.
Author
Design Analysis; Fourier Transformation; Spectrometers; Remote Sensing; Earth Orbital Environments

20030032346 DYNACS Engineering Co., Inc., Cocoa Beach, FL, USA
Air Monitoring for Hazardous Gas Detection
Arkin, C. Richard; Naylor, Guy; Haskell, William; Floyd, David; Curley, Charles; Griffin, Timothy P.; Adams, Frederick; Follistein, Duke; [2003]; 18 pp.; In English; 40th Space Congress, 29 Apr. - 1 May 2003, Cape Canaveral, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS10-98001
Report No.(s): KSC-2003-018; No Copyright; Avail: CASI; A03, Hardcopy

The Hazardous Gas Detection Lab is involved in the design and development of instrumentation that can detect and quantify various hazardous gases. Traditionally these systems are designed for leak detection of the cryogenic gases used for the propulsion of the Shuttle and other vehicles. Mass spectrometers are the basis of these systems, which provide excellent quantitation, sensitivity, selectivity, response and limits of detection. Unfortunately, these systems are large, heavy and expensive. This feature limits the ability to perform gas analysis in certain applications. Smaller and lighter mass spectrometer systems could be used in many more applications primarily due to the portability of the system. Such applications would include air analysis in confined spaces, in-situ environmental analysis and emergency response. In general, system cost is lowered as size is reduced. With a low cost air analysis system, several systems could be utilized for monitoring large areas. These networked systems could be deployed at job-sites for worker safety, throughout a community for pollution warnings, or dispersed in a battlefield for early warning of chemical or biological threats. Presented will be information on the first prototype of this type of system. Included will be field trial data, with this prototype performing air analysis autonomously from an aircraft.
Author
Gas Detectors; Air Quality; Environmental Monitoring; Measuring Instruments; Prototypes

20030032362 AI Solutions, Inc., Lanham, MD, USA
Stationkeeping Approach for the Microwave Anisotropy Probe (MAP)
Rohrbaugh, Dave; Schiff, Conrad; [2002]; 10 pp.; In English; AIAA Guidance and Control Conference, Aug. 2002, Monterey, CA, USA
Contract(s)/Grant(s): NASS-01090
Report No.(s): AIAA Paper 2002-4429; No Copyright; Avail: CASI; A02, Hardcopy

The Microwave Anisotropy Probe was successfully launched on June 30, 2001 and placed into a Lissajous orbit about the L2 Sun-Earth-Moon libration point. However, the L2 libration point is unstable which necessitates occasional stationkeeping maneuvers in order to maintain the spacecraft s Lissajous orbit. Analyses were performed in order to develop a feasible L2 stationkeeping strategy for the MAP mission. The resulting strategy meets the allotted fuel budget, allowing for enough fuel to handle additional he1 taxes, while meeting the attitude requirements for the maneuvers. Results from the first two stationkeeping maneuvers are included.
Author
Stationkeeping; Microwave Anisotropy Probe; Attitude (Inclination)

20030032364 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Use of Transfer Radiometers in Validating the Visible through Shortwave Infrared Calibrations of Radiance Sources Used by Instruments in NASA's Earth Observing System
Butler, James J.; Barnes, Robert A.; [2002]; 22 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The detection and study of climate change over a time frame of decades requires successive generations of satellite, airborne, and ground-based instrumentation carefully calibrated against a common radiance scale. In NASA s Earth Observing System (EOS) program, the pre-launch radiometric calibration of these instruments in the wavelength region from 400 nm to 2500 nm is accomplished using internally illuminated integrating spheres and diffuse reflectance panels illuminated by irradiance standard lamps. Since 1995, the EOS Calibration Program operating within the EOS Project Science Office (PSO) has enlisted the expertise of national standards laboratories and government and university metrology laboratories in an effort to validate the radiance scales assigned to sphere and panel radiance sources by EOS instrument calibration facilities. This state-of-the-art program has been accomplished using ultra-stable transfer radiometers independently calibrated by the above

participating institutions. In ten comparisons since February 1995, the agreement between the radiance measurements of the transfer radiometers is plus or minus 1.80\% at 411 nm, plus or minus 1.31\% at 552.5 nm, plus or minus 1.32\% at 868.0 nm, plus or minus 2.54\% at 1622nm, and plus or minus 2.81\% at 2200nm (sigma =1).
Author
Earth Observing System (Eos); Radiance; Radiometers; Satellite Instruments; Light (Visible Radiation); Short Wave Radiation

20030032406 Ohio Aerospace Inst., Brook Park, OH, USA
Doppler Global Velocimetry at NASA Glenn Research Center: System Discussion and Results
Wernet, Mark P., Technical Monitor; Lant, Christian T.; February 2003; 51 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC3-861; WBS 22-708-73-26
Report No.(s): NASA/CR-2003-212179; E-13780; NAS 1.26:212179; No Copyright; Avail: CASI; A04, Hardcopy

A ruggedized Doppler Global Velocimetry system has been built and tested at NASA Glenn Research Center. One component of planar velocity measurements of subsonic and supersonic flows from an under-expanded free jet are reported, which agree well with predicted values. An error analysis evaluates geometric and spectral error terms, and characterizes speckle noise in isotropic data. A multimode, fused fiber optic bundle is demonstrated to couple up to 650 mJ/pulse of laser light without burning or fiber ablation, and without evidence of Stimulated Brillouin Scattering or other spectral-broadening problems. Comparisons are made between spinning wheel data using illumination by freespace beam propagation and fiber optic beam delivery. The fiber bundle illumination is found to provide more spatially even and stable illumination than is typically available from pulsed Nd:YAG laser beams. The fiber bundle beam delivery is also a step toward making remote measurements and automatic real-time plume sectioning feasible in wind tunnel environments.
Author
Velocity Measurement; Doppler Effect; Subsonic Flow; Supersonic Flow; Free Jets; Pulsed Lasers; Coupling

20030032468 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The STIS CCD Spectroscopic Line Spread Functions
Gull, T.; Lindler, D.; Tennant, D.; Bowers, C.; Grady, C.; Hill, R. S.; Malumuth, E.; [2002]; 18 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

We characterize the spectroscopic line spread functions of the spectroscopic CCD modes for high contrast objects. Our long range goal is to develop tools that accurately extract spectroscopic information of faint, point or extended sources in the vicinity of bright, point sources at separations approaching the realizable angular limits of HST with STIS. Diffracted and scattered light due to the HST optics, and scattered light effects within the STIS are addressed. Filter fringing, CCD fringing, window reflections, and scattering within the detector and other effects are noted. We have obtained spectra of several reference stars, used for flux calibration or for coronagraphic standards, that have spectral distributions ranging from very red to very blue. Spectra of each star were recorded with the star in the aperture and with the star blocked by either the F1 or F2 fiducial. Plots of the detected starlight along the spatial axis of the aperture are provided for four stars. With the star in the aperture, the line spread function is quite noticeable. Placing the star behind one of the fiducials cuts the scattered light and the diffracted light, is detectable even out to 1OOOOA. When the star is placed behind either fiducial, the scattered and diffracted light components, at three arcseconds displacement from the star, are below lop6 the peak of the star at wavelengths below 6000A; at the same angular distance, scattered light does contaminate the background longward of 6000A up to a level of 10(exp -5).
Author
Calibrating; Charge Coupled Devices; Diffraction; Displacement; Extraction; Spectra; Spectroscopy

20030032473 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
NTD Germanium-Based Microcalorimeters For Hard X-Ray Spectroscopy
Silver, E.; Bandler, S.; Schnopper, H.; Murray, S.; Barbera, M.; Madden, N.; Landis, D.; Beeman, J.; Haller, E. E.; August 2000; 5 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-5269; Copyright; Avail: Other Sources

Composite microcalorimeters using neutron transmutation-doped germanium (NTD) thermistors have been tested at hard x-ray energies. We present a broad band spectrum showing the energy resolution at 60 keV to be -50 eV. The application of

these microcalorimeters to the field of nuclear line astrophysics is discussed.
Author
X Ray Spectroscopy; Astronomical Spectroscopy; Calorimeters; Doped Crystals; Germanium; X Ray Spectra

20030032925 Johns Hopkins Univ., Baltimore, MD
Monitoring Brain Injury With TSALLIS Entropy
Tong, S.; Bezerianos, A.; Zhu, Y.; Geocadin, R.; Hanley, D.; Oct 2001; 4 pp.; In English
Report No.(s): AD-A410215; No Copyright; Avail: CASI; A01, Hardcopy

Nonextensive entropy measure, Tsallis Entropy (TE), was undertaken to monitor the brain injury after cardiac arrest. EEG of human and experimental injury model of rats are investigated. In both conditions TE decreases in bad physiological functional outcome. As the brain recovers from injury, the TE will also gradually return to normal level. Meanwhile, TE also shows good sensitivity to different grades of asphyxic injury. This method provides a novel real time brain injury indicator and may be a useful in developing a diagnostic monitoring tool.
DTIC
Cardiology; Entropy; Physiology; Monitors; Brain Damage; Electroencephalography

20030032960 Michigan Univ., Ann Arbor, MI, USA
Design Study of a Synthetic Thinned Aperture Radiometer for Hurricane Impact Prediction
Ruf, Christopher S.; February 06, 2003; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG-1-01032; No Copyright; Avail: CASI; A03, Hardcopy

The principle accomplishments involve a conceptual design of an airborne Hurricane Imaging (microwave) Radiometer (HiRad) instrument for use in operational hurricane surveillance. The basis of the HiRad design is the Stepped Frequency Microwave Radiometer (SFMR) that has successfully measured surface wind speed and rain rate in hurricanes from the NOAA Hurricane Research Division s P-3 aircraft. Unlike the SFMR that views only at nadir, the HiRad provides wide-swath measurements between +/- 45 deg. in incidence angle with a spot-beam spatial resolution of approximately 1-3 km. The system operates at four equally spaced frequency channels that cover a range between 4 GHz and 6 GHz. The final report consists of two parts. Part 1 is a reprint of a conference proceeding presented at the 2002 International Geoscience and Remote Sensing Symposium and authored by the principle members of the HiRad design team. Part 2 is a summary of the MMIC receiver design developed to support the HiRad sensor.
Author
Design Analysis; Airborne Equipment; Hurricanes; Imaging Techniques; Wind Velocity; Spatial Resolution; Microwave Radiometers

20030033013 State Univ. of New York, Buffalo, NY, USA
Modalities and Clinical Applications of Dynamic Infrared Imaging
Anbar, Michael; October 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410561; No Copyright; Avail: CASI; A01, Hardcopy

Dynamic infrared imaging (DIRI), the most effective modality of dynamic area telethermometry (DAT), involves the acquisition of hundreds to thousands of consecutive thermal images, deriving information from the modulation of temperature and of thermal spatial distribution of small subareas. Four groups of clinical applications of dynamic infrared imaging are reviewed from the standpoint of their data processing following FFT analysis of temperature modulation and modulation of perfusion of the cutaneous capillary bed. These include: 1, Visual assessment of spatial abnormalities in perfusion kinetics that can be used in diagnosis of joint disease and of advanced cancer, as well as visual identification of abnormalities in subcutaneous circulation, 2, Objective computerized diagnosis of systemic chronic neuronal disorders that may affect modulation amplitudes and their spatial distribution, 3, Objective computerized detection of cancer, breast and skin cancer in particular, by their effect on the spatial distribution of attenuated subareas at specific frequencies of modulation, 4, Objective assessment of transient mental stress (psychological testing) and of exposure to neurotoxic agents that may affect modulation amplitudes and their distribution over limited periods of time. Following time- dependent changes in temperature modulation at specific frequencies one can assess the severity of functional perturbation of the autonomic nervous system.
DTIC
Infrared Imagery; Stress (Psychology)

20030033836 Florida Univ., Gainesville, FL

Ultrasensitive Biosensors for Molecular Recognition and Manipulation

Tan, Weihong; Feb 2003; 8 pp.; In English

Contract(s)/Grant(s): N00014-98-1-0621

Report No.(s): AD-A410625; No Copyright; Avail: CASI; A02, Hardcopy

Our objective is to develop novel biomolecule recognition mechanisms and ultrasensitive biosensors for direct, real-time biochemical imaging and sensing. These biosensors will provide a novel tool which permits major advances in the investigation and control of fundamental molecular and cellular physiological processes. There are three aspects of our approach: 1. Using nanotechnology and existing sensing mechanisms for nanometer level biosensor development; 2. Using molecular beacon DNA molecules for development of new biomolecule recognition mechanisms; 3. Using single molecule microscopy techniques for molecular interaction studies. Over the three years of this grant, we have published 20 papers and filed two patents (one granted and one pending). The grant also has helped us to train six graduate students, three postdoctoral researchers, five undergraduate students. Among all the students, there are two African American graduate students, one Hispanic graduate student and three minority undergraduate students. The grant has also enabled us to build a world class research laboratory in the area of biomolecular interaction and recognition studies.

DTIC

Bioinstrumentation; Detection; Chemical Properties; Molecules

20030033843 Lawrence Livermore National Lab., Livermore, CA

Polarized Light Propagation in Biologic Tissue and Tissue Phantoms

Sankaran, V.; Walsh, J. T.; Maitland, D. J.; Dec. 10, 1999; 16 pp.; In English

Report No.(s): DE2002-791683; No Copyright; Avail: Department of Energy Information Bridge

Imaging through biologic tissue relies on the discrimination of weakly scattered from multiply scattered photons. The degree of polarization can be used as the discrimination criterion by which to reject multiply scattered photons. Polarized light propagation through biologic tissue is typically studied using tissue phantoms consisting of dilute aqueous suspensions of microspheres. We show that, although such phantoms are designed to match the macroscopic scattering properties of tissue, they do not accurately represent biologic tissue for polarization-sensitive studies. In common tissue phantoms, such as dilute Intralipid and dilute 1-microm-diameter polystyrene microsphere suspensions, we find that linearly polarized light is depolarized more quickly than circularly polarized light. In dense tissue, however, where scatterers are often located in close proximity to one another, circularly polarized light is depolarized similar to or more quickly than linearly polarized light. We also demonstrate that polarized light propagates differently in dilute versus densely packed microsphere suspensions, which may account for the differences seen between polarized light propagation in common dilute tissue phantoms versus dense biologic tissue.

NTIS

Medical Electronics; Imaging Techniques; Polarized Light

20030033862 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Design and Fabrication of Two-Dimensional Semiconducting Bolometer Arrays for the High Resolution Airborne Wideband Camera (HAWC) and the Submillimeter High Angular Resolution Camera II (SHARC-II)

Voellmer, George M.; Allen, Christine A.; Amato, Michael J.; Babu, Sachidananda R.; Bartels, Arlin E.; Benford, Dominic J.; Derro, Rebecca J.; Dowell, C. Darren; Harper, D. Al; Jhabvala, Murzy D.; [2002]; 10 pp.; In English; SPIE Conference on Astronomical Telescopes and Instrumentation, 22-28 Aug. 2002, Waikoloa, HI, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

The High resolution Airborne Wideband Camera (HAWC) and the Submillimeter High Angular Resolution Camera II (SHARC II) will use almost identical versions of an ion-implanted silicon bolometer array developed at the National Aeronautics and Space Administration's Goddard Space Flight Center (GSFC). The GSFC 'Pop-up' Detectors (PUD's) use a unique folding technique to enable a 12 x 32-element close-packed array of bolometers with a filling factor greater than 95 percent. A kinematic Kevlar(trademark) suspension system isolates the 200 mK bolometers from the helium bath temperature, and GSFC - developed silicon bridge chips make electrical connection to the bolometers, while maintaining thermal isolation. The JFET preamps operate at 120 K. Providing good thermal heat sinking for these, and keeping their conduction and radiation from reaching the nearby bolometers, is one of the principal design challenges encountered. Another interesting challenge is the preparation of the silicon bolometers. They are manufactured in 32-element, planar rows using Micro Electro Mechanical Systems (MEMS) semiconductor etching techniques, and then cut and folded onto a ceramic bar. Optical alignment using specialized jigs ensures their uniformity and correct placement. The rows are then stacked to create the 12 x 32-element array.

Engineering results from the first light run of SHARC II at the Caltech Submillimeter Observatory (CSO) are presented. Author

Microelectromechanical Systems; Semiconductors (Materials); Bolometers; Arrays; Cameras

20030034701 Westinghouse Savannah River Co., Aiken, SC

Final MTI Data Report: Ivanpah Playa

Villa-Aleman, E.; Sep. 2002; In English

Report No.(s): DE2002-803619; WSRC-TR-2002-00043; No Copyright; Avail: National Technical Information Service (NTIS)

The Savannah River Technology Center (SRTC) conducted four reflectance and thermal vicarious calibrations for the MTI satellite at Ivanpah Playa, California since July 2000. The vicarious reflectance campaigns held on July and September 2000 were a joint effort between SRTC and the Remote Sensing Group (RSG) of the University of Arizona. The campaign conducted on May 2001 at Ivanpah Playa and Roach Lake was a joint effort between SRTC and Los Alamos National Laboratory (LANL). An additional campaign was conducted on March 2002. The results presented here are a summary of our reflectance and thermal campaigns and interpretation of the satellite imagery. Particular attention was given to the in-depth September 2000 campaign. Analysis of the September 2000 MTI imagery shows close agreement between the ground truth data measured at Ivanpah Playa by SRTC and RSG and the reflectance measured by the MTI satellite.

NTIS

Calibrating; Reflectance; Remote Sensing; Satellite Imagery; Radiometers

20030034730 Middle East Technical Univ., Ankara, Turkey

Implementation of a Data Acquisition System for Contactless Conductivity Imaging

Ulker, B.; Gencer, N. G.; Oct 2001; 5 pp.; In English

Report No.(s): AD-A410709; No Copyright; Avail: CASI; A01, Hardcopy

A data acquisition system is realized to image electrical conductivity of biological tissues via contactless measurements. This system uses magnetic excitation to induce currents inside the body and measures the magnetic fields of the induced currents. A magnetically coupled differential coil system is scanned on the conductive object by a computer controlled scanning system. A data acquisition system is constructed using a PC controlled lock-in amplifier. 1.64V secondary voltage difference can be measured for 0.6 S/m solution. The average data acquisition time is 4.67 sec/mm2. 8 mm diameter objects with conductivity 0.2 S/m can be detected with this system.

DTIC

Tissues (Biology); Electrical Resistivity; Imaging Techniques

20030034736 European Office of Aerospace Research and Development, FPO New York, NY

The O.C.A. Schmidt Telescope CCD Camera Controller

Maury, Alain; Mar. 1995; 226 pp.; In English

Contract(s)/Grant(s): F61708-93-W0076

Report No.(s): AD-A410694; EOARD-SPC-93-4007; No Copyright; Avail: CASI; A11, Hardcopy

This document describes a new COD camera controller adapted to Schmidt telescopes. If several large COD detectors can be adapted in the focal plane of a large Schmidt telescope, deeper digital images can be obtained, the operating cost of a COD camera is several orders of magnitudes smaller than that of glass photographic plates. This also opens new ways of using Schmidt telescopes; i.e., real time detection of celestial sources. This report contains the following sections: Requirements analysis Description of the Loral CCD442A CCD Description of the camera controller Physical implementation of a mono CCD camera Physical implementation of a multi CCD camera Appendix 1: Electronic schematics of the O. C.A. CCD camera controller Appendix 2: Data sheets of the main components of the O.C.A. controller Appendix 3: 87C750 based sequencer software

DTIC

Schmidt Telescopes; Digital Systems

20030034740 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA

NTD-GE Based Microcalorimeter Performance

Bandler, Simon; Silver, Eric; Schnopper, Herbert; Murray, Stephen; Barbera, Marco; Madden, Norm; Landis, Don; Beeman, Jeff; Haller, Eugene; Tucker, Greg; Nuclear Instruments and Methods in Physics Research A; [2000]; Volume 444; 4 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-5269; Copyright; Avail: CASI; A01, Hardcopy

Our group has been developing x-ray microcalorimeters consisting of neutron transmutation doped (NTD) germanium thermistors attached to superconducting tin absorbers. We discuss the performance of single pixel x-ray detectors, and describe an array technology. In this paper we describe the read-out circuit that allows us to measure fast signals in our detectors as this will be important in understanding the primary cause of resolution broadening. We describe briefly a multiplexing scheme that allows a number of different calorimeters to be read out using a single JFET. We list the possible causes of broadening and give a description of the experiment which best demonstrates the cause of the primary broadening source. We mention our strategy for finding a suitable solution to this problem and describe briefly a technology for building arrays of these calorimeters.
Derived from text
Doped Crystals; Calorimeters; X Ray Detectors; Electromagnetic Interference; Heat Measurement; Performance Tests; Structural Design; Linear Arrays

20030037010 Lawrence Livermore National Lab., Livermore, CA
Design and Field Test of a Galvanometer Deflected Streak Camera
Lai, C. C.; Goosman, D. R.; Wade, J. T.; Avara, R.; Nov. 08, 2002; 12 pp.; In English
Report No.(s): DE2002-15002271; UCRL-JC-147892; No Copyright; Avail: Department of Energy Information Bridge
We have developed a compact fieldable optically-deflected streak camera first reported in the 20th HSPP Congress. Using a triggerable galvanometer that scans the optical signal, the imaging and streaking function is an all-optical process without incurring any photon-electron-photon conversion or photoelectronic deflection. As such, the achievable imaging quality is limited mainly only by optical design, rather than by multiple conversions of signal carrier and high voltage electron-optics effect. All core elements of the camera are packaged into a 12x24 footprint box, a size similar to that of a conventional electronic streak camera. At LLNL's (Lawrence Livermore National Laboratory) Site-300 Test Site, we have conducted a Fabry-Perot interferometer measurement of fast object velocity using this all-optical camera side-by-side with an intensified electronic streak camera. These two cameras are configured as two independent instruments for recording synchronously each branch of the 50/50 splits from one incoming signal.
NTIS
Galvanometers; Streak Cameras; Cameras

20030037017 Lawrence Livermore National Lab., Livermore, CA, Paragon Optics Inc. San Ramon, Calif, Spiller X-ray Optics, Livermore, Calif
Design and Evaluation of System Configurations for an EUV Mask Inspection Microscope. Report 3 for AIM Design Study
Barty, A.; Taylor, J. S.; Hudyma, R.; Spiller, E.; Aug. 20, 2002; In English
Report No.(s): DE2002-15002104; No Copyright; Avail: National Technical Information Service (NTIS)
In this mode the microscope is designed to emulate the illumination and imaging characteristics of a stepper to enable rapid evaluation of mask defects without the need for a resist exposure step. The main uses of the microscope in this mode would be: review of multilayer and pattern defects to determine their printability; defect review following a repair process to assess the success of the operation; investigation of the effects of illumination and NA on the printed image; process window analysis of defects and other mask features, and characterizing defects on both patterned and unpatterned masks (i.e. blanks). An essential characteristic of operation in this mode is that the illumination and imaging conditions should emulate that of a production stepper system.
NTIS
Extreme Ultraviolet Radiation; Microscopes; Design

20030038808 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands
Application of Matrix-Assisted Laser Desorption/ionization to On-line Aerosol Time-of-Flight Mass Spectrometry
Kientz, Ch. E.; December 2002; 20 pp.; In English; In Dutch
Contract(s)/Grant(s): A98/D/420; TNO Proj. 014.12830; Proj. V013
Report No.(s): PML-2002-A81; TD-2002-0155; Copyright; Avail: Other Sources
Matrix-assisted laser desorption/ionization (MALDI) mass spectra were obtained from a single biological aerosol particles using an aerosol time-of-flight mass spectrometer (ATOFMS). The inlet to the ATOFMS was coupled with an evaporation/condensation flow cell that allowed the aerosol to be coated with matrix material as the sampled stream entered the spectrometer. Mass spectra were generated from aerosol composed either of gramicidin S or erythromycin, two small

biological molecules, or from aerosolized spores of Bacillus subtilis var niger. Three different matrices were used: 3-nitrobenzylalcohol, picolinic acid and sinapinic acid. A spectrum of gramicidin S was generated from approximately 250 attomoles of material using a molar ration of 3-nitrobenzylalcohol to analyte of approximately 20:1. A single peak, located at 1224 Da, was obtained from the bacterial spores. The washing liquid and extract solution from the spores were analyzed using electrospray mass spectrometry and subsequent MS/MS product ion experiments. This independent analysis suggests that the measured species represent part of the B. subtilis peptidoglycan. The on-line addition of matrix allows quasi-real-time chemical analysis of individual, aerodynamically sized particles, with an overall system residence time of less than 5 seconds. These results suggest that MALDI ATOFMS can provide nearly teal time identification of biological aerosols.
Author
Aerosols; Desorption; Ionization; Lasers; Time Of Flight Spectrometers; Mass Spectrometers

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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*.

20030033829 Vavilov State Optical Inst., Saint Petersburg, USSR
Study Of Pre-Shaped Membrane Mirrors And Electrostatic Mirrors With Nonlinear-Optical Correction
Dimakov, Serguei A.; Emel'yanov, V. K.; Jan. 2002; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410726; No Copyright; Avail: CASI; A04, Hardcopy

This report results from a contract tasking Research Institute for Laser Physics as follows: The aim of this work is to improve low- weight membrane mirror characteristics intended for relaying laser communication beams in space. Such systems would use a non-linear-optical corrector to correct surface figure and other optical aberrations. The analytical part of this project is aimed at estimating the feasibility of designing the mirrors based on the pre-shaped membranes. This evaluation will give a clear understanding of the approaches to forming super-light mirrors as well as of the problems anticipated in creating this new generation of space mirrors. In the course of the experimental work, a low- weight mirror model based on the pre-shaped membrane will be fabricated, and its optical characteristics will be studied. It is expected that the characteristics predicted theoretically will be observed experimentally.
DTIC
Electrostatics; Laser Beams; Optical Communication

20030033839 Lawrence Livermore National Lab., Livermore, CA
Mechanisms of CO(2) Laser Mitigation of Laser Damage Growth in Fused Silica
Feit, M. D.; Rubenchik, A. M.; Sep. 05, 2002; 20 pp.
Report No.(s): DE2002-15002019; No Copyright; Avail: Department of Energy Information Bridge

Theoretical models for heating, evaporation, material flow, and stress and strain generation accompanying CO2 laser damage mitigation and surface treatment of fused silica are developed to aid understanding of scaling with process parameters. We find that lateral nonlinear heat transport is an important cooling mechanism, more significant than evaporative cooling. Scaling laws relating experiments with different set of parameters are presented. Transverse conduction, together with the increased thermal conductivity at high temperatures, allows a gentle evaporation regime at low laser intensity in which the rate can be controlled via laser fluence. For higher laser intensity, recoil momentum imparted by rapid evaporation generates pressure, which can lead to transverse flow of the melted material. Only a very thin layer can flow because viscosity increases rapidly with depth. Evaporation and flow are subject to instabilities that can impact surface quality, especially surface flatness, if large areas are processed. Also material flow can heal cracks and improve material quality. Analysis of stress indicates that maximal tensile stresses of order 0.1 GPa, comparable to the tensile strength, can be generated.
NTIS
Carbon Dioxide Lasers; Silica Glass; Optical Materials; Laser Damage; Cooling

20030033928 Kocaeli Univ., Sariyer, Turkey
Amorphous Silicon Photonic Microcavities
Serpenguzel, Ali; August 03, 2002; 66 pp.; In English
Contract(s)/Grant(s): F61775-01-W-E062
Report No.(s): AD-A410657; No Copyright; Avail: CASI; A04, Hardcopy

This report results from a contract tasking Koc University as follows: The contractor will investigate the use of microcavities to control photoluminescence in amorphous silicon. This can lead to significant improvements in luminescent displays, optical sensors, and optoelectronic devices. Amorphous siliconis of special interest since the material is abundant and inexpensive.
DTIC
Amorphous Materials; Laser Cavities

20030033960 Lawrence Livermore National Lab., Livermore, CA
Final Report for High Precision Short-Pulse Laser Ablation System for Medical Applications
Kim, B. M.; Feit, M. D.; Rubenchik, A. M.; Marion, J. E.; Mar. 04, 2000; 14 pp.; In English
Report No.(s): DE2002-792650; No Copyright; Avail: Department of Energy Information Bridge

During the three year LDRD (Laboratory Directed Research and Development) funding period, we studied the ablation characteristics of biological tissues using ultrashort pulse lasers (USPL) with pulse widths varying from 100 femtoseconds to tens of picoseconds. During the first year, we performed extensive theoretical studies to develop an improved understanding of the USPL (ultra short pulsed laser) ablation process. Two optical signals were tested for feasibility of use in real-time feedback systems during high repetition rate ablation. In the second year, we devised a real-time, feedback-controlled USPL ablation system, based on luminescence, which may be useful for sensitive micro-spinal surgeries. Effective laser parameters were identified to reduce collateral damage. The final year of the project focused on quantification of the pressure pulse induced by USPL ablation of water surfaces representing biological tissues. Results of these studies were presented in invited talks at domestic and international conferences and numerous journal articles were published.
NTIS
Medical Equipment; Laser Ablation; Ultrashort Pulsed Lasers; Tissues (Biology)

20030034631 Air Force Research Lab., Edwards AFB, CA
The Accuracy of Remapping Irregularly Spaced Velocity Data onto a Regular Grid and the Computation of Vorticity
Cohn, Richard K.; Koochesfahani, Manoochehr M.; November 30, 1999; 9 pp.; In English
Contract(s)/Grant(s): AF Proj. 3058
Report No.(s): AD-A410269; AFRL-PR-ED-TP-1999-0218; No Copyright; Avail: CASI; A02, Hardcopy

The velocity data obtained from Molecular Tagging Velocimetry (MTV) are typically located on an irregularly spaced measurement grid. To take advantage of many standard data processing techniques, the MTV data need to be remapped onto a grid with a uniform spacing. In this work, accuracy and noise issues related to the use of a least-squares-fit to various low-order polynomials for the remapping of these data onto a uniformly spaced grid and the subsequent computation of vorticity from these data are examined. This information has relevance to PIV data processing as well. As noted by Spedding and Rignot (1993), the best estimate of the velocity vector acquired through the use of tracer techniques such as PIV is at the midpoint of the displacement vector. Thus, unless special care is taken, PlV data also are initially obtained on an irregular grid. As in the results of Fouras and Soria (l998), the error in the remapped velocity and the calculated vorticity field is divided into a mean bias error and a random error. In the majority of cases, the mean bias error is a more significant source of error than the more often quoted random error. Results of the simulation show that the best choice for remapping is the use of a least-squares fit to a 2nd order polynomial and the best choice for vorticity calculation is to use a 4th order accurate, central, finite difference applied to uniformly sampled data. The actual value of the error depends upon the data density and the radius used for the selection of velocity measurements to be included in the remapping process. Increasing the data density and reducing the fit radius improve the accuracy.
DTIC
Particle Image Velocimetry; Velocity Measurement; Vorticity; Mathematical Models; Accuracy; Fluid Mechanics; Computational Grids

20030034635 Air Force Research Lab., Edwards AFB, CA
Vorticity Field Evolution in a Forced Wake
Cohn, Richard; Koochesfahani, Manoochehr; March 15, 1999; 5 pp.; In English
Contract(s)/Grant(s): AF Proj. 3058
Report No.(s): AD-A410275; AFRL-PR-ED-TP-FY99-0059; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of this work is to quantify the vorticity evolution in the flow field of the forced wake of a splitter plate inside a confining geometry. The interest in this flow stems from the fact that forcing a low Reynolds number 2-D wake can lead

to a highly three-dimensional flow and a large increase in mixing. The authors' recent estimates, based on chemically reacting laser induced fluorescence (LIF) measurements, report the amount of molecularly mixed fluid in terms of mixed-fluid fraction to be 2.5 to 3 times larger than that in high Reynolds number natural two-stream mixing layers. Both reacting and non-reacting LIF data connect this increase in mixing to the downstream evolution of the streamwise vorticity, which is generated by the reorientation and stretching of spanwise vorticity near the side walls of the flow facility. It is believed that understanding the vorticity interaction with walls, its dynamics, and downstream evolution will be helpful to an overall strategy for mixing enhancement and control. The measurements were carried out by Molecular Tagging Velocimetry (MTV), a technique that takes advantage of molecules with long-lived excited states for nonintrusive, multi-point measurements of various fluid dynamical quantities. Small regions of the flow were tagged by a laser and their subsequent evolution was monitored over the luminescence lifetime of the molecule. A two-detector imaging system was used to acquire an image of the initially tagged regions and a subsequent image of these regions convected by the flow over a prescribed time delay. The Lagrangian displacement vectors from such image pairs were computed using a spatial correlation technique. The particular flow investigated here was highly three dimensional. This application highlights the capability of MTV to make measurements when strong out-of-plane motions are present.
DTIC
Flow Distribution; Three Dimensional Flow; Velocity Measurement; Vorticity; Wakes

20030034713 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Stuttgart, Germany
Surface Evaluation of Laser-Irradiated Coated/Uncoated MIR Optronic Components
Riede, Wolfgang; Dec. 2000; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F61775-99-W-E074
Report No.(s): AD-A410688; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking the contractor to investigate the sensitivity of the scatter probe and photothermal deflection techniques for detecting the onset of laser-induced damage, and the applicability of these techniques for online, precursor laser-induced damage detection in mid-IR optical components irradiated with out-of-band radiation.
DTIC
Coatings; Infrared Radiation; Optical Equipment; Irradiation

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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*.

20030032438 NASA Marshall Space Flight Center, Huntsville, AL, USA
Hybrid Residual Flexibility/Mass-Additive Method for Structural Dynamic Testing
Tinker, M. L.; March 2003; 9 pp.; In English; Original document cut on left side some pages contain black border. Black and white illustrations
Report No.(s): NASA/TM-2003-212343; NAS 1.15:212343; M-1071; No Copyright; Avail: CASI; A02, Hardcopy

A large fixture was designed and constructed for modal vibration testing of International Space Station elements. This fixed-base test fixture, which weighs thousands of pounds and is anchored to a massive concrete floor, initially utilized spherical bearings and pendulum mechanisms to simulate Shuttle orbiter boundary constraints for launch of the hardware. Many difficulties were encountered during a checkout test of the common module prototype structure, mainly due to undesirable friction and excessive clearances in the test-article-to-fixture interface bearings. Measured mode shapes and frequencies were not representative of orbiter-constrained modes due to the friction and clearance effects in the bearings. As a result, a major redesign effort for the interface mechanisms was undertaken. The total cost of the fixture design, construction and checkout, and redesign was over $2 million. Because of the problems experienced with fixed-base testing, alternative free-suspension methods were studied, including the residual flexibility and mass-additive approaches. Free-suspension structural dynamics test methods utilize soft elastic bungee cords and overhead frame suspension systems that are less complex and much less expensive than fixed-base systems. The cost of free-suspension fixturing is on the order of tens of thousands of dollars as opposed to millions, for large fixed-base fixturing. In addition, free-suspension test configurations are portable, allowing modal tests to be done at sites without modal test facilities. For example, a mass-additive modal test of the ASTRO-1 Shuttle payload was done at the Kennedy Space Center launch site. In this Technical Memorandum, the mass-additive and

residual flexibility test methods are described in detail. A discussion of a hybrid approach that combines the best characteristics of each method follows and is the focus of the study.
Author
Test Equipment; Dynamic Tests; Dynamic Structural Analysis; Coupled Modes; Design

20030032481 NASA Glenn Research Center, Cleveland, OH, USA
Microstructure and Properties of Thermally Sprayed Functionally Graded Coatings for Polymeric Substrates
Ivosevic, M.; Knight, R.; Kalidindi, S. R.; Palmese, G. R.; Sutter, J. K.; March 2003; 12 pp.; In English; International Thermal Spray Conference and Exposition, 5-8 May 2003, Orlando, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-825; WBS 22-708-31-14
Report No.(s): NASA/TM-2003-212119; E-13771; NAS 1.15:212119; No Copyright; Avail: CASI; A03, Hardcopy

The use of polymer matrix composites (PMCs) in the gas flow path of advanced turbine engines offers significant benefits for aircraft engine performance but their useful lifetime is limited by their poor erosion resistance. High velocity oxy-fuel (HVOF) sprayed polymer/cermet functionally graded (FGM) coatings are being investigated as a method to address this technology gap by providing erosion and oxidation protection to polymer matrix composites. The FGM coating structures are based on a polyimide matrix filled with varying volume fractions of WC-Co. The graded coating architecture was produced using a combination of internal and external feedstock injection, via two computer-controlled powder feeders and controlled substrate preheating. Porosity, coating thickness and volume fraction of the WC-Co filler retained in the coatings were determined using standard metallographic techniques and computer image analysis. The pull-off strength (often referred to as the adhesive strength) of the coatings was evaluated according to the ASTM D 4541 standard test method, which measured the greatest normal tensile force that the coating could withstand. Adhesive/cohesive strengths were determined for three different types of coating structures and compared based on the maximum indicated load and the surface area loaded. The nature and locus of the fractures were characterized according to the percent of adhesive and/or cohesive failure, and the tested interfaces and layers involved were analyzed by Scanning Electron Microscopy.
Author
Microstructure; Functionally Gradient Materials; Sprayed Coatings; Polymer Matrix Composites; Polyimides; Hvof Thermal Spraying; Cermets

20030032931 NASA Marshall Space Flight Center, Huntsville, AL, USA
Statistical Evaluation and Improvement of Methods for Combining Random and Harmonic Loads
Brown, A. M.; McGhee, D. S.; February 2003; 33 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/TP-2003-212257; NAS 1.60:212257; M-1062; No Copyright; Avail: CASI; A03, Hardcopy

Structures in many environments experience both random and harmonic excitation. A variety of closed-form techniques has been used in the aerospace industry to combine the loads resulting from the two sources. The resulting combined loads are then used to design for both yield/ultimate strength and high-cycle fatigue capability. This Technical Publication examines the cumulative distribution percentiles obtained using each method by integrating the joint probability density function of the sine and random components. A new Microsoft Excel spreadsheet macro that links with the software program Mathematica to calculate the combined value corresponding to any desired percentile is then presented along with a curve fit to this value. Another Excel macro that calculates the combination using Monte Carlo simulation is shown. Unlike the traditional techniques, these methods quantify the calculated load value with a consistent percentile. Using either of the presented methods can be extremely valuable in probabilistic design, which requires a statistical characterization of the loading. Additionally, since the CDF at high probability levels is very flat, the design value is extremely sensitive to the predetermined percentile; therefore, applying the new techniques can substantially lower the design loading without losing any of the identified structural reliability.
Author
Statistical Analysis; Design Optimization; Random Loads; Harmonic Excitation; Yield Strength

20030032936 NASA Goddard Space Flight Center, Greenbelt, MD, USA
CdZnTe Background Measurements at Balloon Altitudes with PoRTIA
Parsons, A.; Barthelmy, S.; Bartlett, L.; Gehrels, N.; Naya, J.; Stahle, C. M.; Tueller, J.; Teegarden, B.; [2003]; 15 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Measurements of the CdZnTe internal background at balloon altitudes are essential to determine which physical processes make the most important background contributions. We present results from CdZnTe background measurements made by

PoRTIA, a small CdZnTe balloon instrument that was flown three times in three different shielding configurations. PoRTIA was passively shielded during its first flight from Palestine, Texas and actively shielded as a piggyback instrument on the GRIS balloon experiment during its second and third flights from Alice Springs, Australia, using the thick GRIS Nal anticoincidence shield. A significant CdZnTe background reduction was achieved during the third flight with PoRTIA placed completely inside the GRIS shield and blocking crystal, and thus completely surrounded by 15 cm of Nal. A unique balloon altitude background data set is provided by CdZnTe and Ge detectors simultaneously surrounded by the same thick anticoincidence shield; the presence of a single coxial Ge detector inside the shield next to PoRTIA allowed a measurement of the ambient neutron flux inside the shield throughout the flight. These neutrons interact with the detector material to produce isomeric states of the Cd, Zn and Te nuclei that radiatively decay; calculations are presented that indicate that these decays may explain most of the fully shielded CdZnTe background.
Author
Balloon-Borne Instruments; Gamma Rays; X Rays; Anticoincidence Detectors; Electromagnetic Shielding; Sensitivity Analysis; Measuring Instruments

20030034606 NASA Glenn Research Center, Cleveland, OH, USA
Effects on Diagnostic Parameters After Removing Additional Synchronous Gear Meshes
Decker, Harry J.; April 2003; 14 pp.; In English; 57th Meeting of the Society for Machinery Failure Prevention Technology (MFPT), 14-18 Apr. 2003, Virginia Beach, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS-22-708-87-12; DA Proj. 1L1-61102-AF-20
Report No.(s): NASA/TM-2003-212312; NAS 1.15:212312; E-13899; ARL-TR-2933; No Copyright; Avail: CASI; A03, Hardcopy

Gear cracks are typically difficult to diagnose with sufficient time before catastrophic damage occurs. Significant damage must be present before algorithms appear to be able to detect the damage. Frequently there are multiple gear meshes on a single shaft. Since they are all synchronous with the shaft frequency, the commonly used synchronous averaging technique is ineffective in removing other gear mesh effects. Carefully applying a filter to these extraneous gear mesh frequencies can reduce the overall vibration signal and increase the accuracy of commonly used vibration metrics. The vibration signals from three seeded fault tests were analyzed using this filtering procedure. Both the filtered and unfiltered vibration signals were then analyzed using commonly used fault detection metrics and compared. The tests were conducted on aerospace quality spur gears in a test rig. The tests were conducted at speeds ranging from 2500 to 5000 revolutions per minute and torques from 184 to 228 percent of design load. The inability to detect these cracks with high confidence results from the high loading which is causing fast fracture as opposed to stable crack growth. The results indicate that these techniques do not currently produce an indication of damage that significantly exceeds experimental scatter.
Author
Systems Health Monitoring; Gear Teeth; Fracture Mechanics; Synchronous Motors; Crack Propagation; Grid Generation (Mathematics)

20030036936 National Inst. of Standards and Technology (CSTL), Gaithersburg, MD
Wear Mechanisms of Valves and Valve Seat Inserts in a Gas-Fired Reciprocating Engine
Lacey, P. I.; Hsu, S. M.; Gates, R. S.; Lee, S.; Ives, L.; Jun. 1990; 80 pp.; In English
Report No.(s): PB2003-101410; NISTIR-90-4264; No Copyright; Avail: CASI; A05, Hardcopy

The objective of the report is to quantitatively measure wear and to identify the dominant wear mechanisms experienced by selected valve and valve seat insert combinations during operation in a natural gas-fueled reciprocating engine.
NTIS
Valves; Wear Tests; Piston Engines

20030037026 National Renewable Energy Lab., Golden, CO
Durability of Solar Reflective Materials with an Alumina Hard Coat Produced by Ion-Bean-Assisted Deposition
Kennedy, C. E.; Smilgys, R. V.; Oct. 2002; In English
Report No.(s): DE2002-15002207; No Copyright; Avail: National Technical Information Service (NTIS)

A promising low-cost reflector material for solar concentrating power (CSP) generation is a silvered substrate protected by an alumina coating several microns thick. The alumina hard coat is deposited under high vacuum by ion-beam-assisted-deposition (IBAD). Samples of this material have been produced both by batch and continuous roll-coating processes. The substrate materials investigated were polyethylene terephthalate (PET), PET laminated to stainless-steel foil, and chrome-

plated carbon steel strip. The advantage of steel strip compared to PET is that it withstands a higher process temperature and lowers the final product installation costs. In this paper, we compare the durability of batch and roll-coated reflective materials with an alumina deposition rate as high as 10 nm/s. In general, the durability of the samples is found to be excellent. Comparisons between accelerated and outdoor exposure testing results indicate that these front-surface mirrors are more susceptible to weather conditions not simulated by accelerated tests (i.e., rain, sleet, snow, etc.) than other types of solar reflectors. For long-term durability edge protection will be necessary and durability could be improved by the addition of an adhesion-promoting layer between the silver and alumina.
NTIS
Solar Reflectors; Coatings; Aluminum Oxides; Ion Beams

20030038814 NASA Glenn Research Center, Cleveland, OH, USA
Permanent Magnetic Bearing for Spacecraft Applications
Morales, Wilfredo; Fusaro, Robert; Kascak, Albert; March 2003; 16 pp.; In English; 2003 Annual Meeting and Exhibition, 28 Apr. - 1 May 2003, New York City, NY, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-708-90-01
Report No.(s): NASA/TM-2003-211996; E-13668; NAS 1.15:211996; No Copyright; Avail: CASI; A03, Hardcopy

A permanent, totally passive magnetic bearing rig was designed, constructed, and tested. The suspension of the rotor was provided by two sets of radial permanent magnetic bearings operating in the repulsive mode. The axial support was provided by jewel bearings on both ends of the rotor. The rig was successfully operated to speeds of 5500 rpm using an air impeller. Radial and axial stiffnesses of the permanent magnetic bearings were experimentally measured and then compared to finite element results. The natural damping of the rotor was measured and a damping coefficient was calculated.
Author
Magnetic Bearings; Stiffness; Damping; Spin Tests

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20030032262 NASA Glenn Research Center, Cleveland, OH, USA
Reliability Analysis of Brittle Material Structures - Including MEMS(?) - With the CARES/Life Program
Nemeth, Noel N.; [2002]; 70 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): RTOP 708-87-13; No Copyright; Avail: CASI; A04, Hardcopy

Brittle materials are being used, or considered, for a wide variety of high tech applications that operate in harsh environments, including static and rotating turbine parts. thermal protection systems, dental prosthetics, fuel cells, oxygen transport membranes, radomes, and MEMS. Designing components to sustain repeated load without fracturing while using the minimum amount of material requires the use of a probabilistic design methodology. The CARES/Life code provides a general-purpose analysis tool that predicts the probability of failure of a ceramic component as a function of its time in service. For this presentation an interview of the CARES/Life program will be provided. Emphasis will be placed on describing the latest enhancements to the code for reliability analysis with time varying loads and temperatures (fully transient reliability analysis). Also, early efforts in investigating the validity of using Weibull statistics, the basis of the CARES/Life program, to characterize the strength of MEMS structures will be described as as well as the version of CARES/Life for MEMS (CARES/MEMS) being prepared which incorporates single crystal and edge flaw reliability analysis capability. It is hoped this talk will open a dialog for potential collaboration in the area of MEMS testing and life prediction.
Author
Brittle Materials; Reliability Analysis; Microelectromechanical Systems; Weibull Density Functions; Structural Analysis

20030032270 Army Research Lab., Hampton, VA, USA, NASA Langley Research Center, Hampton, VA, USA
Simulation of Fatigue Crack Initiation at Corrosion Pits With EDM Notches
Smith, Stephen W.; Newman, John A.; Piascik, Robert S.; March 2003; 20 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): RTOP 762-60-61-09
Report No.(s): NASA/TM-2003-212166; NAS 1.15:212166; L-18262; AFL-TR-2927; No Copyright; Avail: CASI; A03, Hardcopy

Uniaxial fatigue tests were conducted to compare the fatigue life of laboratory produced corrosion pits, similar to those observed in the shuttle main landing gear wheel bolt-hole, and an electro-discharged-machined (EDM) flaw. EDM Jaws are used to simulate corrosion pits during shuttle wheel (dynamometer) testing. The aluminum alloy, (AA 7050) laboratory fatigue tests were conducted to simulate the local stress level contained in the wheel bolt-hole. Under this high local stress condition, the EDM notch produced a fatigue life similar to test specimens containing corrosion pits of similar size. Based on the laboratory fatigue test results, the EDM Jaw (semi-circular disc shaped) produces a local stress state similar to corrosion pits and can be used to simulate a corrosion pit during the shuttle wheel dynamometer tests.
Author
Fatigue Tests; Simulation; Crack Initiation; Corrosion; Stress Corrosion; Aluminum Alloys

20030033863 NASA Glenn Research Center, Cleveland, OH, USA
Gear Damage Detection Using Oil Debris Analysis
Dempsy, Paula J.; The Journal of Gear Manufacturing; January-February 2003, pp. 12-17; In English; Original contains black and white illustrations
Contract(s)/Grant(s): RTOP 704-30-06; RTOP 712-30-13; Copyright; Avail: Other Sources

The purpose of this paper was to verify, when using an oil debris sensor, that accumulated mass predicts gear pitting damage and to identify method to set threshold limits for damaged gears. Oil debris data was collected from eight experiments with no damage and eight with pitting damage in the NASA Glenn Research Center's spur gear fatigue rig. Oil debris feature analysis was performed on this data. Video images of damage progression were also collected from six of the experiments with pitting damage. During each test, data from an oil debris sensor was monitored and recorded for the occurrence of pitting damage. The data measured from the oil debris sensor during experiments with no damage was used to identify membership functions, which are required to build a simple fuzzy-logic model. Using fuzzy-logic techniques and the oil debris data, threshold limits were defined that discriminate between stages of pitting wear. Results indicate that accumulated mass combined with fuzzy-logic analysis techniques is a good predictor of pitting damage on spur gears.
Author
Gears; Damage; Detection; Oils; Debris; Pitting

20030036938 National Inst. of Standards and Technology, Gaithersburg, MD
Tolerance Synthesis Scheme
Roy, U.; Pramanik, N.; Wang, H.; Sudarsan, R.; Sriram, R. D.; Jan. 2003; 70 pp.
Report No.(s): PB2003-102249; NISTIR-6836; No Copyright; Avail: CASI; A04, Hardcopy

The objective of this report is to identify representations and issues for the generic assembly information model and its use in a proactive tolerance synthesis scheme. It is proposed to use the small displacement torsors (the screw parameters) as a mathematical tool for analyzing the causal relationship between variations in parts' shapes and sizes (due to the small allowances permitted by tolerance specifications), and their effects on relative positioning on adjacent parts. For a given assembly, the allowable geometric variations of assembled parts, the assembly specification and the desired functional requirements have been characterized by finite sets of equality and inequality constraints. An optimized process is then formulated to study the tolerance synthesis and analysis problems in the assembly.
NTIS
Functional Design Specifications; Assembling; Displacement

20030036942 National Inst. of Standards and Technology (TS), Gaithersburg, MD
Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as Adopted by the 87th National Conference on Weights and Measures 2002. 2003 Edition
Grimes, T. L.; Suiter, R.; Williams, J.; Dec. 2002; 334 pp.; In English
Report No.(s): PB2003-102253; NIST/HB-44/2003; No Copyright; Avail: CASI; A15, Hardcopy

Handbook 44 was first published in 1949, having been preceded by similar handbooks of various designations and in several forms, beginning in 1918. Handbook 44 is published in its entirety each year following the Annual Meeting of the National Conference on Weights and Measures (NCWM). The Committee on Specifications and Tolerances of the NCWM developed the 2003 Edition with the assistance of the Weights and Measures Division (WMD) of the National Institute of Standards and Technology (NIST). This handbook includes amendments endorsed by the 87th National Conference on Weights and Measures during its Annual Meeting in 2002.
NTIS
Measuring Instruments; Handbooks; Weight Measurement

20030037106 National Inst. of Standards and Technology (TS), Gaithersburg, MD

Index to the Reports of the National Conference on Weights and Measures from the First to the Eighty-Fifth (1905 to 2000)

Koenig, J.; Newrock, G.; Grimes, T.; Jan. 2001; 88 pp.; In English

Report No.(s): PB2001-102392; NIST/SP-964; No Copyright; Avail: CASI; A05, Hardcopy

Since the inception of the National Conference on Weights and Measures (NCWM) in 1905, a great deal of information on a wide variety of weights and measures subjects has been published in the Reports of the Annual Meetings of the NCWM. This publication is designed to assist those who use the NCWM Reports in finding information on specific subjects or Conference presentations. It contains a subject index and a speaker index covering the proceedings of the Annual Meetings from the First in 1905 through the Eighty-Fifth in 2000. This publication supersedes NBS Special Publication 769, which was an index of the Proceedings from the First through the Seventy-Third. The information from the First through the Fifty-Sixth was compiled by Frances Bell; from the Fifty-Seventh through the Sixty-Ninth by William G. Mott; from the Seventieth through the Seventy-Third by Nancy H. Chaconas; and from the Seventy-Fourth through the Eighty-Fifth by Gail Newrock (Subject Index) and Joan Koenig (Speaker Index).

NTIS

Conferences; Indexes (Documentation); Weight Measurement; Metrology

20030037167 Lawrence Livermore National Lab., Livermore, CA

Measurement of the Variations in Thickness and Refractive Index of NIF Crystals

Sommargren, G. E.; Phillion, D. W.; Johnson, M. A.; Bradsher, L. S.; Jan. 29, 2002; In English

Report No.(s): DE2002-15002093; UCRL-ID-147764; No Copyright; Avail: National Technical Information Service (NTIS)

This report discusses one method of characterizing the variations in the physical thickness and refractive index of NIF doubler, tripler and switch crystals that are relatively thin (10mm thick). These particular measurements are difficult to perform with standard laser interferometers when the front and back substrate surfaces are near-parallel. A complicated interference pattern is formed from the interference of more than two beams due to the temporal coherence of the laser source. There are a number of methods that can be used to minimize this problem. They are referenced in a paper by Peter de Groot. In this report we discuss a method that eliminates the problem completely and show the results of measurements of two crystals.

NTIS

Refractivity; Crystals

20030037170 Lawrence Livermore National Lab., Livermore, CA

Recent Results in the Development of Fast Neutron Imaging Techniques

Hall, J.; Dietrich, F.; Logan, C.; Rusnak, B.; Sep. 11, 2000; In English

Report No.(s): DE2002-15002096; UCRL-MI-140345; No Copyright; Avail: National Technical Information Service (NTIS)

We are continuing with the development of fast neutron imaging techniques for use in NDE applications. Our goal is to develop a neutron imaging system capable of detecting sub-mm-scale cracks, cubic-mm-scale voids and other structural defects in heavily-shielded low-Z materials within thick sealed objects. The final system will be relatively compact (suitable for use in a small laboratory) and capable of acquiring both radiographic and full tomographic image sets. The design of a prototype imaging detector will be reviewed and results from several recent imaging experiments will be presented. The concurrent development of an intense, accelerator-driven neutron source suitable for use with the final production imaging system will also be discussed.

NTIS

Fast Neutrons; Neutron Radiography

20030038807 Lawrence Livermore National Lab., Livermore, CA

Handbook for the Manybeam Velocimeter

Strand, T.; Feb. 06, 2002; 132 pp.

Report No.(s): DE2002-15002225; UCRL-ID-147167; No Copyright; Avail: Department of Energy Information Bridge

Partial Contents: Lasers (Laser room, Class IV pulsed laser, Imbedded CW laser); Fibers (Types and specifications, Transmission, Jackets); Probes (General information, Centering cylinder, Nested lens, Surface preparation); Analyzer table (Geometry, Simplified optics, Fiber chuck types, Fiber chuck angle polish, Shaper, Etalons); Streak cameras (General information, Foreoptics, Tube Geometry, Sweep Settings, Film Layout, Suggestions for coverage); Film/filters (Polaroid, Hard film, Neutral density filters, Bandpass filters); Data analysis (Velocity, Timing); Basic optics (with examples on the analyzer

table) (Index of refraction, Snell's law, Lens equation for thin lenses, Magnification, Divergence, Depth of focus, Reflectance at normal incidence); Useful information (Geometry formulas, Trig identities); Useful formulas; Outline.
NTIS
Velocity Measurement; Laser Doppler Velocimeters; Laser Applications; Handbooks

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*.

20030032264 NASA Glenn Research Center, Cleveland, OH, USA
Surface Cracking and Interface Reaction Associated Delamination Failure of Thermal and Environmental Barrier Coatings
Zhu, Dongming; Choi, Sung R.; Eldridge, Jeffrey I.; Lee, Kang N.; Miller, Robert A.; January 2003; 7 pp.; In English; 27th Annual International Conference on Advanced Ceramics and Composite, 26-31 Jan. 2003, Cocoa Beach, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 22-714-04-05; No Copyright; Avail: CASI; A02, Hardcopy

In this paper, surface cracking and interface reactions of a BSAS coating and a multi-layer ZTO2-8wt%Y2O3 and mullite/BSAS/Si thermal and environmental barrier coating system on SiC/SiC ceramic matrix composites were characterized after long-term combined laser thermal gradient and furnace cyclic tests in a water vapor containing environment. The surface cracking was analyzed based on the coating thermal gradient sintering behavior and thermal expansion mismatch stress characteristics under the thermal cyclic conditions. The interface reactions, which were largely enhanced by the coating surface cracking in the water vapor environment, were investigated in detail, and the reaction phases were identified for the coating system after the long- term exposure. The accelerated coating delamination failure was attributed to the increased delamination driving force under the thermal gradient cyclic loading and the reduced interface adhesion due to the detrimental interface reactions.
Author
Surface Cracks; Delaminating; Thermal Control Coatings; Ceramic Matrix Composites; Silicon Carbides; Crack Propagation; Mullites

20030032378 Air Force Research Lab., Edwards AFB, CA, USA
Estimating the Initial Crack Size in a Particulate Composite Material: An Analytical and Experimental Approach
Liu, C. T.; October 11, 2001; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410164; AFRL-PR-ED-VG-2001-200; No Copyright; Avail: CASI; A03, Hardcopy

The objectives in this report are to: determine the inherent critical initial crack size in a particulate composite material, determine the statistical distribution function of the inherent critical crack size, normal distribution, two parameter lognormal distribution, two parameter weibull distribution, and second asymptotic distribution of maximum value.
DTIC
Composite Materials; Cracks; Crack Propagation

20030033040 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
SIF Distributions in Cracked Photoelastic Rocket Motor Models: Preliminary Studies
Smith, C. W.; Constantinescu, D. M.; Liu, C. T.; March 08, 2001; 6 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410535; AFRL-PR-ED-AB-2001-047; No Copyright; Avail: CASI; A02, Hardcopy

It is generally believed that motor grain design criteria which or treats a part through crack in the fin of a rocket motor as an edge crack extending through the length of the motor is a conservative approach to the problem. Some estimates suggest a margin of safety of about 1.5 is achieved in doing so. In an attempt to improve cost effectiveness and efficiency, an experimental effort has been undertaken to obtain stress intensity factors (SIF) at critical locations around the border of part through cracks in motor grain fins to compare with the design criteria using photoelastic models and a method of analysis developed by the first author (Appendix A). The frozen stress photoelastic method is used and a new material employing amine

type hardeners is used which may produce surface effects in the initial casting but appears far superior to other materials in other respects. Two-dimensional experimental studies at AFRL-Edwards AFB suggest that cracks tend to initiate at the locus along the fin tip, where the main tip radius coalesces with a much smaller corner radius. However, some manufacturers report cracks initiating on the axis of symmetry of the fin, possibly due to defects collected there during the casting process.
DTIC
Fins; Cracks; Rocket Engines; Photoelasticity; Stress Intensity Factors

20030033122 Air Force Research Lab., Edwards AFB, CA, USA
Investigating the Constraint Effect in a Particulate Composite Material
Liu, C. T.; June 27, 2002; 19 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410613; AFRL-PR-ED-VG-2002-166; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this report was to investigate the constraint effect on the critical stress intensity factor, K(li) for the onset of crack growth in a particulate composite material.
DTIC
Crack Propagation; Particulate Reinforced Composites

20030033869 NASA Marshall Space Flight Center, Huntsville, AL, USA
Using Plate Finite Elements for Modeling Fillets in Design, Optimization, and Dynamic Analysis
Brown, A. M.; Seugling, R. M.; March 2003; 29 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/TP-2003-212340; NAS 1.60:212340; M-1068; Copyright; Avail: CASI; A03, Hardcopy

A methodology has been developed that allows the use of plate elements instead of numerically inefficient solid elements for modeling structures with 90 degree fillets. The technique uses plate bridges with pseudo Young's modulus (Eb) and thickness (tb) values placed between the tangent points of the fillets. These parameters are obtained by solving two nonlinear simultaneous equations in terms of the independent variables rlt and twallt. These equations are generated by equating the rotation at the tangent point of a bridge system with that of a fillet, where both rotations are derived using beam theory. Accurate surface fits of the solutions are also presented to provide the user with closed-form equations for the parameters. The methodology was verified on the subcomponent level and with a representative filleted structure, where the technique yielded a plate model exhibiting a level of accuracy better than or equal to a high-fidelity solid model and with a 90-percent reduction in the number of DOFs. The application of this method for parametric design studies, optimization, and dynamic analysis should prove extremely beneficial for the finite element practitioner. Although the method does not attempt to produce accurate stresses in the filleted region, it can also be used to obtain stresses elsewhere in the structure for preliminary analysis. A future avenue of study is to extend the theory developed here to other fillet geometries, including fillet angles other than 90 and multifaceted intersections.
Derived from text
Finite Element Method; Fillets; Mathematical Models; Methodology; Design Optimization; Plates (Structural Members); Dynamic Structural Analysis

20030033924 Ohio State Univ., Columbus, OH, USA
Study of High Strain Rate Response of Composites
Gilat, Amos; April 2003; 98 pp.; In English
Contract(s)/Grant(s): NAG3-2748; OSURF Proj. 742677; Proj. 869947
Report No.(s): Rept-30030104; No Copyright; Avail: CASI; A05, Hardcopy

The objective of the research was to continue the experimental study of the effect of strain rate on mechanical response (deformation and failure) of epoxy resins and carbon fibers/epoxy matrix composites, and to initiate a study of the effects of temperature by developing an elevated temperature test. The experimental data provide the information needed for NASA scientists for the development of a nonlinear, rate dependent deformation and strength models for composites that can subsequently be used in design. This year effort was directed into testing the epoxy resin. Three types of epoxy resins were tested in tension and shear at various strain rates that ranges from 5 x 10(exp -5), to 1000 per second. Pilot shear experiments were done at high strain rate and an elevated temperature of 80 C. The results show that all, the strain rate, the mode of loading, and temperature significantly affect the response of epoxy.
Derived from text
Strain Rate; Epoxy Matrix Composites; Epoxy Resins; Mechanical Properties; Torsional Stress; Deformation

20030034625 IMPERIUM INC SILVER SPRING MD

Composite Damage Detection Using a Novel Ultrasonic Method

Miller, T. C.; Lasser, Bob; VanderHeiden, Burt; January 27, 2003; 32 pp.; In English

Contract(s)/Grant(s): F04611-02-M-0042; AF Proj. 3005

Report No.(s): AD-A410224; AFRL-PR-ED-TP-2003-015; No Copyright; Avail: CASI; A03, Hardcopy

The nondestructive evaluation (NDE) of complex composite structures often requires labor intensive, expensive methods due to multiple failure modes, difficulty detecting damage, and the large scale of the structures. Conventional NDE methods have been successful but can be improved by incorporating ideas from other fields. In this work, the technology developed in the infrared camera industry is used and incorporated into an ultra-sound system to produce an inspection tool with a wide field of view that displays video images of damage in composite structures in real time. Benefits are higher sensitivity, increased inspection speed, and intuitive interpretation of results.

DTIC

Composite Structures; Damage; Failure Modes

20030034666 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Development of a Toolbox for Dynamic Analysis of Simplified Structures

Rhijnsburger, M. P. M.; vanDeursen, J. R.; vanDoormaal, J. C. A. M.; February 2003; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): TNO Proj. 014.13093; A01/D/429

Report No.(s): PML-2002-A96; TD-2002-0170; Copyright; Avail: Other Sources

Within the framework of the project Ontwerpmethodieken VDI', on behalf of the Dutch Ministry of Defence, a Toolbox is developed suitable for dynamic response calculations. The Toolbox is based on a single degree of freedom (SDOF) system and the empirical formulas of the TM 5-1300. The structure of the Toolbox is modular and a number of basic structures have been implemented. The Toolbox can be used in two ways, to perform a response calculation for a given structure under a given load or to calculate iso-damage contours (p-i-diagrams) for a given structure. The modular structure of the Toolbox makes it possible to expand the Toolbox.

Author

Dynamic Response; Dynamic Structural Analysis; Mechanical Properties; Concrete Structures; Modularity

20030034672 Air Force Research Lab., Edwards AFB, CA, USA

Crack Growth Rates in a Propellant Under Various Conditions

Miller, T. C.; March 16, 2001; 10 pp.; In English

Contract(s)/Grant(s): AF Proj. 2302

Report No.(s): AD-A410476; AFRL-PR-ED-TP-2001-061; No Copyright; Avail: CASI; A02, Hardcopy

Cracks may form in a solid rocket propellant during the manufacture, handling, storage, or use of the solid rocket motor. However, even after the formation of these cracks, the motor may still be usable, because the cracks may not grow under anticipated loads or may grow slowly enough to avoid catastrophic consequences before service life ends. This study attempts to answer two key questions about cracks in solid propellant: (1) at what point does a crack in propellant begin to grow, and (2) after growth begins, at what rate does this growth occur? Experimental studies at both ambient and pressurized conditions were conducted, and the results include crack growth data for different geometries at different pressures. Results show that specimen geometry and crack geometry did not significantly affect crack growth in the solid propellant. Biaxial test specimens gave similar results to single-edge notched tension (SENT) specimens, as did surface cracked specimens. This robustness did not change with the application of pressure. The effect of pressure, however, was significant, and caused a slowing of the crack growth for identical stress intensities. This slowing is due to the pressure affecting the hydrostatic component of stress near the crack tip, which in turn affects the microstructural phenomena of void nucleation, growth, and coalescence. The results show that experimenters can be less concerned with specimen geometry, but should be careful to use growth data with pressure conditions similar to those anticipated in service.

DTIC

Crack Propagation; Rates (Per Time); Crack Geometry; Specimen Geometry; Composite Materials; Growth; Cracking (Fracturing); Fractures (Materials); Predictions; Pressurizing

20030036924 Virginia Transportation Research Council, Charlottesville, VA

Testing of Selected Metallic Reinforcing Bars for Extending the Service Life of Concrete Bridges: Testing in Solutions

Scully, J. R.; Marks, C. A.; Hurley, M. F.; Jan. 2003; 62 pp.; In English

Report No.(s): PB2003-102216; VTRC-03-CR11; Copyright; Avail: National Technical Information Service (NTIS)

Stainless steel-clad rebar provides an opportunity to significantly increase the CT threshold concentration associated with active corrosion initiation compared to plain carbon steel. However, threshold CT concentrations for 316L stainless steel-clad rebar are unknown. Moreover, the impact of possible galvanic corrosion between the clad layer and any exposed carbon steel core has not been investigated.
NTIS
Thresholds; Chlorides; Stainless Steels; Reinforcing Materials; Concrete Structures; Bridges (Structures); Service Life

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20030032470 California Univ., San Diego, CA, USA
[Results for SHEBA/FIRE]
Valero, Francisco P. J.; March 21, 2003; 4 pp.; In English; Original document is slightly crooked with black and white illustrations.
Contract(s)/Grant(s): NAG1-2044; No Copyright; Avail: CASI; A01, Hardcopy

The Atmospheric Research Laboratory's Radiation Measurement System (RAMS) was on the NCAR C-130 aircraft in May and July 1998, collecting radiometric data on the science flights conducted in the vicinity of the Surface Heat Budget of the Arctic Ocean (SHEBA) ship. These measurements were part of the FIRE Arctic Cloud Experiment (FIRE ACE). Analysis of some of the data focused on the absorption, reflection, and transmittance of Arctic clouds, especially compared to model results. In order to assess the absorption of solar radiation by the clear and cloudy atmosphere in the Arctic the measurements from the radiometers were combined in pairs of above-cloud segments and below-cloud segments. To get these pairs, the data for all sixteen of the flights (8 in May and 8 in July) were examined for occurrences of low-altitude segments in proximity to high-altitude segments. The low-altitude data are then treated as measurements of the bottom of a layer and the high-altitude data are taken as measurements of the top of the layer. With measurements of the upwelling and downwelling irradiances above and below a layer one can determine the reflectance, transmittance, and absorptance of the layer. Attachment: Doelling, D.R., P. Minnis, D.A. Spangenberg, V. Chakrapani, A. Mahesh, S.K. Pope, and F.P.J. Valero, Cloud radiative forcing at the top of the atmosphere during FIRE ACE derived from AVHRR data, J. Geophys. Res. 106, 15,279-15,296,2001. Minnis, P., D.R. Doelling, D.A. Spangenberg, A. Mahesh, S.K. Pope, and F.P.J. Valero, AVHRR-derived cloud radiative forcing over the ARM NSA and SHEBA site during FIRE ACE, abstract submitted to the ARM Science Team Meeting, San Antonio, TX, M a . 13-17,2000. Pope, S.K., and F.P.J. Valero, Measured and modeled radiometric fluxes in the Arctic during FIRE-ACE, presented as a poster at the American Geophysical Union meeting, San Francisco, CA, Dec. 13-17, 1999. Pope, S.K., and F.P.J. Valero, Measured and modeled radiometric fluxes in the Arctic during FIRE-ACEy paper presented at SHEBA/FIRE Workshop, National Center for Atmospheric Research, Boulder, Colo., Apr. 17-20,2000.
Derived from text
Data Acquisition; Advanced Very High Resolution Radiometer; Atmospheric Radiation; Fires; Irradiance; Radiation Absorption; Radiation Measurement; Arctic Regions; Clouds (Meteorology)

20030033842 Pacific Northwest National Lab., Richland, WA
Vadose Zone Transport Field: FY2002 Test Plan
Ward, A. L.; Gee, F. W.; May 2002; In English
Report No.(s): DE2002-15001410; PNNL-13857; No Copyright; Avail: National Technical Information Service (NTIS)

This project will use a combination of geophysical and soil-physics techniques to investigate the infiltration and redistribution of water and dilute tracers in a controlled field experiment at the Army loop Road clastic dike site. In the FY 2002 tests, surface-deployed ground-penetrating radar will be used to identify the discrete pattern of horizonation that comprises the coarse component of the heterogeneity along a 60-m (197-ft) transect. Undisturbed cores from major sedimentary facies will be used to quantify hydraulic properties in the laboratory. The transect will be instrumented to allow water to be applied along its length from a line source. Local-scale water content, matric potential, and tracer concentrations will be monitored as a function of spatial scale by multipurpose Time Domain Reflectometry (TDR) probes and suction lysimeters. The tension infiltrometer will be used to measure mobile-immobile parameters. The resulting data will be used to characterize fine-scale heterogeneity as well as correlation lengths of hydraulic and transport parameters. Tracer-breakthrough data will be used to determine longitudinal and transverse dispersivities and their scale dependence. Parameters will be

analyzed to identify a suitable averaging (upscaling) procedure for field-scale infiltration predictions. Distributions of water and solute will be used to validate a numerical model for forward predictions and the applicability of upscaled parameters to processes that typically occur under transient flow and at impracticably large spatial and temporal scales.
NTIS
Vadose Water; Radioactive Isotopes; Transport Properties

20030034705 Pacific Northwest National Lab., Richland, WA, Idaho National Engineering and Environmental Lab., Idaho Falls, ID, CH2M Hill Hanford Group, Inc., Richland, WA
Installation of a Hydrologic Characterization Network for Vadose Zone Monitoring of a Single-Shell Tank Farm at the U.S. Department of Energy Handford Site
Gee, G. W.; Ward, A. L.; Ritter, J. C.; Sisson, J. B.; Hubbell, J. M.; Oct. 2001; In English
Report No.(s): DE2002-15001084; PNNL-13712; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of the deployment was to obtain in situ hydrologic characterization data within the vadose zone of a high-level-waste tank farm. Eight sensor nests, ranging in depth from 67 m (220 ft) below ground surface (bgs) to 0.9 m (3 ft) bgs were placed in contact with vadose-zone sediments inside a recently drilled, uncased, borehole (C3360) located adjacent to Tank B-110. The sensor sets are part of the Vadose Zone Monitoring System and include advanced tensiometers, heat dissipation units, frequency domain reflectometers, thermal probes, and vadose zone solution samplers. Within the top meter of the surface, a water flux meter was deployed to estimate net infiltration from meteoric water (rain and snowmelt) sources. In addition, a rain gage was located within the tank farm to document on-site precipitation events. All sensor units, with the exception of the solution samplers, were connected to a solar-powered data logger located within the tank farm. Data collected from these sensors are currently being accessed by modem and cell phone and will be analyzed during the coming year (FY 2001).
NTIS
Measuring Instruments; Radioactive Wastes; Tanks (Containers)

20030034709 Lawrence Livermore National Lab., Livermore, CA
Aseismic Slip Events along the Southern San Andreas Fault System Captured by Radar Interferometry
Vincent, P.; Oct. 01, 2001; In English
Report No.(s): DE2002-15002023; UCRL-JC-145561; No Copyright; Avail: National Technical Information Service (NTIS)

Aseismic slip is observed along several faults in the Salton Sea and southernmost Landers rupture zone regions using interferometric synthetic aperture radar (InSAR) data spanning different time periods between 1992 and 1997.
NTIS
San Andreas Fault; Geological Faults

20030036964 Northeastern Research Station, Princeton, WV
Survey of Primary Processors in New York, 1999
Hansen, B.; Crawford, S.; Baker, I.; Akers, M.; Nov. 2002; 22 pp.
Report No.(s): PB2003-102648; FSRB-NE-155; No Copyright; Avail: CASI; A03, Hardcopy

This report presents the results of a survey of primary wood processors in New York and surrounding states and Canada that relied on New Yorks forests for at least a portion or their roundwood receipts in 1999. The previous survey of wood use and production in New York was conducted in 1993. At that time, New York was a net importer of roundwood. The latest study found that New York is now a net exporter of roundwood with Canada receiving about two-thirds of all exports. Both sawlog and total roundwood production in New York were at levels not seen since the early 1900s. Hardwoods account for just under two-thirds of the total roundwood production.
NTIS
New York; Wood; Industries

20030036997 Geological Survey, Menlo Park, CA
Studies by the U.S. Geological Survey in Alaska, 2000
Wilson, F. H.; Galloway, J. P.; 2002; In English
Report No.(s): PB2003-102708; USGS-PP-1662; No Copyright; Avail: National Technical Information Service (NTIS)

The collection of eight papers that follow continue the series of U.S. Geological Survey (USGS) investigative reports in Alaska under the broad umbrella of the geologic sciences. The series presents new and sometimes-preliminary findings that

are of interest to earth scientists in academia, government, and industry; to land and resource managers; and to the general public. Reports presented cover a broad spectrum of topics from various parts of the State, serving to emphasize the diversity of USGS efforts to meet the Nation's needs for earth-science information in Alaska. The papers in this volume are organized under the topics Geologic Framework, Resources, and Environment and Climate.
NTIS
Geological Surveys; Alaska; Earth Sciences; Geochemistry

20030037009 Lawrence Livermore National Lab., Livermore, CA
Moisture Retention Curves of Topopah Spring Tuff at Elevated Temperatures
Lin, W.; Roberts, R.; Carlberg, E.; Ruddle, D.; Pletcher, R.; Nov. 30, 2001; 22 pp.; In English
Report No.(s): DE2002-802876; UCRL-ID-146579; No Copyright; Avail: Department of Energy Information Bridge
Knowledge of unsaturated flow and transport in porous media is critical for understanding the movement of water and solute through the unsaturated zone. The suction potential of rock determines the inhibition of water and, therefore, the moisture retention in the matrix. That, in turn, affects the relative importance of matrix flow and fracture flow, and their interaction, because greater suction potential moves more water from fractures into the matrix and therefore retards fracture flow. The moisture content as a function of the suction potential is called a moisture retention curve or a characteristic curve. Moisture retention data are important input for numerical models of water movement in unsaturated porous media. Also important are the effect of sample history on the moisture-retention curves and whether there is significant hysteresis between wetting and drying measurements. The Yucca Mountain Site Characterization Project (YMP) of the U.S. Department of Energy is studying the suitability of the tuffaceous rock at Yucca Mountain, Nevada, for a potential high-level nuclear waste repository. The potential repository horizon will be in the unsaturated zone of the Topopah Spring member (densely welded) of the Paintbrush Tuff unit at Yucca Mountain.
NTIS
Fractures (Materials); Mathematical Models; Moisture Content; High Temperature

20030037039 Geological Survey, East Hartford, CT, Connecticut Dept. of Environmental Protection, Hartford, CT
Streamflow in the Quinnipiac River Basin, Connecticut: Statistics and Trends, 1931-2000
Ahearn, E. A.; 2002; In English
Report No.(s): PB2003-101733; USGS/WRI-02-4217; No Copyright; Avail: National Technical Information Service (NTIS)
This report presents streamflow statistics of duration, frequency, and quantity of annual, monthly, maximum, and minimum streamflow for two gaging stations in the Quinnipiac River Basin. Streamflow statistics are presented in tabular and graphical form to characterize the basin's water resources and estimate flows needed for water supply and allocation. The report also presents trends in streamflow for 1931-00 at the Wallingford gaging station. Statistical techniques used to perform the trend analysis and compute the basin characteristics that affect streamflow processes are presented to provide perspective on the detected trends. In addition, the report briefly describes how and to what extent climatic and human influences affect streamflow characteristics.
NTIS
River Basins; Water Resources; Water Flow; Hydrology

20030037101 Westinghouse Savannah River Co., Aiken, SC
FY2002 P Well Report
Noonkester, J. V.; Nichols, R. L.; Betivas, C. R.; Simmons, J. L.; Aug. 27, 2002; 21 pp.; In English
Report No.(s): DE2002-805615; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
NTIS
Aquifers; Hydrogeology; Pumps

20030037130 Minnesota Dept. of Natural Resources, St. Paul. Div. of Waters
Minnesota's Water Supply: Natural Conditions and Human Impacts
Sep. 2000; In English
Report No.(s): PB2003-102701; No Copyright; Avail: National Technical Information Service (NTIS)
The fair and wise allocation of the water supply in light of increasing, competing demands is one of the greatest challenges facing the Minnesota Department of Natural Resources (DNR). Withdrawals for public water supplies, domestic uses,

irrigation, industrial processing, or power production can conflict with the need to maintain adequate streamflows and water levels for recreation, fish and wildlife habitat, and reliable ground water supplies. A significant increase in the amount of water available for competing needs is not feasible. Therefore, expectations for future water use and demands must be managed using sound water resource information and a profound understanding of the relationship between human activities and natural conditions. Included in this report are discussions of the following key topics: current water budget and human impacts; an overview of water resource management concerns that are being addressed statewide and by geographic and hydrogeologic areas; and current strategies for water supply management, and planning and development suggestions.
NTIS
Water Management; Water Resources; Management Planning; Earth Resources; Irrigation

20030037135 Environmental Protection Agency, Washington, DC
Proven Alternatives for Aboveground Treatment of Arsenic in Groundwater. Engineering Forum Issue Paper (Revised)
Oct. 2002; 72 pp.
Report No.(s): PB2003-102717; EPA/542/S-02/002; No Copyright; Avail: CASI; A04, Hardcopy
This issue paper identifies and summarizes experiences with proven aboveground treatment alternatives for arsenic in groundwater, and provides information on their relative effectiveness and costs.
NTIS
Arsenic; Ground Water

20030037140 Geological Survey, Charleston, WV
Estimating the Magnitude of Annual Peak Discharges with Recurrence Intervals between 1.1 and 3.0 Years for Rural, Unregulated Streams in West Virginia
Wiley, J. B.; Atkins, J. T.; Newell, D. A.; 2002; In English
Report No.(s): PB2003-102722; USGS/WRI-02-4164; No Copyright; Avail: National Technical Information Service (NTIS)
Contents include the following: Abstract; Introduction; Development of low-recurrence- intervalpeak-discharge estimating equations; Estimating discharge for gaged and ungaged locations; Accuracy of low-recurrence-interval peak-discharge estimating equations; Limitations of low-recurrence-interval peak-discharge estimating equations; Summary; References cited; Appendix1. Fortran program for calculating frequency factors; Appendix 2. Accuracy of estimating equations; Plate; Figures and Table.
NTIS
Streams; Rural Areas; West Virginia; Estimating

20030037143 Geological Survey, Denver, CO
Evaluation of Water Quality, Suspended Sediment, and Stream Morphology with an Emphasis on Effects of Stormflow on Fountain and Monument Creek Basins, Colorado Springs and Vicinity, Colorado, 1981 through 2001
Edelmann, P.; Ferguson, S. A.; Stogner, R. W.; August, M.; Payne, W. F.; 2002; In English
Report No.(s): PB2003-102724; USGS/WRIR-02-4104; No Copyright; Avail: National Technical Information Service (NTIS)
This report documents water quality and suspended sediment with an emphasis on evaluating the effects of stormflow on Fountain Creek Basin in the vicinity of Colorado Springs, Colorado. Water-quality data collected at ll sites between l981 and 2001 were used to evaluate the effects of stormflow on water quality. Suspended-sediment data collected at seven sites from 1998 through 2001 were used to evaluate effects of stormflow on suspended-sediment concentrations, discharges, and yields. Data were separated into three flow regimes: base flow, normal flow, and stormflow.
NTIS
Sediments; Water Quality

20030037145 Geological Survey, Menlo Park, CA, California State Dept. of Water Resources, Sacramento
Salinity and Temperature in South San Francisco Bay, California, at Dumbarton Bridge: Results from the 1999-2002 Water Years and an Overview of Previous Data
Schemel, L. E.; Brown, R. L.; Bell, N. W.; Jan. 2003; In English
Report No.(s): PB2003-102725; USGS/WRI-03-4005; No Copyright; Avail: National Technical Information Service (NTIS)
Salinity and temperature were measured in near-surface waters at Dumbarton Bridge in South San Francisco Bay during the 1999-2002 water years (1999WY-2002WY). The complete data set from this site, which included 1990WY-1993WY and 1995WY-1998WY, provided a time-series of observations covering a wide range of hydrologic conditions. These conditions

included critically dry years and years with above normal and near-record precipitation and discharges from the major rivers and local streams. Data collection at 15-minute intervals allowed resolution of variability associated with daily tides and other short-term phenomena. Both local stream discharges to South San Francisco Bay and Sacramento-San Joaquin River discharges to North San Francisco Bay affected salinity at Dumbarton Bridge. Salinity at Dumbarton Bridge varied with the daily tides, and the lowest salinity values (annual) coincided with precipitation and freshwater inflows usually in winter. Short-term and seasonal variations in temperature at Dumbarton Bridge typically followed changes in air temperature and solar irradiance.
NTIS
San Francisco Bay (Ca); Salinity; Water Temperature

20030037159 Joint Oceanographic Institutions, Inc., Washington, DC, Texas A and M Coll., College Station, Rice Univ., Dept. of Earth Sciences, Houston, TX
Technical Progress Report Number 3
Rack, F. R.; Diiickens, G.; Ford, K.; Schroeder, D.; Stroms, M.; Aug. 2002; 44 pp.; In English
Report No.(s): DE2002-803201; No Copyright; Avail: Department of Energy Information Bridge
The primary accomplishments of the JOI Cooperative Agreement with DOE/NETL in this quarter was the preparation of tools and measurement systems for deployment, testing and use on ODP Leg 204, which will study hydrate deposits on Hydrate Ridge, offshore Oregon. Additional accomplishments were related to the post-cruise evaluation of tools and measurements systems used on ODP Leg 201 along the Peru margin from January through March, 2002.
NTIS
Hydrates; Methane; Marine Environments; Gases; Lithosphere

20030037163 Corps of Engineers, Portland, OR
Water Quality Annual Report 2000, Corps of Engineers Northwestern Division
2002; 90 pp.; In English
Report No.(s): PB2003-102721; No Copyright; Avail: CASI; A05, Hardcopy
No abstract available
NTIS
Engineers; Water Quality; Pacific Ocean; Management Planning

20030037173 Lawrence Livermore National Lab., Livermore, CA
Multi-Isotope (B, Sr, O, H, C) and Age Dating ((3)H-(3)He,(14)C) Study of Ground Water from Salinas Valley California: Hydrochemistry, Dynamics, and Contamination Processes
Vengosh, A.; Gill, J.; Davisson, M. L.; Hudson, G. B.; Aug. 01, 2001; 48 pp.
Report No.(s): DE2002-15002099; UCRL-JC-147271; No Copyright; Avail: Department of Energy Information Bridge
The chemical and isotopic (11B/10B, 87Sr/86Sr, 180/160, 2H/H, 13C/12C, 14C, 3He/3H) compositions of groundwater from the upper aquifer system of the Salinas Valley in coastal central California were invesugated in order to delineate the origin and processes of groundwater contamination in this complex system. The Salinas Valley has a relatively deep, confined '400-foot' aquifer, overlain by a '180-foot' aquifer, and a shallower perched aquifer, all made up of alluvial sand, gravel, and clay deposits. Groundwater from the aquifers have different t4C ages; fossil (14C=21.3 pmc) for the 400-foot, and modern (14C=72.2 to 98.2 pmc) for the 180-foot. Fresh groundwater in all aquifers is recharged naturally and artificially and through the Salinas River. The two modes of recharge can be distinguished chemically.
NTIS
Ground Water; Geochemistry; California; Contamination; Radioactive Isotopes

20030037185 Lawrence Livermore National Lab., Livermore, CA
Effects of Fluid Distribution on Measured Geophysical Properties for Partially Saturated, Shallow Subsurface Conditions
Berge, P. A.; Jun. 11, 2002; 10 pp.; In English
Report No.(s): DE2002-15002136; UCRL-ID-148954; No Copyright; Avail: Department of Energy Information Bridge
Our goal is to improve geophysical imaging of the vadose zone. We are achieving this goal by providing new methods to improve interpretation of field data. The purpose of this EMSP project is to develop relationships between laboratory measured geophysical properties and porosity, saturation, and fluid distribution, for partially saturated soils. Algorithms for

relationships between soil composition, saturation, and geophysical measurements will provide new methods to interpret geophysical field data collected in the vadose zone at sites such as Hanford, WA.
NTIS
Geophysics; Surface Properties; Fluid Flow

20030038792 Lawrence Livermore National Lab., Livermore, CA
Analysis of Radionuclide Migration through a 200-m Vadose Zone following a 16-year Infiltration Event
Tompson, A. F. B.; Smith, D. K.; Hudson, G. B.; Jan. 31, 2002; In English
Report No.(s): DE2002-15002146; UCRL-ID-146979; No Copyright; Avail: National Technical Information Service (NTIS)
The CAMBRIC nuclear test was conducted beneath Frenchman Flat at the Nevada Test Site on May 14, 1965. The nuclear device was emplaced in heterogeneous alluvium, approximately 70 m beneath the ambient water table, which is itself 220 m beneath the ground surface. Approximately 10 years later, groundwater adjacent to the test was pumped steadily for 16 years to elicit information on radionuclide migration in the saturated zone. The pumping well effluent containing mostly soluble radionuclides such as tritium, 14C, 36Cl, 85Kr, 129I, and 106Ru was monitored, discharged to an unlined ditch, and allowed to flow towards Frenchman Lake just over one kilometer away. Water discharged into the ditch infiltrated into the ground during flow along the ditch. This created an unexpected and remarkable second experiment in which the migration of the effluent through the 220 meters of unsaturated media, or vadose zone, back to the water table, could be studied. In this paper, the pumping and effluent data are being utilized in conjunction with a series of geologic data, new radionuclide measurements, isotopic age-dating estimates, and vadose zone flow and transport models to better understand the movement of radionuclides between the ditch and the water table. Measurements of radionuclide concentrations in water samples produced from a water table monitoring well 100m away from the ditch indicate rising levels of tritium since 1993.
NTIS
Radioactive Isotopes; Migration; Ground Water

20030038793 Minerals Management Service, New Orleans, LA
Atlantic Outer Continental Shelf, Georges Bank: Compilation of Continental Offshore Stratigraphic Test (COST) and Industry Exploration Drilling, 1976-1982
2002; In English
Report No.(s): PB2002-500098; MMS-2000-040-CD; No Copyright; Avail: National Technical Information Service (NTIS)
Ten wells were drilled offshore from New England on Georges Bank from 1976 through 1982. The first two wells were Continental Offshore Stratigraphic Test (COST) wells, drilled during 1976 and 1977 by energy company consortiums to gain geologic information prior to the initial offshore lease sale. After leases were awarded, eight industry exploration wells were drilled in 1982 and 1981. The disc captures this historic data. The U.S. Geological Survey released reports on the two COST wells in 1980 as an open file report. The Minerals Management Service (MMS) has now completed reports on each of the petroleum exploration wells drilled by industry. The MMS reports are taken from Agency files and contain no recent analysis. These reports contain information on drilling operations, sonic well velocities, litho logic and biostratigraphic interpretations, well log analyses, well temperatures, kerogen analyses, petroleum geochemistry, and geologic thermal history. All the MMS and both the USGS studies are contained on the disc, which includes selected operator-submitted original well data as PDF and TIF files, as well longs as TIF images and LAS files.
NTIS
Continental Shelves; Geology; Atlantic Ocean; Offshore Energy Sources; Stratigraphy

20030038805 Lawrence Livermore National Lab., Livermore, CA
Analysis of Site Response at U1A Hole at the Nevada Test Site from Weak Motion Recordings
Hutchings, L.; Furrey, L.; May 21, 2002; 36 pp.
Report No.(s): DE2002-15002159; UCRL-ID-148493; No Copyright; Avail: Department of Energy Information Bridge
We utilize weak motion recordings to evaluate the site response at the U1A hole, Nevada Test site to determine the effect on potential ground motion at the drift of the U1A hole 962 ft deep. We estimated the site response amplification of ground motion at the surface relative to the drift with the spectral ratio method. We utilized Fourier amplitude and absolute acceleration response spectra, and confined our study to frequencies of 0.5 to 25.0 Hz (.04 to 2.0 s periods). We identified 8 earthquakes in the area that were recorded at the bottom and top of the hole that were used for spectral ratios. We calculated the average and one standard deviation of ratios from all the events.
NTIS
Earthquakes; Seismology; Nevada

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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*.

20030032303 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
An Index for Evaluation of Digital Imagery Segmentation (IAVAS): Application in Agriculture
CesardeOliveira, Julio; 2003; 162 pp.; In Portuguese; Original contains color illustrations
Report No.(s): INPE-9554-TDI/830; Copyright; Avail: CASI; A08, Hardcopy

Remote sensing techniques have been increasingly used for obtaining more rapid, accurate and cheap agricultural statistics comparing with the current subjective used methodologies. One important aspect of these methodologies is the estimation of the crop areas that must be made in an objective way. Orbital data may allow approaches in the municipality or in the county levels, so that the use of segmentation algorithms for extracting the crop plots limits is an essential step in the process of agricultural land use classification. Thus, the main objective of the present research is the development of a quantitative method for evaluating results of orbital imagery segmentation. Such an evaluation system is based on discrepancy measures of following reference parameters: number of polygons; total line lengths; polygon areas variance; closer mass center and certain overlaying region. Proposed methodology also defines criteria for selecting thresholds (area and similarity) for the used segmentation algorithm that was a region growth one. The study area corresponded to Ipua, Guara and Sao Joaquim da Barra municipalities in the north of Sao Paulo State, Brazil, representing significantly the agricultural conditions of this State. From the obtained results it was verified that the proposed quantitative methodology was suitable and competent for defining the segmentation thresholds. The area/similarity thresholds pair 16/24 provided the best segmentation results for the study area when considering reference data obtained with field data. But, when reference data were obtained by the user through manual interpretation, the thresholds that produced the best segmentation results were 16/44 and 16/45.
Author
Agriculture; Remote Sensing; Segments; Imagery; Digital Techniques; Indexes (Documentation); Algorithms

20030032336 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Use and Assessment of Data Integration and Spatial Analysis in Mineral Research Applied in 'Pocos de Caldas' Plato
RoquedeSilvaMoreira, Fabio; 2002; 166 pp.; In Portuguese; Original contains color illustrations
Report No.(s): INPE-9481-TDI/825; Copyright; Avail: CASI; A08, Hardcopy

This work compared the performance of 8 methods of multi-criteria analysis of geological and radiometric data, in the prediction of potential areas for radioactive mineral deposits in the 'Pocos de Caldas' alkaline complex, Brazil. The used methods (Boolean, Logic Weighed Means, Minimum-Maximum Fuzzy, Mean Fuzzy, Weighted Fuzzy, Gamma Fuzzy, Bayes and Artificial Neural Network) were applied according to a empiric prospecting model, which generated scenarios with different priority levels for mineral prospecting. The Boolean procedure produced binary tematic maps indicating areas as favorable and not favorable for mineral prospecting. In the others methods, results were produced in numeric format and sliced in 4 potential classes (null, low, medium, high). In the map evaluation were used 48 mineral occurrences that were overlaid for visual assessment and crosstabulated to calculate the conditional probabilities, used in the confident parameter. The produced scenarios showed different performances. The Weighted Fuzzy map showed the best performance among others, followed by Artificial Neural Network and Weighted means maps. The Boolean and Gamma Fuzzy models showed be unsuitable for similar studies. The others models showed moderate performances.
Author
Data Integration; Mineralogy; Spatial Distribution; Radiometers; Artificial Intelligence; Fuzzy Systems

20030032359 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Tropical Warm Pool Surface Heat Budgets and Temperature: Contrasts Between 1997-98 El Nino and 1998-99 La Nina
Chou, Shu-Hsien; Chou, Ming-Dah; Chan, Pui-King; Lin, Po-Hsiung; Wang, Kung-Hwa; [2003]; 30 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Seasonal and interannual variations of the net surface heating F(sub NET) and sea surface temperature tendency (T(sub s)/dt) in the tropical eastern Indian and western Pacific Oceans are studied. The surface heat fluxes are derived from the Special Sensor Microwave/Imager and Japanese Geostationary Meteorological Satellite radiance measurements for the period October 1997-September 2000. It is found that the magnitude of solar heating is lager than that of evaporative cooling, but the spatial variation of the latter is significantly large than the former. As a result, the spatial variations of seasonal and interannual

variability of F(sub NET), follow closely that of evaporative cooling. Seasonal variations of F(sub NET) and T(sub s)/dt are significantly correlated, except for the equatorial western Pacific. The high correlation is primarily attributable to high correlation between seasonal cycles of solar heating and T(sub s)/dt. The change of F(sub NET) between 1997-98 El Nino and 1998-99 La Nina is significantly larger in the tropical eastern Indian Ocean than tropical western Pacific. For the former region, the reduced evaporative cooling arising from weakened winds during the El Nino is generally associated with enhanced solar heating due to decreased cloudiness, and thus increases the interannual variability of F(sub NET). For the latter region, the reduced evaporative cooling due to weakened winds is generally associated with but exceeds the reduced solar heating arising from increased cloudiness, and vise versa. Thus the interannual variability of F(sub NET) is reduced due to this offsetting effect. Interannual variations of F(sub NET) and T(sub s)/dt have very low correlation. This is most likely related to interannual variability of ocean dynamics, which includes the variations of solar radiation penetrating through oceanic mixed layer, upwelling of cold thermocline water, Indonesian throughflow for transporting heat from the Pacific to Indian Ocean, and interhemispheric transport in the Indian Ocean.
Author
El Nino; Annual Variations; Sea Surface Temperature; Air Water Interactions; Solar Heating; Evaporative Cooling; Heat Flux; Remote Sensing

20030032407 Scripps Institution of Oceanography, San Diego, CA, USA
Measured and Modeled Radiometric Fluxes in the Arctic during FIRE-ACE
Pope, S. K.; Valero, F. P. J.; April 18, 2000; 6 pp.; In English; SHEBA/FIRE Workshop, 18 Apr. 2000, Boulder, CO, USA; Copyright; Avail: Other Sources

Radiative flux measurements made during the FIRE Arctic Clouds Experiment are compared to model calculations. The data were collected by radiometers on board the NCAR C-130 aircraft which flew in the vicinity of the SHEBA ship, located in the Arctic Ocean, in sky conditions ranging from clear to cloudy. Measurements made at different altitudes on May 24, 1998 (a relatively clear day) are combined to give a profile of irradiances from the surface up to 4 km altitude. Model values were calculated with Stamnes's DISORT module, with exponential sum fits from Tsay. The atmospheric structure (pressure, temperature, relative humidity, ozone) was taken from SHEBA ship sondes.
Author
Arctic Regions; Cloud Cover; Radiant Flux Density; Mathematical Models; Ozone; Remote Sensing

20030032420 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Goddard Earth Observing System - Data Assimilation System (GEOS-4 DAS) Data Products at the NASA Goddard Earth Science DISC DAAC
March 2003; 1 pp.; In English; Fall 2002 AGU Meeting, Fall 2002, San Francisco, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy

This list contains the names of data products from the Goddard Earth Observing System - Data Assimilation System (GEOS-4 DAS) at the Goddard Earth Science (GES) Data and Information Services Center (DISC) Distributed Active Archive Center (DAAC). The list divides the data products into Assimilated Synoptic Files and Assimilated Time Averaged Files.
CASI
Earth Observing System (Eos); Data Processing; Computer Programs

20030032421 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Phenology - Foliar Classification and Monitoring the Vegetation Cover in the Tapajos National Forest Region - Para State, Utilizing Multitemporal Data from Landsat Thematic Mapper (TM) Sensor
Verona, Jane Delane; 2003; 161 pp.; In Portuguese; Original contains color illustrations
Report No.(s): INPE-9556-TDI/832; Copyright; Avail: CASI; A08, Hardcopy

The relative importance of accuracy in forest cover mapping is given by the necessity to obtain improvement in the elaboration of a management plan of natural resources and in the definition of priority areas for conservation, as well as in landscape analysis. Other aspect that has raised even more interest in the scientific community is concerned to modeling of biogeochemical cycles and global changes. Studies related to forest phenology have offered promising results to help the researches of ecological subject, by directing important questions with respect to global modeling, monitoring and climate changes. The main contribution of this work was to identify and quantify the fluctuation of spectral response throughout of seven distinct months, as a consequence of forest phenology related to climate variations, and, from this, to direct the choice of images more adequate for discriminating physiognomies in tropical forest areas. The study area is located in the north

region of the Tapajos National Forest, Para State. Multitemporal Landsat-5 TM images, corresponding to the months selected in the period from May 1997 to August 1999 were utilized. Initially, these images were pre-processed involving procedures of geometric rectification and image registration, as well as radiometric rectification. Besides 3, 4, 5, and 7 bands of each TM image, it was also generated synthetics bands such as NDVI, 5/4 ratio, and shade, soil and vegetation fraction images. Following, some tasks were developed to guarantee reliable samples of vegetation classes to perform the statistical tests: preliminary analysis with 1999 TM image (forest and non forest mask); change detection between two dates, 1986 and 1999 (to guarantee the presence of forest cover in the latest date) and cloud masks for all dates. Seven forest samples were selected, with forest in the high and low plateau, 'babacu', regeneration areas with 21 years and scarp among them. With the objective to verify the presence of phenology at terrestrial level, field campaigns were performed, where floristic and structural information were collected, as well as measurements of leaf area index variation, with LAI-2000, in three different epochs, in some primary and secondary forest transects. The results were not satisfactory. However, at orbital level, the correlation between precipitation and the bands of each TM image for the seven vegetation classes were elaborated, confirming the presence of seasonal variation, considering that a correlation of 0.94 between precipitation and vegetation fraction image was achieved. The interesting thing was that the NDVI presented a very low correlation, maybe due to the fact that NDVI values saturate rapidly in the forest environment. Based on these results, the work was pursued by selecting the best dates and processing to classify the vegetation classes. So, two statistical approaches were performed: the anomaly test and the stepwise discriminant analysis. Both tests selected the same months, September, October, December, and May, as the ideal for classifying the highest number of vegetation samples, and the selected bands by both statistical approaches were shade fraction image, band 3, vegetation fraction image, and band 5. In addition, the anomaly test identified the band 7, while the NDVI was selected in the stepwise discriminant analysis. The unitemporal classification approach discriminated a maximum of 56.61\% of the vegetation samples, while the multitemporal approach achieved values greater than 90\% of classification, utilizing 3 or more dates and several bands. The adopted methodology achieved successfully the objectives of this work and will be useful for future multitemporal classification of forest cover in the tropical environment.
Author
Forests; Phenology; Foliage; Vegetation; Landsat 5; Thematic Mapping; Remote Sensing

20030032433 Communications Research Lab., Tokyo, Japan
Journal of the Communications Research Laboratory: Special Issue on Global Environment Measurements, Volume 49, No. 2
Igarashi, Kiyoshi, Editor; Hase, Yoshihiro, Editor; Yoshimoto, Shigetoshi, Editor; Kumagai, Hiroshi, Editor; June 2002; ISSN 0914-9260; 263 pp.; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

In the study of global environment measurements, two categories of research and development projects are going on: one is for satellite-borne sensor development for global scaled targets, the other is for advanced measurement technology development applied to ground-based and aircraft-borne systems. This field of research activities have been conducted so far for the expanded utilization of electromagnetic wave technologies. Recently, the activities have been focused on the global environment measurements and more effective implementation has been pursued in order to meet public interests and to exhibit visible contribution to the society. It is suggested in CRL to carry out these activities as a part of info-communications research activities and with close collaboration with science communities outside CRL. From fiscal year of 2001, CRL's organization was changed to an Independent Administrative Institution (IAI). Research management policy necessary in implementation of projects in IAI will be discussed with showing medium-term research objectives and plans in this fields. Outline of individual ongoing research projects in this field is described.
Author
Technology Utilization; Research And Development; Environmental Monitoring; Remote Sensing; Satellite Observation; Bibliographies; Meteorology; Climatology

20030032934 NASA Goddard Space Flight Center, Greenbelt, MD, USA
MODIS Data from the GES DISC DAAC: Moderate-Resolution Imaging Spectroradiometer (MODIS)
December 2002; 4 pp.; In English; Fall 2002 AGU Meeting, 2002; Original contains black and white illustrations
Report No.(s): NASA/NP-2001-11-517-GSFC; NAS 1.83:2001-11-517-GSFC; No Copyright; Avail: CASI; A01, Hardcopy

The Goddard Earth Sciences (GES) Distributed Active Archive Center (DAAC) is responsible for the distribution of the Level 1 data, and the higher levels of all Ocean and Atmosphere products (Land products are distributed through the Land Processes (LP) DAAC DAAC, and the Snow and Ice products are distributed though the National Snow and Ice Data Center (NSIDC) DAAC). Ocean products include sea surface temperature (SST), concentrations of chlorophyll, pigment and coccolithophores, fluorescence, absorptions, and primary productivity. Atmosphere products include aerosols, atmospheric

water vapor, clouds and cloud masks, and atmospheric profiles from 20 layers. While most MODIS data products are archived in the Hierarchical Data Format-Earth Observing System (HDF-EOS 2.7) format, the ocean binned products and primary productivity products (Level 4) are in the native HDF4 format. MODIS Level 1 and 2 data are of the Swath type and are packaged in files representing five minutes of Files for Level 3 and 4 are global products at daily, weekly, monthly or yearly resolutions. Apart from the ocean binned and Level 4 products, these are in Grid type, and the maps are in the Cylindrical Equidistant projection with rectangular grid. Terra viewing (scenes of approximately 2000 by 2330 km). MODIS data have several levels of maturity. Most products are released with a provisional level of maturity and only announced as validated after rigorous testing by the MODIS Science Teams. MODIS/Terra Level 1, and all MODIS/Terra 11 micron SST products are announced as validated. At the time of this publication, the MODIS Data Support Team (MDST) is working with the Ocean Science Team toward announcing the validated status of the remainder of MODIS/Terra Ocean products. MODIS/Aqua Level 1 and cloud mask products are released with provisional maturity.
Derived from text
Imaging Spectrometers; Spectroradiometers; Earth Observations (From Space); Information Resources Management; Information Dissemination; Information Retrieval

20030032999 NASA Goddard Space Flight Center, Greenbelt, MD, USA
AIRS Data Products at GES DISC DAAC
[2003]; 4 pp.; In English; Fall 2002 AGU Meeting; No Copyright; Avail: CASI; A01, Hardcopy

This list contains the names and some characteristics of Atmospheric InfraRed Sounder (AIRS) data products at the Goddard Earth Sciences (GES) Data and Information Services Center (DISC) Distributed Active Archive Center (DAAC). The list includes variables, units, dimensions, and descriptions for each of the data products, which include infrared radiances and brightness temperatures.
Author
Infrared Instruments; Atmospheric Sounding; Data Processing; Computer Programs

20030033057 EG and G Services, Gaithersburg, MD, USA
Airborne Oceanographic Lidar (AOL) (Global Carbon Cycle)
March 2003; 15 pp.; In English
Contract(s)/Grant(s): NAS5-99094; No Copyright; Avail: CASI; A03, Hardcopy

This bimonthly contractor progress report covers the operation, maintenance and data management of the Airborne Oceanographic Lidar and the Airborne Topographic Mapper. Monthly activities included: mission planning, sensor operation and calibration, data processing, data analysis, network development and maintenance and instrument maintenance engineering and fabrication.
CASI
Airborne Lasers; Ocean Data Acquisitions Systems; Optical Radar; Data Processing

20030033912 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Palm Tree (Euterpe Edulis Martius) Potential Distribution Modeling in a Mountainous Region Based on Topographic Variables
deOliveiraMortara, Magaly; [2003]; In Portuguese
Report No.(s): INPE-8857-TDI/805; Copyright; Avail: CASI; C01, CD-ROM

The objective of this work is to produce a potential distribution model for the palm tree Euterpe edulis Martius. Two suppositions were considered: (1) the distribution of E. edulis is conditioned by a set of environmental variables; (2) given that the previous condition is true, it is possible to establish a predictive spatial model of these relationships in order to map the potential distribution of the species. The first suppositon was investigated with the use of published information on the ecological behavior of the species in relation to the variables under consideration. Further information was collected during exploratory field works that were conducted in the Serra da Mantiqueira between the municipalities of Taubate - SP and Campos do Jordao - SP. The following environmental variables were considered: land cover (forest/non-forest) and the topographic variables (altitude, slope curvature, slope attitude and distance form the drainage network). In the investigation of the second supposition, Remote Sensing and Geographic Information System techniques were applied for the representation of the landscape and for the modeling of the environmental variables into values of favorability for E. edulis ranked into the interval. In the modeling of terrain favorability to E. edulis, first order functions were established according to the assumptions in order to map the conceptual model into an ordinal model of favorability through the use of Map Algebra. The global

favorability weight for each topographic variable was attained with the use of decision support technique Analytic Hierarchial Process (AHP). With these weights, Map Algebra was again utilized to construct the Potential Distribution Gradient (PDG) for the E. edulis, which does not consider the land cover, and to produce the Current Potential Distribution Gradient (CPDG) which is the PDG restricted to forested areas. The presented study can be used as a support to other studies oriented to the improvement of the techniques used here or to the ones that aim at the acquisition of quantitative information about plant distribution. The methods and the results can be applied to the implementation and management of environmental protection areas for E. edulis, to the detection of areas favorable to E. edulis subject to anthropic pressure and also to the support of sylvicultural projects for the restoration and management of the species.
Author
Trees (Plants); Mountains; Topography; Remote Sensing; Mathematical Models; Ecology; Vegetation; Distribution Functions

20030037069 North Central Research Station, St. Paul, MN
Proceedings of the Second Missouri Ozark Forest Ecosystem Project Symposium: Post-Treatment Results of the Landscape Experiment
Shifley, S. R.; Kabrick, J. M.; Oct. 2002; 240 pp.; In English, October 17 - 18, 2000, St. Louis, Missouri
Report No.(s): PB2003-102176; FSGTR-NC-227; No Copyright; Avail: CASI; A11, Hardcopy

The Missouri Ozark Forest Ecosystem Project (MOFEP) is a centuries-long experiment to examine the impacts of alternative forest management practices on a wide array of ecosystem attributes. MOFEP includes an integrated program of research studies conducted by dozens of scientists and technicians. The studies are replicated on nine forest compartments that are the experiment sites. Between 1990 and 1996, all MOFEP sites were monitored to collect pre-treatment baseline data. This publication complements the first MOFEP Proceedings. This second proceedings reports findings two to three years after implementation of the even-aged, uneven-aged, and no-harvest management treatments. The introductory paper by Sheriff describes the experiment and sets the stage. The remaining papers describe the treatment effects for many different ecosystems attributes.
NTIS
Forest Management; Conferences; Forests

20030037131 Environmental Protection Agency, Washington, DC
National Recommended Water Quality Criteria: 2002. Human Health Criteria Calculation Matrix
Nov. 2002; 26 pp.
Report No.(s): PB2003-102694; EPA/822/R-02/012; No Copyright; Avail: CASI; A03, Hardcopy

This document contains information regarding the calculation of the human health criteria contained in the document entitled, National Recommended Water Quality Criteria: 2002. This document provides: cancer potency factors (q1*s); reference doses (RfDs); relative source contributions (RSCs); fish intake values; and equations used to derive the human health criteria in the aforementioned compilation. This document is not a regulation and cannot substitute for the Clean Water Act or Environmental Protection Agency (EPA) regulations. Thus, the criteria in the calculation matrix cannot impose legally binding requirements on EPA (Environmental Protection Agency), states, authorized tribes or the regulated community.
NTIS
Water Quality; Public Health

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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*.

20030033011 Massachusetts Inst. of Tech., Cambridge, MA
Marine Applications of Power Supply and Conditioning Interfaces for High Power Pulse Devices
Rutan, Ronald J.; Sep. 2002; 103 pp.; In English
Contract(s)/Grant(s): N62271-97-G-0026
Report No.(s): AD-A410668; No Copyright; Avail: CASI; A06, Hardcopy

Numerous high power pulse devices are being considered for marine applications, particularly military vessels to include Electro Magnetic Aircraft Launching System, Electro Thermal Gun (ETG), Particle Beam Weapons, High Powered Lasers,

and Rail Guns which are directly considered in this thesis. Currently marine vessels do not have the power generation capability to deliver the massive power over the short duration required. The weight, volume, and environment constraints inherent in marine vessels limit the development of a method to store the power and deliver it upon request with a sufficient repetition rate as needed by mission requirements. This thesis mathematically models Flywheels, Superconducting Magnet Energy Storage (SMES), Capacitors, Compulsators, and Batteries as energy storage devices and graphically illustrates pertinent data (weight, volume, etc) per pulse power application for the ship designer to determine suitability for marine vessels.
DTIC
Pulse Generators; Power Supplies

20030033852 Massachusetts Inst. of Tech., Cambridge, MA
Concept and Feasibility Study of Self-Organized Electrochemical Devices
Moorehead, William D.; Sep. 2002; 78 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N62271-97-G-0026
Report No.(s): AD-A410656; No Copyright; Avail: CASI; A05, Hardcopy

Since Volta's discovery of 'an electric battery' in 1800, advancements have proceeded due to great materials advances. However, the basic configuration he proposed then is still present in today's portable power sources. In this work, using attractive and repulsive London-van der Waals forces, a self-organized, interpenetrating, separator-free rechargeable lithium ion battery called a self-organized battery system (SBS) is proposed. In this design, a repulsive interaction between the cathode and anode is used to establish the basic electrochemical junction. Increases in both energy density (Wh/kg, Wh/l) and power density (W/kg, W/l) are possible from such a design, due to 1) the decrease of inactive materials required, and 2) the decrease in Li ion diffusion length between the cathode and anode.
DTIC
Feasibility Analysis; Electrochemical Cells; Lithium Batteries; Flux Density

20030033916 MSE Technology Applications, Inc., Butte, MT, USA, NASA Langley Research Center, Hampton, VA, USA
Advanced Energetics for Aeronautical Applications
Alexander, David S.; February 2003; 105 pp.; In English
Contract(s)/Grant(s): NAG1-02048; RTOP 282-10-01-01
Report No.(s): NASA/CR-2003-212169; NAS 1.26:212169; NASA-43; No Copyright; Avail: CASI; A06, Hardcopy

NASA has identified water vapor emission into the upper atmosphere from commercial transport aircraft, particularly as it relates to the formation of persistent contrails, as a potential environmental problem. Since 1999, MSE has been working with NASA-LaRC to investigate the concept of a transport-size emissionless aircraft fueled with liquid hydrogen combined with other possible breakthrough technologies. The goal of the project is to significantly advance air transportation in the next decade and beyond. The power and propulsion (P/P) system currently being studied would be based on hydrogen fuel cells (HFCs) powering electric motors, which drive fans for propulsion. The liquid water reaction product is retained onboard the aircraft until a flight mission is completed. As of now, NASA-LaRC and MSE have identified P/P system components that, according to the high-level analysis conducted to date, are light enough to make the emissionless aircraft concept feasible. Calculated maximum aircraft ranges (within a maximum weight constraint) and other performance predictions are included in this report. This report also includes current information on advanced energy-related technologies, which are still being researched, as well as breakthrough physics concepts that may be applicable for advanced energetics and aerospace propulsion in the future.
Author
Liquid Hydrogen; Hydrogen Fuels; Electric Motors; Transport Aircraft; Aircraft Engines; Hydrogen-Based Energy; Hydrogen Oxygen Fuel Cells; Energy Conversion

20030034615 PowerLight(tm) Corp., Berkeley, CA, National Renewable Energy Lab., Golden, CO
PowerGuard(TRADE MARK) Advanced Manufacturing: PvMat Final Report
Dinwoodie, T. L.; Botkin, J.; Oct. 2002; 48 pp.; In English
Report No.(s): DE2002-15002201; No Copyright; Avail: Department of Energy Information Bridge

PowerLight Corporation (PowerLight) has completed its Photovoltaic Manufacturing Technology (PVMaT) 5A1 subcontract, PowerGuard Advanced Manufacturing, addressing the U.S. Department of Energys PVMaT goals of manufacturing improvements directed toward innovative, low-cost, high-return, high-impact PV products. PowerLights focus

for this subcontract was its patented PowerGuard building-integrated PV roofing tile. The objective of the subcontract over its three-year duration was to continue the advancement of PowerLights PowerGuard manufacturing improvements in order to reduce PowerGuard system costs, increase PowerGuard tile fabrication capability to 16-MW/year, and stimulate an increase in manufacturing of PV laminates, within the USA, by 2-MW/year. PowerLight has also continued to address quality issues by working on continuous improvement of tools and processes. Many aspects of factory operation have been improved, which has helped reduce overall costs. Increased demand for PowerGuard, which has been generated in part by cost reduction measures of the earlier phases of this project, has moved PowerLight into continuous production. This has allowed a shift from a temporary work force hired for each job to a full time production staff, improving product quality and further cutting costs by reducing the need for training.
NTIS
Photovoltaic Effect; Tiles; Fabrication; Laminates

20030034676 National Renewable Energy Lab., Golden, CO
Controls Advanced Research Turbine (CART) Commissioning and Baseline Data Collection
Fingersh, L. J.; Johnson, K.; Oct. 2002; In English
Report No.(s): DE2002-15002211; No Copyright; Avail: National Technical Information Service (NTIS)
During FY 2002, the Controls Advanced Research Turbine (CART) turbine and controller were developed and commissioned. This included developing and checking out the protection and operational control systems. More than 50 hours of data were collected in constant and variable-speed modes. A new strategy, which underwent limited testing on the machine, was created for avoiding tower resonance. All the data from the checkout throughout the operational periods were organized, archived, and backed up.
NTIS
Controllers; Wind Turbines; Electricity; Electric Generators

20030034707 Lawrence Livermore National Lab., Livermore, CA
Measurement of Actinides in Environmental Samples at Micro-Becquerel Levels by Accelerator Mass Spectrometry
Brown, T. A.; Knezovich, J. P.; Marchetti, A. A.; Hamilton, T. F.; Sep. 03, 2002; 16 pp.
Report No.(s): DE2002-15002018; No Copyright; Avail: Department of Energy Information Bridge
The need for ultra-sensitive actinide measurements continues to expand in the fields of environmental stewardship, nuclear isotope forensics, radiobioassay and environmental research. We have developed a heavy isotope accelerator mass spectrometry (AMS) system at Lawrence Livermore National Laboratorys Center for Accelerator Mass Spectrometry (CAMS). The system was designed particularly for the measurement of actinide concentrations and isotopic ratios. A fast isotope switching capability has been incorporated in the system, allowing flexibility in isotope selection and for the quasi-continuous normalization to a reference isotope spike. The development of the heavy isotope system was undertaken with particular interest in the measurement of environmental samples, including soils, sediments, waters, air filters, tissue samples, and human urine. The high rejection of interferences, including molecular interferences, and low susceptibility to matrix components, provided by the AMS technique are of particular relevance for such complex samples.
NTIS
Environmental Monitoring; Mass Spectroscopy; Actinide Series

20030034832 Naval Undersea Warfare Center, Newport, RI
Hydraulic Activated Spreader Arm Aperture Generation System
Dec 2002; 13 pp.; In English
Report No.(s): AD-D020048; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC))
A spreader arm aperture generation system for use with a towed array is provided. The spreader arm aperture generation system broadly comprises a plurality of lines and a plurality of hydraulically activated, inflatable tubes for generating horizontal and vertical separation among the lines. Each of the tubes is filled with seawater to a desired pressure to achieve the desired horizontal and vertical line separation. Preferably, each of the tubes is formed from a high strength woven fabric.
DTIC
Actuators; Electric Generators

20030036969 Netherlands Energy Research Foundation, Petten
mc-Si: Relation Between Ingot Quality and Cell Efficiency
Geerligs, L. J.; 2002; 8 pp.
Report No.(s): PB2003-102651; Copyright; Avail: National Technical Information Service (NTIS)

We have investigated and compared material properties and solar cells of several common multicrystalline ingots. Apart from the contaminated end parts of the ingots the cell quality correlates well with the as-received lifetime, and the lifetime profile through the ingot correlates with the distribution of defect densities in the material. The asreceived lifetime after light soaking is a reasonable predictive parameter for cell performance for the complete ingot if the major impurity in the end parts is iron, and if the oxygen concentration is low. A high oxygen concentration of 15-20 ppma in the bottom parts of some ingots, instead of the more common 5-10 ppma for that position, correlates with a strong reduction of cell efficiency.
NTIS
Ingots; Solar Cells; Mechanical Properties

20030036974 Netherlands Energy Research Foundation, Petten
Simple, Detailed and Fast Firing Furnace Temperature Profiling for Improved Efficiency
Hoornstra, J.; van der Heide, A.; Bultman, J.; Weeber, A.; 2002; 8 pp.
Report No.(s): PB2003-102653; Copyright; Avail: National Technical Information Service (NTIS)
A new temperature profiling method in a firing furnace is demonstrated. A data logger in a thermal barrier is connected to a thermocouple traveling through the furnace. The use of smaller and multiple thermocouples attached to a wafer enable more accurate profiling than the commonly used method. Possibilities for improving the firing furnace could be determined using the data logger and contact resistance scans made with the Corescan.
NTIS
Temperature Distribution; Furnaces; Energy Conversion; Thermodynamic Efficiency

20030036975 Netherlands Energy Research Foundation, Petten
Locating Losses Due to Contact Resistance, Shunts and Recombination by Potential Mapping with the Corescan
van der Heide, A. S. H.; Bultman, J. H.; Hoornstra, J.; Schoenecker, A.; Wyers, G. P.; Aug. 2002; In English
Report No.(s): PB2003-102650; ECN-RX-02-039; Copyright; Avail: National Technical Information Service (NTIS)
A visualization tool to locate losses in a solar cell can be very helpful in troubleshooting a non-optimal production line. Therefore, the Corescan has been developed, in which three different locating methods are incorporated, the Corescan, Shuntscan and the new Voc scan. In this paper it is explained how the scan results have to be interpretated and it is shown that the sensitivity of the methods is more than sufficient. The unique Voc scan method is introduced for the first time; this technique can locate recombination losses on cells that are almost complete (only the front contact has to be omitted). Several examples of how the Corescan instrument can be used for troubleshooting and process optimization are presented in this paper. These examples will help users of the instrument to relate measured scans with reasons for non-optimal processing.
NTIS
Solar Cells; Contact Resistance; Bypasses; Circuits

20030036977 Netherlands Energy Research Foundation, Petten
Selecting Optimal Interconnection Methodology for Easy and Cost Efficient Manufacturing of the Pin Up Module
Bultman, J. H.; Eikelboom, D. W. K.; Kinderman, R. K.; Tip, A. C.; Weeber, A. W.; 2002; 8 pp.
Report No.(s): PB2003-102655; Copyright; Avail: National Technical Information Service (NTIS)
Rear contacted solar cells are successfully glued onto an interconnection foil which also serves as the environmental barrier at the rear of the module. Resulting fill factors are similar to cells connected with strips that are soldered and glued. Glued cells are interconnected and laminated in a single step, which reduces labor to a minimum, reduces stress on the cells, and therefore could increase process yield. Considering these advantages, this concept has the potential to interconnect very thin cells without additional stress on the cells.
NTIS
Costs; Manufacturing; Solar Cells; Joining; Energy Technology; Methodology

20030036979 Netherlands Energy Research Foundation, Petten
PV-Wirefree: Redesigning and Innovating Grid-Connected PV-Systems
Oldenkamp, H.; de Jong, I.; Sinke, W. C.; 2002; 8 pp.
Report No.(s): PB2003-102656; Copyright; Avail: National Technical Information Service (NTIS)
In this paper a new concept for designing grid-connected PV-systems is presented: PV-wirefree, aiming at minimizing PV BOS costs Balance of System costs - and inherently safe PV-systems. The guiding design principles used are: minimize dc-voltage, minimize components and material, integrate functions, simplify the PV-system and design for easy installation.

Only one solution appeared to meet the goals: the PV-modules have to be connected in parallel to keep the dc-voltage as low as possible. The low dc-voltage also allows omitting many of the safety components used in series connected PV-system. To minimize the number of components even more two new PV-wirefree components are designed in which different functions are integrated. The most innovative new component is the PV-wirefree mounting bus, a current carrying mounting frame. So, a PV-wirefree system does not include expensive dc-wiring anymore, whereas the number of connectors is reduced considerably. In this paper the new PV-wirefree components are presented and safety issues related to paralleling PV-modules are discussed, as well as the additional advantages of PV-wirefree regarding reliability and efficiency.
NTIS
Design Analysis; Power Supplies; Electric Potential

20030036999 National Renewable Energy Lab., Golden, CO
What is the Appropriate Reference Spectrum for Characterizing Concentrator Cells
Emery, K.; Myers, D.; Kurtz, S.; May 2002; 12 pp.; In English
Report No.(s): DE2002-15000983; No Copyright; Avail: Department of Energy Information Bridge

This conference paper describes Consensus standards for determining the efficiency of a concentrator cell or module that have not been developed. NREL, Sandia National Laboratory, the Fraunhofer Institute for Solar Energy in Germany, and the Progress in Photovoltaics Efficiency Table authors have informally agreed upon concentrator-cell reference conditions. These conditions are 25 deg C cell temperature, 1-sun =1000 W/m2 total irradiance, and the ASTM E891-87 direct-normal reference spectrum. Deficiencies in the direct reference spectrum are discussed, and a more representative reference spectrum for evaluating concentrator cells is proposed. The spectrum was generated by the SMARTS model, and the atmospheric parameters are as close as possible to the existing direct spectrum, with the exception that the aerosol optical depth at 500 nm is reduced from 0.27 to 0.085.
NTIS
Concentrators; Solar Cells; Energy Technology; Spectrum Analysis

20030037000 National Renewable Energy Lab., Golden, CO
Proposed Reference Spectral Irradiance Standards to Improve Concentrating Photovoltaic System Design and Performance Evaluation
Myers, D. R.; Emery, K. E.; May 2002; In English
Report No.(s): DE2002-15000984; No Copyright; Avail: National Technical Information Service (NTIS)

This conference paper describes the American Society for Testing and Materials (ASTM), the International Electrotechnical Commission (IEC), and the International Standards Organization (ISO) standard solar terrestrial spectra (ASTM G-159, IEC-904-3, ISO 9845-1) provide standard spectra for photovoltaic performance applications. Modern terrestrial spectral radiation models and knowledge of atmospheric physics are applied to develop suggested revisions to update the reference spectra. We use a moderately complex radiative transfer model (SMARTS2) to produce the revised spectra. SMARTS2 has been validated against the complex MODTRAN radiative transfer code and spectral measurements. The model is proposed as an adjunct standard to reproduce the reference spectra. The proposed spectra represent typical clear sky spectral conditions associated with sites representing reasonable photovoltaic energy production and weathering and durability climates. The proposed spectra are under consideration by ASTM.
NTIS
Energy Conversion Efficiency; Photovoltaic Conversion; Solar Spectra; Atmospheric Physics; Solar Energy; Irradiance

20030037001 National Renewable Energy Lab., Golden, CO
Terrestrial Solar Spectral Modeling Tools and Applications for Photovoltaic Devices
Myers, D. R.; Emergy, K. E.; May 2002; In English
Report No.(s): DE2002-15000985; No Copyright; Avail: National Technical Information Service (NTIS)

This conference paper describes the variations in terrestrial spectral irradiance on photovoltaic devices can be an important consideration in photovoltaic device design and performance. This paper describes three available atmospheric transmission models, MODTRAN, SMARTS2, and SPCTRAL2. We describe the basics of their operation and performance, and applications in the photovoltaic community. Examples of model input and output data and comparisons between the model results for each under similar conditions are presented. The SMARTS2 model is shown to be much easier to use, as accurate

as the complex MODTRAN model, and more accurate than the historical NREL SPCTRAL2 model.
NTIS
Photovoltaic Conversion; Spectral Emission; Solar Spectra; Irradiance; Applications Programs (Computers); Atmospheric Models; Terrestrial Radiation

20030037004 National Renewable Energy Lab., Golden, CO
Identifying Critical Pathways to High Performance PV
Symko, M.; Noufi, R.; Kurtz, S.; May 2002; 12 pp.; In English
Report No.(s): DE2002-15000988; No Copyright; Avail: Department of Energy Information Bridge
The High-Performance Photovoltaic (HiPerf PV) Project was initiated by the U.S. Department of Energy to substantially increase the viability of photovoltaics (PV) for cost-competitive applications so that PV can contribute significantly to our energy supply and our environment in the 21st century. To accomplish this, the NCPV directs in-house and subcontracted research in high-performance polycrystalline thin-film and multijunction concentrator devices. Details of the subcontractor and in-house progress will be described toward identifying critical pathways of 25\% polycrystalline thin-film tandem cells and developing multijunction concentrator modules to 33\%.
NTIS
Photovoltaic Conversion; Energy Technology; Concentrators; Polycrystals

20030037008 National Renewable Energy Lab., Golden, CO
New Thin-Film CuGaSe(2) Cu(In,Ga)Se(2) Bifacial, Tandem Solar Cell with Both Junctions Formed Simultaneously
Young, D. L.; Abushama, J.; Noufi, R.; Li, X.; Keane, J.; May 2002; In English
Report No.(s): DE2002-15000989; No Copyright; Avail: National Technical Information Service (NTIS)
Thin films of CuGaSe2 and Cu(In,Ga)Se2 were evaporated by the 3-stage process onto opposite sides of a single piece of soda-lime glass, coated bifacially with an n +/-TCO. Junctions were formed simultaneously with each of the p-type absorbers by depositing thin films of n-CdS via chemical bath deposition (CBD) at 60 degrees C. The resulting four-terminal device is a non-mechanically stacked, two-junction tandem. The unique growth sequence protects the temperature-sensitive p/n junctions. The initial device (h = 3.7\%, Voc = 1.1 V (AM1.5)) suffered from low quantum efficiencies. Initial results are also presented from experiments with variations in growth sequence and back reflectors.
NTIS
High Temperature; Layers; Copper Alloys; Thin Films; Photovoltaic Effect; Solar Cells

20030037021 National Renewable Energy Lab., Golden, CO
Wind Powering America: Goals, Approach, Perspectives, and Prospects
Flowers, L. T.; Dougherty, P. J.; Mar. 2002; 12 pp.; In English
Report No.(s): DE2002-15002202; No Copyright; Avail: Department of Energy Information Bridge
While wind development activity in the USA has dramatically increased over the last 3 years, it has been mainly driven by policy mandates in the investor owned utility community. Also, while significant wind development has and is now occurring in the Northwest, the Great Plains, the Rocky Mountains, Texas, and several eastern states, there remain a number of states that have excellent resources that are essentially undeveloped. Additionally, the U.S. federal agencies represent the largest institutional load in the world, and thus are a potential large market for green (wind) energy. Rural America is economically stressed and traditional agricultural incomes are seriously threatened; wind development in these windy regions offers one of the most promising crops of the 21st century. Public power serves these communities, and local development of wind with low-cost financing appears to be competitive with new conventional fossil energy sources.
NTIS
Windpower Utilization; United States

20030037025 National Renewable Energy Lab., Golden, CO
Atmospheric Pressure Chemical Vapor Deposition and Jet Vapor Deposition of CdTe for High Efficiency Thin Film PV Devices
Woods, L.; Meyers, P.; Aug. 2002; In English
Report No.(s): DE2002-15002205; NREL/SR-520-32761; No Copyright; Avail: National Technical Information Service (NTIS)
ITN's three year project Atmospheric Pressure Chemical Vapor Deposition (APCVD) of CdTe for High Efficiency Thin

Film PV Devices has the overall objectives of improving thin film CdTe PV manufacturing technology and increasing CdTe PV device power conversion efficiency. CdTe deposition by APCVD employs the same reaction chemistry as has been used to deposit 16\% efficient CdTe PV films, i.e., close spaced sublimation, but employs forced convection rather than diffusion as a mechanism of mass transport. Tasks of the APCVD program center on demonstration of APCVD of CdTe films, discovery of fundamental mass transport parameters, application of established engineering principles to the deposition of CdTe films, and verification of reactor design principles which could be used to design high throughput, high yield manufacturing equipment. Additional tasks relate to improved device measurement and characterization procedures that can lead to a more fundamental understanding of CdTe PV device operation and ultimately to higher device conversion efficiency and greater stability. Under the APCVD program, device analysis goes beyond conventional one-dimensional device characterization and analysis toward two dimension measurements and modeling.
NTIS
Photovoltaic Cells; Semiconductors (Materials)

20030037029 National Renewable Energy Lab., Golden, CO, BP Solar, Fairfield, CA
Apollo (TRADEMARK) Thin Film Process Development: Final Technical Report
Cunningham, D. W.; Oct. 2002; In English
Report No.(s): DE2002-15002212; No Copyright; Avail: National Technical Information Service (NTIS)
The Thin Film PV Partnership program, subcontract ZAK-8-17619-27, was started in May 1998. This report describes the approach and findings of the work performed over this period. BP Solar first started investigative work on CdTe photovoltaic in 1986. The module product name chosen for the CdTe devices is Apollo. The deposition method chosen was electro-chemical deposition due to its simplicity and good control of stoichiometric composition. The window layer used is CdS produced from a chemical bath deposition. Initial work focused on increasing photovoltaic cell size from a few mm(sub 2) to 900 cm(sub 2). At BP Solar's Fairfield plant, work is focused on increasing semiconductor deposition to 1m(sub 2). The primary objective of this subcontract is to establish the conditions required for the efficient plating of CdS/CdTe on large area transparent conducting tin oxide coated glass superstrate.
NTIS

20030037030 National Renewable Energy Lab., Golden, CO, Colorado State Univ., Fort Collins
Surface Treatment of CuLnGaSe(2) Thin Films and Its Effect on the Photovoltaic Properties of Solar Cells
Ramanathan, K.; Hasoon, F. S.; Smith, S.; Young, D. L.; Contreras, M. A.; Oct. 2002; 14 pp.; In English
Report No.(s): DE2002-15002214; No Copyright; Avail: Department of Energy Information Bridge
No abstract available.
NTIS

20030037034 National Renewable Energy Lab., Golden, CO
Electrodeposition of Culn(1-X)Ga(X)Se(2) Materials for Solar Cells
Bhattacharya, R.; Fernandez, A. M.; Batchelor, W.; Alleman, J.; Keane, J.; Oct. 2002; In English
Report No.(s): DE2002-15002206; No Copyright; Avail: National Technical Information Service (NTIS)
This report will present and discuss the research performed during a 6-year period (4/24/95 to 12/31/01) under support of Contract FIA-95-1326 between NREL and Davis, Joseph & Negley. The total budget amount during this 6-year period was $737,942. The contract, Electrodeposition of Culn(1-X)Ga(X)Se(2) Materials for Solar Cells, was integrally linked with a much larger effort in CIGS at NREL supported by the DOE to develop the scientific understanding of this materials system, solar cells, and processes that can address the goals of the National Photovoltaics Program. Through DOE support, the investigators developed much of the technology and device fabrication infrastructure applied to electrodeposited (ED) materials.
NTIS
Cadmium Tellurides; Solar Cells

20030037064 General Atomics Co., San Diego, CA
Direct Energy Conversion Fission Reactor. Annual Report for the Period August 15, 2000 Through September 30, 2001
Brown, L. C.; Jan. 2002; In English
Report No.(s): DE2002-805252; No Copyright; Avail: National Technical Information Service (NTIS)
Sandia National Laboratories, Los Alamos National Laboratories, The University of Florida, Texas A&M University and

General Atomics have undertaken a joint project to explore the possibilities of exploiting direct energy conversion to increase the efficiency of electricity production from fission nuclear reactors. This report describes only the work performed at General Atomics during Phase 2 of this three-year project. Sandia National Laboratories leads the overall project and provides overall project reporting.
NTIS
Energy Conversion; Fission

20030037164 National Renewable Energy Lab., Golden, CO
Criteria for the Design of GaInP/GaAs/Ge Triple-Junction Cells top Optimize Their Performance
McMahon, W. E.; Kurtz, S.; Emery, K.; Young, M. S.; May 2002; 12 pp.; In English
Report No.(s): DE2002-15000997; No Copyright; Avail: Department of Energy Information Bridge

This conference paper investigates which reference spectrum should be used to design GaInP/GaAs/Ge triple-junction cells (at 300 K) in order to optimize their performance outdoors (at elevated temperatures). The outdoor performance is simulated using direct spectra from the recently proposed Module Energy Rating Procedure. We find that triple-junction cells designed for AM1.5D, low-AOD and AM1.5G standard spectra at 300 K all work well for maximizing daily energy production at elevated temperatures. AM1.5G cells are the best choice for midday power production, whereas AM1.5D cells are the best choice for power production during the morning and evening. Performance of cells optimized for a newly proposed Low-AOD spectrum is intermediate between these two extremes.
NTIS
Concentrators; Solar Collectors; Design Analysis

20030037166 Lawrence Livermore National Lab., Livermore, CA
Separation of Climate Signals
Fodor, I. K.; Kamath, C.; Nov. 13, 2002; In English
Report No.(s): DE2002-15002083; UCRL-ID-150775; No Copyright; Avail: National Technical Information Service (NTIS)

Understanding changes in global climate is a challenging scientific problem. Simulated and observed data include signals from many sources, and untangling their respective effects is difficult. In order to make meaningful comparisons between different models, and to understand human effects on global climate, we need to isolate the effects of different sources. Recent eruptions of the El Chichon and Mt. Pinatubo volcanoes coincided with large El Nino and Southern Oscillation (ENSO) events, which complicates the separation of their contributions on global temperatures. Current approaches for separating volcano and ENSO signals in global mean data involve parametric models and iterative techniques. We investigate alternative methods based on principal component analysis (PCA) and independent component analysis (ICA). Our goal is to determine if such techniques can automatically identify the signals corresponding to the different sources, without relying on parametric models.
NTIS
Signals; Climate Change

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20030034742 Utah State Univ., Logan, UT
Estimating Biogenic Non-Methane Hydrocarbon Emissions for the Wasatch Front Through a High-Resolution. Gridded, Biogenic Volatile Organic Compound Emissions Inventory
Oldham, Jeremy V.; Jan. 2002; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410695; CI02-812; No Copyright; Avail: CASI; A06, Hardcopy

During the summers of 2000, 2001, and 2002, monitoring sites along the Wasatch Front reported ground-level concentrations of ozone exceeding both the 1-hour and proposed 8-hour National Ambient Air Quality Standards. Reactive biogenic (natural) volatile organic compounds emitted from plants have been shown to have the potential to increase the formation of ozone and other photochemical products. In order to better estimate and spatially characterize the vegetative emissions of photochemically reactive hydrocarbons along the Wasatch Front, a high-resolution, 30-meter gridded biogenic emissions inventory was created for the Wasatch Front using remotely sensed data. Local vegetative survey information was used to help reduce some of the uncertainty in predicting plant species composition and frequency. Isoprene emissions

computed for the study area from the project's high-resolution gridded inventory were 65\% higher than isoprene estimates from the second version of the U.S. E.P.A's currently recommended inventory, Biogenic Emissions Landcover Database (BELD 2), while monoterpene and other reactive volatile organic compound emission rates were almost 26\% and 28\% lower, respectively. This high-resolution emissions inventory also characterized the spatial distribution of biogenic hydrocarbon emissions within the study area at a 30-meter resolution, whereas BELD 2 assumes homogenous, countywide emissions. This high-resolution model could potentially increase the accuracy of model predictions that utilize biogenic hydrocarbon emission estimates as input for air quality modeling and assist regulators in developing control strategies for ozone formation.
DTIC
Emission; High Resolution; Hydrocarbons; Volatile Organic Compounds; Air Quality; Biogeny; Environment Pollution

20030034877 Applied Research Associates, Inc., South Royalton, VT
Tomographic Site Characterization Using CPT, ERT, & GPR
Morey, R. M.; Conklin, S. M.; Farrington, S. P.; Shinn, J. D.; 2002; In English
Report No.(s): DE2002-773811; No Copyright; Avail: National Technical Information Service (NTIS)

The U.S. Department of Energy (DOE) is responsible for the cleanup of inactive DOE sites and for bringing DOE sites and facilities into compliance with federal, state, and local laws and regulations. The DOE's Office of Environmental Management (EM) needs advanced technologies that can make environmental restoration and waste management operations more efficient and less costly. These techniques are required to better characterize the physical, hydrogeological, and chemical properties of the subsurface while minimizing and optimizing the use of boreholes and monitoring wells. Today the cone penetrometer technique (CPT) is demonstrating the value of a minimally invasive deployment system for site characterization.
NTIS
Ground Penetrating Radar; Tomography; Drilling; Waste Management; Environmental Cleanup

20030036908 Lockheed Martin Hanford Corp., Richland, WA
Availability Analysis of the Ventilation Stack CAM Interlock System
Young, J.; 2002; 44 pp.; In English
Report No.(s): DE2002-801135; RPP-5453; No Copyright; Avail: Department of Energy Information Bridge

Ventilation Stack Continuous Air Monitor (CAM) Interlock System failure modes, failure frequencies and system availability have been evaluated for the RPP. The evaluation concludes that CAM availability is as high as assumed in the safety analysis and that the current routine system surveillance is adequate to maintain this availability. Further, requiring an alarm to actuate upon CAM failure is not necessary to maintain the availability credited in the safety analysis, nor is such an arrangement predicted to significantly improve system availability. However, if CAM failures were only detected by the 92-day functional tests required in the Authorization Basis (AB), CAM availability would be much less than that credited in the safety analysis. Therefore it is recommended that the current surveillance practice of daily simple system checks, 30-day source checks and 92-day functional tests be continued in order to maintain CAM availability.
NTIS
Air Sampling; Pollution Monitoring; Locking; Availability

20030036926 Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)
Computational Simulation of Aerosol Behaviour
Pyykoenen, J.; Mar. 2002; 234 pp.
Report No.(s): PB2003-101264; VTT-PUB-461; Copyright; Avail: National Technical Information Service (NTIS)

In this thesis, computational methods have been developed for the simulation of aerosol dynamics and transport. Two different coupled aerosol-computational fluid dynamics (CFD) models are discussed. One is a full Eulerian model and the other is a boundary layer-type steamtube model.
NTIS
Aerosols; Computational Fluid Dynamics

20030036930 Sonoma Technology, Inc., Petaluma, CA, Parsons Corp., Pasadena, CA, National Oceanic and Atmospheric Administration, Boulder, CO
Processing and Validation of Data Collected by RADAR Wind Profilers, Radio Acoustic Sounding Systems, and SODARS During the 1997 Southern California Ozone Study
MacDonald, C. P.; Nguyen, D. T.; Dye, T. S.; Barnett, A. N.; Knoderer, C. A.; May 2002; 112 pp.; In English
Report No.(s): PB2003-101389; No Copyright; Avail: CASI; A06, Hardcopy

This report provides a users' guide to the database of upper-air meteorological observations made during the 1997 Southern California Ozone Study, North American Research Strategies for Tropospheric Ozone (SCOS97-NARSTO). It describes quality assurance efforts and makes recommendations for futures studies.
NTIS
Meteorological Parameters; Ozone

20030036931 Pennsylvania State Univ., University Park. Dept. of Meteorology
Numerical and Analytical Investigation of Meteorological Characteristics Over the Northeastern USA during Episodes of Poor Air Quality
Seaman, N. L.; Michelson, S. A.; Stauffer, D. R.; Oct. 18, 2002; 236 pp.; In English
Report No.(s): PB2003-102409; No Copyright; Avail: CASI; A11, Hardcopy

The North American Research Strategy for Tropospheric Ozone (NARSTO) was established to develop the scientific basis for better understanding of the meteorological and chemical processes associated with high concentrations of ozone. In the summer of 1995, the NARSTO consortium conducted a field program in the Northeast U.S. to provide the observational data base necessary to better study the regional ozone problem. With support from the Coordinating Research Council (CRC) through contract A-12, Penn State University performed meteorological analysis and numerical modeling with the following objectives: (1) Identify the key meteorological structures over the Northeast U. S. that led to the most intense high-ozone episode of 1995 (the NARSTO episode of 12-15 July 1995), and (2) Assess the ability of a mesoscale numerical model (the Penn State/NCAR MM5) to simulate those structures, including an Appalachian Lee Trough (APLT) lying just east of the mountain chain.
NTIS
Data Bases; Appalachian Mountains (North America); Troughs; Troposphere; Ozone; Air Quality; Meteorology; Air Pollution

20030036935 Massachusetts Inst. of Tech., Cambridge
Remote Sensing Measurement of On-Road Heavy-Duty Diesel NOx and PM Emissions
Slott, R.; Jan. 2003; 100 pp.; In English
Report No.(s): PB2003-102410; CRC-633; No Copyright; Avail: CASI; A05, Hardcopy

This report summarizes the analysis of E-56 data obtained in Denver in February 2001 during a comparative test of two systems, one by Denver University and the other from Desert Research Institute, which were attempting to measure particles in vehicle exhaust plumes by remote sensing. The two systems, at their then current state of development, were, at best, only able to distinguish particle measurements from a diesel vehicle above 4 grams/kilogram of fuel from those below 2.5 grams/kilogram of fuel. In February 2001, these instruments were not ready for obtaining reliable remote sensing particulate emissions measurements from on-road vehicles.
NTIS
Colorado; Remote Sensing; Nitrogen Oxides; Particulates; Diesel Fuels; Exhaust Emission

20030036944 Swedish Environmental Research Inst., Stockholm
Effective Control Measures to Avoid Exposure to Isocyanates in Car Body Workshops
Antonsson, A. B.; Christensson, B.; Ancker, K.; Aug. 2002; 54 pp.; In Swedish
Report No.(s): PB2003-102620; IVL-B-1501; Copyright; Avail: National Technical Information Service (NTIS)

Isocyanates are chemical substances that may cause respiratory allergies even at very low concentrations. They are the most common cause of work-related allergies. Therefore it is important to avoid exposure to isocyanates and undertake control measures in such environments where exposure may occur. A series of effective control measures to avoid exposure to isocyanates are recommended. They are based on measurements of exposure to isocyanates and amines (which frequently occur together with isocyanates) during typical operations in car body workshops. Measurements, tests and evaluations have also been made of different control measures.
NTIS
Occupational Diseases; Isocyanates; Toxic Hazards; Air Pollution; Pollution Control

20030036945 International Climate Change Partnership, Arlington, VA
Incorporating Climate Change into Corporate Business Strategies: Conference Proceedings
Dec. 31, 1997; 200 pp.; In English
Report No.(s): PB2003-102414; CONF-970687--PROC; DE98003129; No Copyright; Avail: CASI; A09, Hardcopy

The conference participants included more than one hundred experts in the fields of climate change, public policy and industry to share their knowledge and insights as speakers. The timing of the conference was very appropriate as efforts proceed at the international level to develop a protocol or other legal instrument to address the increase of greenhouse gas emissions. Increasingly, policymakers will turn to the private sector to expand the development and dissemination of technologies that reduce the threat of global climate change. The conference offered an opportunity to discuss the policies, both existing and proposed, which address global climate change, as well as policies that may inhibit technology dissemination and enhancement. Various industry sectors had the opportunity to discuss the issues concerning their industries. These sessions focused primarily on five sectors including energy supply and electricity generation, buildings and energy efficiency, transportation, forestry and agriculture, and industrial.
NTIS
Climate Change; Forest Management; Exhaust Emission; Exhaust Gases; Climatology

20030036981 National Governors' Association, Washington, DC
Growing with Less Greenhouse Gases: State Growth Management Policies that Reduce GHG Emissions
2002; 36 pp.
Report No.(s): PB2003-102669; No Copyright; Avail: CASI; A03, Hardcopy
Communities are grappling with the good and bad of growth. Growth is the engine of prosperity, but maintaining a good quality of life in a growing community can be challenging. Growth increasingly produces traffic congestion, greater demand on resources, loss of green space, and other undesirable consequences. By properly managing growth, communities can reduce the negative effects of expansion while still reaping its benefits. Although not always identified as a benefit, common-sense growth policies can reduce greenhouse gas (GHG) emissions. In fact, a well-designed community can reduce emissions without having to implement expensive regulations or programs. This added benefit of growth management makes 'smart growth' an even more attractive policy alternative. Three growth strategies are helping to curb GHG emissions: expanding transportation choices, conserving green spaces, and designing communities that place less demand on energy production and infrastructure.
NTIS
Greenhouse Effect; Exhaust Gases

20030037014 Lawrence Livermore National Lab., Livermore, CA
Studies of Corrosion Resistant Materials being Considered for High-Level Nuclear Waste Containment in Yucca Mountain Relevant Environments
McCright, R. D.; IIevbare, G.; Estill, J.; Rebak, R.; Dec. 09, 2001; 26 pp.; In English
Report No.(s): DE2002-803181; UCRL-JC-148771; No Copyright; Avail: Department of Energy Information Bridge
Containment of spent nuclear fuel and vitrified forms of high level nuclear waste require use of materials that are highly corrosion resistant to all of the anticipated environmental scenarios that can occur in a geological repository. Ni-Cr-Mo Alloy 22 (UNS N60622) is proposed for the corrosion resistant outer barrier of a two-layer waste package container at the potential repository site at Yucca Mountain. A range of water compositions that may contact the outer barrier is under consideration, and a testing program is underway to characterize the forms of corrosion and to quantify the corrosion rates. Results from the testing support models for long term prediction of the performance of the container. Results obtained to date indicate a very low general corrosion rate for Alloy 22 and very high resistance to all forms of localized and environmentally assisted cracking in environments tested to date.
NTIS
Corrosion Resistance; Materials Tests; Radioactive Wastes

20030037023 National Renewable Energy Lab., Golden, CO, Energy and Environmental Analysis, Inc., Arlington, VA, Distributed Utility Associates, Livermore, CA, Competitive Utility Strategies, Boulder, CO
Impact of Air Quality Regulations on Distributed Generation
Bluestein, J.; Horgan, S.; Eldride, M. M.; Oct. 2002; In English
Report No.(s): DE2002-15002200; No Copyright; Avail: National Technical Information Service (NTIS)
Relatively small projects for generating electrical power at or near the point of use--distributed generation (DG)--offer unique opportunities for enhancing the U.S. electric system. This report finds that current air quality regulatory practices are inappropriately inhibiting the development of DG through a failure to recognize the environmental benefits offered by DG or by imposing requirements designed for larger systems that are not appropriate to DG systems. The report recommends that

air quality regulation be made more efficient and appropriate for DG by establishing national standards for DG equipment. NTIS

Electric Generators; Air Quality; Electric Power; Air Pollution; Regulations

20030037095 Lawrence Livermore National Lab., Livermore, CA

Autonomous Pathogen Detection System FY 02 Annual Progress Report

Colston, B.; Brown, S.; Burris, K.; Elkin, C.; Hindson, B.; Nov. 11, 2002; 10 pp.

Report No.(s): DE2002-15002220; UCRL-ID-144275-02; No Copyright; Avail: Department of Energy Information Bridge

The objective of this project is to design, fabricate and field demonstrate a biological agent detection and identification capability, the Autonomous Pathogen Detector System (APDS). Integrating a flow cytometer and real-time polymerase chain reaction (PCR) detector with sample collection, sample preparation and fluidics will provide a compact, autonomously operating instrument capable of simultaneously detecting multiple pathogens and/or toxins. The APDS will operate in fixed locations, continuously monitoring air samples and automatically reporting the presence of specific biological agents. The APDS will utilize both multiplex immunoassays and nucleic acid assays to provide quasi-orthogonal multiple agent detection approaches to minimize false positives and increase the reliability of identification. Technical advances across several fronts must occur, however, to realize the full extent of the APDS. The end goal of a commercially available system for civilian biological weapon defense will be accomplished through three progressive generations of APDS instruments. The APDS is targeted for civilian applications in which the public is at high risk of exposure to covert releases of bioagent, such as major subway systems and other transportation terminals, large office complexes and convention centers. APDS is also designed to be part of a monitoring network of sensors integrated with command and control systems for wide-area monitoring of urban areas and major public gatherings.

NTIS

Pathogens; Detection; Autonomy

20030037104 Department of Energy, Washington, DC

Radioactive Air Emissions Notice of Construction Application for the Waste Receiving and Processing Facility

Dec. 19, 2000; 74 pp.; In English

Report No.(s): DE2002-805620; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

NTIS

Construction; Waste Treatment; Facilities; Air Pollution; Emission

20030037111 Department of Energy, Richland, WA

Environmental Management Performance Report December 1999

2000; 154 pp.; In English

Report No.(s): DE2002-801306; OE/RL-99-83; No Copyright; Avail: Department of Energy Information Bridge

This is a report of the Project Hanford Management Contractor's (PHMC) Environmental Management (EM) performance by Fluor Hanford (FH) and its subcontractors. Provided are detailed performance data relative to each individual mission area (e.g., Waste Management, Spent Nuclear Fuels, etc,).

NTIS

Environment Management; Hazardous Wastes; Waste Management

20030037114 Environmental Protection Agency, Washington, DC

National Emission Standards for Hazardous Air Pollutants for Source Category: Pulp and Paper Production Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards: Pulp, Paper, and Paperboard Category. 40 CFR Part

Oct. 1997; 680 pp.; In English

Report No.(s): PB2003-101563; EPA-821-R-97-019; No Copyright; Avail: CASI; A99, Hardcopy

This action promulgates effluent limitations guidelines and standards under the Clean Water Act (CWA) for a portion of the pulp, paper, and paperboard industry, and national emission standards for hazardous air pollutants (NESHAP) under the Clean Air Act (CAA) as amended in 1990 for the pulp and paper production source category.

NTIS

Effluents; Pollution Control; Air Quality; Standards

20030037118 Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering

Diesel Aerosol Sampling Methodology (CRC-E-43)

Kittelson, D.; Watts, W.; Johnson, J.; Aug. 19, 2002; In English

Report No.(s): PB2003-102419; No Copyright; Avail: National Technical Information Service (NTIS)

The University of Minnesota and research partners West Virginia University, Carnegie Mellon University, Tampere University, Paul Scherrer Institute, University of California at Riverside, Caterpillar, Inc., and Cummins, Inc. undertook the study titled Diesel Aerosol Sampling Methodology to sample, characterize and quantify particles in Diesel exhaust. The goal of this project (E-43) was to develop Diesel aerosol sampling methods for the laboratory that would produce particle size distributions similar to those obtained under real-world roadway conditions. The study was carried out at four locations with measurements on four test trucks powered by Caterpillar and Cummins engines and several engines installed on engine dynamometers. Standard certification (EPA) and market basket blends of California fuels (CA fuel) were used for all tests. A mobile laboratory was built and used to conduct onroad, chase studies, and a wind tunnel study was carried out at the Langley Wind Tunnel in Langley, Virginia. Engine and chassis dynamometer laboratory studies were carried out at Caterpillar, Cummins, and at the University of Minnesota.

NTIS

Exhaust Emission; Diesel Engines; Air Sampling; Aerosols

20030037124 Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering, Paul Scherrer Inst., Villigen (Switzerland), Tampere Univ. (Finland)

Diesel Aerosol Sampling Methodology (CRC-E-43) Caterpillar Data Report

Kittelson, D.; Watts, W.; Johnson, J.; Ristimaeki, J.; Drayton, M.; Oct. 14, 2002; In English

Report No.(s): PB2003-102420; No Copyright; Avail: National Technical Information Service (NTIS)

The University of Minnesota formed an international research team to conduct the CRC E-43 project Diesel Aerosol Sampling Methodology. The objectives of the E-43 project were: 1. Determine the actual particle size distribution and particle number concentration in the exhaust plume from heavy-duty diesel vehicles operated on the road. 2. Compare on-road aerosol data with data generated in emissions test facilities to determine if current emission test facility sampling and analysis methods are adequate for characterizing particle size observed on the road. 3. Examine particle transformations as the plume disperses downwind of the roadway in a typical urban situation. 4. Characterize the bulk diesel particulate matter chemical composition and to determine surface properties and composition. The goal of E-43 was to develop diesel aerosol sampling methods for the laboratory that would produce results similar to those obtained under real- world roadway conditions. As part of E-43, a field study was carried out using two test trucks powered by Caterpillar engines, a 3406C and a 3406E. A central goal of the E-43 project was to recommend methods and procedures that when used in the laboratory would improve the simulation of on-road exhaust aerosol sampling. Detailed recommendations are made in the E-43 Final Report along with a discussion of the theory behind nanoparticle formation and growth.

NTIS

Aerosols; Exhaust Gases; Nanoparticles; Air Pollution; Methodology; Air Sampling; Diesel Fuels

20030037141 Pacific Northwest National Lab., Richland, WA

Assessment of Unabated Facility Emission Potentials for Evaluating Airborne Radionuclide Monitoring Requirements at Pacific Northwest National Laboratory, 1999

Sep. 1999; 40 pp.; In English

Report No.(s): DE2002-15001488; No Copyright; Avail: Department of Energy Information Bridge

Assessments were performed to evaluate compliance with the airborne radionuclide emission monitoring requirements in the National Emission Standards for Hazardous Air Pollutants. In these assessments, potential unabated offsite doses were evaluated for emission locations at facilities owned by the U.S. Department of Energy and operated by Pacific Northwest National Laboratory (pacific Northwest) on the Hanford Site. Two of the facilities evaluated, 325 Building Radiochemical Processing Laboratory, and 331 Building Life Sciences Laboratory met state and federal criteria for continuous sampling of airborne radionuclide emissions. One other building, the 3720 Environmental Sciences Laboratory, was recognized as being in transition with the potential for meeting the continuous sampling criteria.

NTIS

Radioactive Contaminants; Aerosols; Air Pollution; Pollution Monitoring

20030037149 Environmental Protection Agency, Washington, DC

Indoor Air Quality Tools for Schools Program: Benefits of Improving Air Quality in the School Environment

2002; 22 pp.

Report No.(s): PB2003-102736; No Copyright; Avail: CASI; A03, Hardcopy

Indoor air quality (IAQ) is increasingly an important issue in our nation's schools. Approximately 20 percent of the U.S. population- nearly 55 million people-spend their days inside elementary and secondary schools. In 1999, indoor air quality (IAQ) was reported to be unsatisfactory in about one in five public schools in the USA, while ventilation was reported as unsatisfactory in about one-quarter of public schools, according to the National Center for Education Statistics of the Department of Education. The health of students and staff in these schools is a cause for great concern, particularly the negative effects of poor IAQ on asthma and other respiratory illnesses. The U.S. Environmental Protection Agency (EPA) developed the Indoor Air Quality Tools for Schools (IAQ TfS) Program to help schools prevent, identify, and resolve their IAQ problems. Through simple, low-cost measures, schools can: Reduce IAQ-related health risks and triggers for asthma; Identify sources of mold; Improve comfort and performance levels; Avoid costly repairs; Avoid negative publicity and loss of parent and community trust; and Avoid liability problems.

NTIS

Air Quality; Schools; Indoor Air Pollution; Environmental Quality

20030037152 Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering, Cummins Engine Co., Inc., Columbus, IN, California Univ., Davis

Diesel Aerosol Sampling Methodology (CRC-E-43) Cummins Final Report

Oct. 14, 2002; In English

Report No.(s): PB2003-102761; CRC-E-43-CUMMINS; No Copyright; Avail: National Technical Information Service (NTIS)

The University of Minnesota formed an international research team to conduct the CRC E-43 project, titled 'Diesel Aerosol Sampling Methodology'. The objectives of the E-43 project were: To determine the actual particle size distribution and particle number concentration in the exhaust plume from heavy-duty Diesel vehicles operated on the road; to compare on-road aerosol data with data generated in emissions test facilities to determine if current emission test facility sampling and analysis methods are adequate for characterizing particle size observed on the road; to examine particle transformations as the plume disperses downwind of the roadway in a typical urban situation; and to characterize the bulk Diesel particulate matter chemical composition and to determine surface properties and composition. The goal of the E-43 project was to develop laboratory methods to measure Diesel aerosol size that would mimic results obtained under real-world roadway conditions. To accomplish this goal, a fundamental understanding of aerosol formation, trans formation and measurement, and the physical processes that affect the size distribution, such as dilution, nucleation, condensation, adsorption and coagulation was required. The University of Minnesota formed a research team that measured and characterized Diesel aerosol on the roadway and in the laboratory to try and establish a link between aerosol size characteristics measured on the roadway under real- world conditions and those measured in the laboratory.

NTIS

Aerosols; Air Sampling; Exhaust Gases

20030037153 Carnegie-Mellon Univ., Pittsburgh, PA

Lifetimes of Ultrafine Diesel Aerosol

Capaldo, K.; Pandis, S.; Dec. 01, 2001; In English

Report No.(s): PB2003-102763; No Copyright; Avail: National Technical Information Service (NTIS)

The University of Minnesota (UMN) group measured the aerosol size distributions in the plume of diesel trucks under realistic on-road driving conditions. During a typical test, the UMN mobile lab followed a truck (e.g., truck 61) at a distance ranging from 15 to 60 m from the back of the cab or trailer depending upon the specific test condition. The sampling boom of the lab was kept in the truck plume and bag samples were collected for analysis by the Scanning Mobility Particle Spectrometer (SMPS). Tests were conducted at idle, 55-mph, 40-55 mph acceleration, and 55-45 mph deceleration. For the cruise, acceleration and deceleration the tests were conducted when the truck was configured with and without load. For all conditions two fuels were evaluated: a market basket blend California fuel and an EPA certification fuel.

NTIS

Aerosols; Fuels; Diesel Engines

20030037155 Environmental Protection Agency, Ann Arbor, MI, Minnesota Univ., Minneapolis. Particle Technology Lab
CRC E-43 Final QA Audit (Addendum to Final QA Report)
Cantrell, B.; Ayala, A.; Olson, B.; Oct. 2002; In English
Report No.(s): PB2003-102769; No Copyright; Avail: National Technical Information Service (NTIS)

During the final QA audit for Project E-43, the QA team conducted an in-depth survey of the project database. In addition to critiquing the QA protocols used for data acceptance, reduction, and incorporation into the database, an assessment of project results is also provided. The latter includes validation of results produced in this study and verification that these results are usable in meeting project objectives and goals. In the following audit report, deficiencies noted during the audit are flagged by enclosing them in a text box. The audit revealed that some of the aerosol number concentration and size distribution data accepted as valid for inclusion in the database, and the results of analysis of that data, as reported, should be considered as qualitatively valid.
NTIS
Quality Control; Aerosols

20030037156 Statewide Air Pollution Research Center, Riverside, CA
Chemical Analysis of Diesel Nanoparticles Using a Nano-DMA/Thermal Desorption Particle Beam Mass Spectrometer. Final Report for Phase 1
Zuenann, P. J.; Oct. 17, 2000; 44 pp.; In English
Report No.(s): PB2003-102766; No Copyright; Avail: CASI; A03, Hardcopy

The primary objective of Phase 1 was to evaluate the use the Nano-DMA/TDPBMS to obtain information on the chemical composition of diesel nanoparticles formed under various engine operating conditions. The studies were carried out at UMNCDR. The focus was on the chemistry of nucleationmode particles, but larger particles were also analyzed for comparison. The goal was to use the composition data in conjunction with measured particle physical properties (e.g., size, concentration, etc.) to develop an understanding of the chemical mechanisms by which nanoparticles are formed in diesel exhaust. Such knowledge could aid in determining modifications in engine design, operation, fuel, lubricating oil, or after-treatment that might be made in order to ameliorate the problem of nanoparticle formation.
NTIS
Chemical Analysis; Exhaust Emission; Mass Spectrometers; Engine Design; Exhaust Gases

20030037160 West Virginia Univ., Morgantown, Desert Research Inst., Reno, NV, Old Dominion Univ., Norfolk, VA
Diesel Particulate Sampling Methodology (Langley Wind Tunnel Research)
Clark, N. N.; Gautam, M.; Lyons, D. W.; Ayala, A.; 2002; In English
Report No.(s): PB2003-102765; CRC-E-43-WVU; No Copyright; Avail: National Technical Information Service (NTIS)

Concern over health effects associated with diesel exhaust and debate over the influence of high number counts of particles in diesel exhaust prompted a study (E-43) of methodology for diesel particulate matter (PM) characterization. As part of this program, a tractor truck with an electronically managed diesel engine was installed on a dynamometer in the Old Dominion University (ODU) Langley full-scale wind tunnel. This arrangement permitted repeat measurements of diesel exhaust under realistic and reproducible conditions and permitted examination of the steady exhaust plume at multiple points. Background particle size distribution was characterized using a Scanning Mobility Particle Sizer (SMPS). In addition, a remote sampling system consisting of a SMPS, PM filter arrangement, and carbon dioxide (CO2) analyzer was attached to a roving gantry that allowed for exhaust plume sampling in a three dimensional grid. Raw exhaust CO2 levels were also measured in the vehicles exhaust stack. The plume centerline was mapped and dilution ratios were determined and mapped.
NTIS
Particulates; Wind Tunnel Tests; Diesel Fuels; Exhaust Emission; Trucks; Air Pollution; Pollution Monitoring; Air Sampling

20030037162 Environmental Protection Agency, Research Triangle Park, NC
Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: Interim Report including Errata dated 03-21-2002
Kilgroe, J. D.; Sedman, C. B.; Srivastava, R. K.; Ryan, J. V.; Lee, C. W.; Apr. 2002; 46 pp.; In English
Report No.(s): PB2003-102793; EPA/600/R-01/109; No Copyright; Avail: CASI; A03, Hardcopy

In December 2000, the U.S. Environmental Protection Agency (USEPA) announced its intent to regulate mercury emissions from coal-fired electric utility steam generating plants. This report, produced by EPA's Office of Research and Development (ORD), National Risk Management Research Laboratory (NRMRL), provides additional information on

mercury emissions control, following the release of 'Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Plants - Final Report to Congress,' in February 1998. The first three chapters describe EPA's December 2000 decision to regulate mercury under the National Emission Standards for Hazardous Air Pollutants (NESHAP) provisions of the Clean Air Act, coal use in electric power generation, and mercury behavior in coal combustion. Chapters 4-9 report: new information on current electric utility fuels, boilers, and emission control technologies; mercury emissions associated with these diverse technology combinations; results and implications of tests to evaluate the performance of mercury control technologies and strategies; retrofit control cost modeling; and mercury behavior in solid residues from coal combustion. The final chapter summarizes current research and identifies future efforts needed to ensure cost-effective control of mercury emissions. References are provided at the conclusion of each chapter.
NTIS
Research And Development; Boilers; Exhaust Emission

20030037448 Environmental Protection Agency, Cincinnati, OH
Selected Office of Water Methods and Guidance, Version 2, and Guidance for the Analysis of Water (on CD-ROM with search & retrieval software)
Jun. 2002; In English
Report No.(s): PB2002-500075; No Copyright; Avail: National Technical Information Service (NTIS)

The Selected Office of Water Methods and Guidance CD-ROM includes recently developed and frequently requested analytical methods and related guidance, including methods for the detection of trace metals, microbiological contaminants, and organics in wastewater and drinking water, chemical and biological methods for biosolids, guidance documents on Office of Water's (OW) revised approach to method approval, whole affluent toxicity testing, and oil and grease analysis. Version 2.0 of this popular CD-ROM lets you search, print and display the full text of more than 500 EPA wastewater and drinking water methods and guidance documents. Additionally, the CD-ROM contains the full text of all EPA methods approved for compliance monitoring at 40 Code of Federal Regulations (CFR) part 136 and 141 including the 500-, 600- and 1600-series methods and a complete version of the March 1983 revision of Methods for Chemical Analysis of Water and Waste (MCAWW). For the first time, the Office of Water CD-ROM identifies which methods are approved at 40 CFR parts 136 and 141 for wastewater and drinking water compliance monitoring. The EPA Methods and Guidance for the Analysis of Water CD-Rom, version 2.0, includes the full text of newly developed EPA wastewater and drinking water methods and guidance documents. Additionally, the CD contains tables detailing what methods are approved at 40 CFR part 136 and 141. For the first time, the Office of Water CD includes links tables based on those in the Code of Federal Regulations (CFR) listing which methods are approved for wastewater and drinking water compliance monitoring. Accessing approved EPA water test methods has never been easier. To find which methods are approved an an analyte of interest, simply click on the tables of approved methods button and search by analyte. Then click on the EPA method number listed for that analyte to instantly access the full text of approved methods listed at 40 CFR parts 136 and 141. Software includes a powerful text search engine to allow searches by method number, analyte name, and key words. All methods, guidance documents, and graphics have been converted to Adobe Acrobat8 Portable Document Format (PDF) to ensure efficient text searches.
NTIS
Procedures; Methodology; Water Pollution; Water Sampling; Pollution Monitoring; Chemical Analysis

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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*.

20030032282 NASA Goddard Space Flight Center, Greenbelt, MD, USA
X-Ray Fluctuation Power Spectral Densities of Seyfert 1 Galaxies
Markowitz, A.; Edelson, R.; Vaughan, S.; Uttley, P.; George, I. M.; Griffiths, R. E.; Kaspi, S.; Lawrence, A.; McHandy, I.; Nandra, K., et al.; [2003]; 26 pp.; In English
Contract(s)/Grant(s): NAG5-7385; NAG5-7067; NAG5-9023; NAG 5-9902; Copyright; Avail: CASI; A03, Hardcopy

By combining complementary monitoring observations spanning long, medium and short time scales, we have constructed power spectral densities (PSDs) of six Seyfert 1 galaxies. These PSDs span approx. greater than 4 orders of magnitude in temporal frequency, sampling variations on time scales ranging from tens of minutes to over a year. In at least four cases, the PSD shows a 'break,' a significant departure from a power law, typically on time scales of order a few days.

This is similar to the behavior of Galactic X-ray binaries (XRBs), lower mass compact systems with breaks on time scales of seconds. NGC 3783 shows tentative evidence for a doubly-broken power law, a feature that until now has only been seen in the (much better-defined) PSDs of low-state XRBs. It is also interesting that (when one previously-observed object is added to make a small sample of seven), an apparently significant correlation is seen between the break time scale T and the putative black hole mass M(sub BH), while none is seen between break time scale and luminosity. The data are consistent with the linear relation T = M(sub BH) /10(exp 6.5) solar mass; extrapolation over 6-7 orders of magnitude is in reasonable agreement with XRBs. All of this strengthens the case for a physical similarity between Seyfert 1s and XRBs.
Author
X Rays; Seyfert Galaxies; Spectra; Radiant Flux Density

20030032286 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Overview of the Upper Atmosphere Research Satellite: Observations from 1991 to 2002
Jackman, Charles H.; Douglass, Anne R.; [2003]; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The Upper Atmosphere Research Satellite (UARS) was launched in September 1991 by the Space Shuttle Discovery and continues to make relevant atmospheric measurements (as of October 2002). This successful satellite has fostered a better understanding of the middle atmospheric processes, especially those important in the control of ozone. Seven of the original ten instruments aboard the UARS are still functional and six instruments regularly make measurements. The UARS is in a stable observing configuration, in spite of experiencing several anomalies over its lifetime. It is expected that the UARS will overlap the Earth Observing System (EOS) Aura satellite (scheduled launch in January 2004) for several months before the end of the UARS mission.
Author
Upper Atmosphere Research Satellite (Uars); Satellite Instruments; Earth Atmosphere; Geophysics; Space Missions; General Overviews

20030032292 NASA Glenn Research Center, Cleveland, OH, USA
ISS FPP Ionospheric Electron Density and Temperature Measurements: Results, Comparison with the IRI-90 Model, and Implications for ISS Charging
Ferguson, D. C.; Hillard, G. B.; Morton, T. L.; Personen, R.; [2003]; 17 pp.; In English; AIAA ASME 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-755-04-04
Report No.(s): AIAA Paper 2003-1083; Copyright; Avail: CASI; A03, Hardcopy

We give measurement results of electron temperature and electron density from the Floating Potential Probe (FPP) on the International Space Station (ISS), and relate them to the electron current collection of the ISS solar arrays and the degree of charging of ISS when its Plasma Contacting Units (PCUs) are not operating. We show that on days of high solar activity index Kp, high levels of ISS charging are significantly more probable than on days of low solar activity, due to some abnormally low morning electron temperatures. Although the FPP electron temperatures measured are almost always higher than predicted by the International Reference Ionosphere 90 model (IRI-90), it is shown that the CHAMP satellite Langmuir Probe (PLP) also shows low dawn electron temperatures on the same day as those found by FPP. It is further shown that similar high levels of predicted charging, accompanied by vxB charging on the ISS structure, could exceed the -40 V specification on ISS charging, and could be dangerous to ISS astronauts if the PCUs fail to operate.
Author
Temperature Measurement; Electron Energy; Solar Activity; Ionospheric Electron Density

20030032305 National Optical Astronomy Observatories, Tucson, AZ, USA
NOAO Newsletter, No. 73
Isbell, Doug, Editor; Bell, Dave, Editor; vanderBliek, Nicole, Editor; Green Richard, Editor; Hinkle, Ken, Editor; Leibacher, John, Editor; Piano, Priscilla, Editor; March 2003; 45 pp.; In English; Original contains color illustrations; Copyright; Avail: Other Sources

Observers using the Mosaic II imager on the Blanco 4-m 0 have reported the discovery of what may be dozens of bright proplyds and dark silhouette disks within the hostile environment of the Carina Nebula. Both proplyds and silhouette disks are generally recognized to be circumstellar matter surrounding young stars that is rendered visible by ionizing photons from nearby hot stars. As their name suggests, silhouette disks are seen in absorption against bright-background line emission from an HII region. In the case of the proplyds, the circumstellar material is itself lit up as it is ionized by photons from the hot

star. Proplyds are, thus, sources of bright line emission. The name proplyd is derived from the likelihood that the circumstellar material harbors a protoplanetary disk.
Derived from text
H Ii Regions; Hot Stars; Nebulae; Protoplanetary Disks

20030032335 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Ozone and UV-B Radiation Observations at the Andes Mountains
Guarnieri, Fernando Luis; 2003; 118 pp.; In Portuguese; Original contains color illustrations
Report No.(s): INPE-9552-TDI/828; Copyright; Avail: CASI; A06, Hardcopy

The region of La Paz, Bolivia (68,03 W, 16,52 S) located at an altitude of 3420m, has favorable features to study the altitude effects on total ozone and UV-B radiation. Ozone data from a Brewer Spectrophotometer, from the TOMS Spectrometer and ozone soundings at three locations (La Paz, Cuiaba and Natal) were used to compare the ozone layer at the Bolivian Andes region with results from Cuiab and Natal, in Brazil. The average vertical ozone profile for La Paz and Cuiaba were determined and compared with the Natal ozone profile. The results from this analysis show the altitude effect on the ozone column observed by TOMS and confirmed by ozone soundings at La Paz, where a mean reduction of 7,7UD is observed, comparing with Cuiaba. Analysis of direct ultraviolet radiation shows high values of the La Paz Natal ratio, with 2,37 for 306nm and 1,94 for 320nm, showing that La Paz presents values of direct UV radiation higher than Natal. A significant part of this increase in UV-B radiation at La Paz results from Rayleigh scattering decrease, due to a thinner atmosphere.
Author
Andes Mountains (South America); Ozone; Ultraviolet Radiation; Observation; Spectrophotometers

20030032383 Army Cold Regions Research and Engineering Lab., Hanover, NH
Mechanical System Simulations for Seismic Signature Modeling
Lacombe, J.; Moran, M.; Harjes, D.; Oct. 2001; ISBN0309084997; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410109; No Copyright; Avail: CASI; A03, Hardcopy

In this paper we present seismic signature simulations using ground vibration inputs from high-fidelity 3-D mechanical system models. Results for an M1A1 and T72 are discussed. By analyzing the simulated seismic signature data in conjunction with the spectral features associated with the vibrations of specific vehicle sprung and un-sprung components we are able to make unambiguous associations of seismic signal features with suspension elements, offering valuable insight into target classification. The development of a utility ('Tankmod') to streamline creation of DADS tracked vehicle dynamic models for generating seismic signals was reported in 2000. A model of an M1A1 tank created using Tankmod was described. During the past year, two new models were created: a T72 tank and a BMP-2 armored personnel carrier. In addition, an improved vehicle speed/steer controller was developed. The new controller maintains realistic vehicle behavior by properly limiting drive sprocket torques and sprocket rotation for skid steering. Model inputs used in seismic signature modeling are in the form of time series of ground reaction force and absolute position for each track block.
DTIC
Dynamic Models; Tracked Vehicles; Acoustic Simulation; Spectral Signatures

20030032410 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Magnetospheric Constellation Mission (MC-DRACO)
Moore, Thomas E.; [2003]; 17 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Magnetospheric Constellation Mission Dynamic Response and Coupling Observatory (MC-DRACO), the logical outgrowth of a sequence of STP missions, will explore plasma transport and energy conversion processes over a broad range of spatial sizes. Designed to be a meso-/macroscope for the magnetotail, it will resolve persistent controversies and yield a new understanding on which to build a predictive science of next generation magnetospheric meteorology.
Derived from text
Satellite Constellations; Earth Magnetosphere; Scientific Satellites

20030032487 NASA Goddard Space Flight Center, Greenbelt, MD, USA
International Laser Ranging Services (ILRS) 2001 Annual Report
Pearlman, Michael, Editor; Torrence, Mark, Editor; Noll, Carey, Editor; June 2002; 179 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TP-2002-211610; NAS 1.60-211610; Rept-2003-00851-0; No Copyright; Avail: CASI; A09, Hardcopy

This 2001 Annual Report of the International Laser Ranging Services (ILRS) is comprised of individual contributions from ILRS components within the international geodetic community. This report documents the work of the ILRS components for the year 2001. The report documents changes and progress of the ILRS. This document is also available on the ILRS Web site at http://ilrs.gsfc.nasa.gov/reports/ilrs_reports/ilrsar_2001.html.
Author
Laser Ranging; Geophysics; Geodynamics; Geodesy; Research Facilities; Project Management; Data Management

20030032516 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Global Projection of Rangel: A Projection System of Terrestrial Globe on an Ellipsoid
Rangle, Ricardo Rodriques; 2003; 212 pp.; In Portuguese; Original contains black and white illustrations
Report No.(s): INPE-9559-TDI/834; Copyright; Avail: CASI; A10, Hardcopy

This work proposes a new mathematical methodology to represent the terrestrial global on an ellipsoid, capable of offering equations for dealing geodetic positions, geo-reference, and distance and bearings determination, with variable precision and continuity of information in whole ellipsoid. The study has been developed with the intention of creating a projection mechanism, in three dimensions, able to reduce or eliminate all found limitations in actual cartographic projection systems, as Universal Transverse of Mercator and Conical of Lambert. All mathematical equations have been implemented and tested in computational environment.
Author
Numerical Analysis; Mercator Projection; Terrestrial Planets; Geodetic Coordinates; Distance

20030032518 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Atmospheric Pressure Corrections In Geodesy and Oceanography: A Strategy For Handling Air Tides
Ponte, Rui M.; Ray, Richard D., Americ; Geophysical Research Letters; January 2003; ISSN 0094-8276, pp. 1-3; In English; Original contains black and white illustrations
Contract(s)/Grant(s): Proj-1206432; Copyright; Avail: Other Sources

Global pressure data are often needed for processing or interpreting modern geodetic and oceanographic measurements. The most common source of these data is the analysis or reanalysis products of various meteorological centers. Tidal signals in these products can be problematic for several reasons, including potentially aliased sampling of the semidiurnal solar tide as well as the presence of various modeling or timing errors. Building on the work of Van den Dool and colleagues, we lay out a strategy for handling atmospheric tides in (re)analysis data. The procedure also offers a method to account for ocean loading corrections in satellite altimeter data that are consistent with standard ocean-tide corrections. The proposed strategy has immediate application to the on-going Jason-1 and GRACE satellite missions.
Author
Atmospheric Pressure; Error Analysis; Correlation; Geodesy; Oceanography; Atmospheric Tides

20030032932 Pennsylvania State Univ., State College, PA
Monte Carlo Simulation of Seismic Location Errors for Moving Vehicles
Greenfield, Roy J.; Moran, M. L.; Oct 2001; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410216; No Copyright; Avail: CASI; A03, Hardcopy

A method was developed to predict the distribution of seismic source mislocation errors for tracked vehicles using bearing and range (r) location statistics obtained from field data. The method is of use for 1) guiding the design and deployment of seismic sensor networks and 2) statistically modeling seismic network tracking performance. In the present work, a seismic array is composed of one or multiple seismic subarrays each of which makes estimates of bearing and range. The bearing and range estimates are taken to be normally distributed around the true target location with errors sigma(sup b) and sigma(sup r) respectively. When these sigma's are used in our Monte Carlo simulation, we chose a true source point, and network geometry (array locations). Using these source and sensor positions, a set of true bearing and rare computed. The Monte Carlo simulation is done with 100 trials, in each trial a random error is added to the true bearing and r for each array according to the observed sigma. For each of the 100 bearing and r Monte Carlo measurements, a weighted least squares solution for the East and North value of the source is found. A statistical fit for all 100 trials is used to find the 9007) confidence location ellipse surrounding the true source point. Two types of displays are presented. The first fixes sigma(sup b)and sigma(sup r) and makes a map that displays the error ellipse axes and orientation as a function of map position. The second uses a fixed map position and displays the error ellipse axes and orientation as a function of sigma(sup b) and sigma(sup r). This allows convenient analysis of how the location error changes with changes of the array measurement accuracy. The later format is particularly

suited for evaluating the impact of seismic senor configuration on network tracking performance. Results are presented for a number of different network configurations representative of battlefield situations.
DTIC
Monte Carlo Method; Tracked Vehicles; Seismology; Error Analysis; Computerized Simulation; Position (Location)

20030033081 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Middle Atmosphere Temperature Trends from Small Rocketsondes
Schmidlin, F. J.; January 2002; 1 pp.; In English; American Geophysical Union, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Stratospheric temperature trends derived from USA meteorological rocketsonde measurements obtained between the late 1960's and mid 1990's are examined at the 50-, 40-, and 25-km altitude levels. Although the trends are different at each of the launch locations there is an unequivocal downward slope of about -0.1 K to -0.3K per year at many of the launch sites. Distances between launch sites and, in some cases unequal data-record lengths, inhibit determination of trend inter-relationship among the various sites. Although the data only provide a 'snapshot' of atmospheric behavior for the specific location, a particular advantage resulting from using these particular rocketsonde observations is their consistency over time. Thus, using the same rocketsonde type over the data period, i.e., Datasonde insures a significant reduction of instrument induced anomalies in the temperature profiles. Trends at the 25-km altitude level, approximately 30 hPa, are compared with trends from radiosonde observations. Both rocketsonde and radiosonde measurements were obtained at approximately the same local times and within less than 100 km of each other. Rocketsonde temperatures from the Former Soviet Union are also used and often complement trends from US data.
Author
Atmospheric Temperature; Middle Atmosphere; Radiosondes; Temperature Profiles; Trend Analysis

20030033853 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Particle Events as a Possible Source of Large Ozone Loss during Magnetic Polarity Transitions
vonKoenig, M.; Burrows, J. P.; Chipperfield, M. P.; Jackman, C. H.; Kallenrode, M.-B.; Kuenzi, K. F.; Quack, M.; [2002]; 10 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

The energy deposition in the mesosphere and stratosphere during large extraterrestrial charged particle precipitation events has been known for some time to contribute to ozone losses due to the formation of potential ozone destroying species like NO(sub x), and HO(sub x). These impacts have been measured and can be reproduced with chemistry models fairly well. In the recent past, however, even the impact of the largest solar proton events on the total amount of ozone has been small compared to the dynamical variability of ozone, and to the anthropogenic induced impacts like the Antarctic 'ozone hole'. This is due to the shielding effect of the magnetic field. However, there is evidence that the earth's magnetic field may approach a reversal. This could lead to a decrease of magnetic field strength to less than 25\% of its usual value over a period of several centuries . We show that with realistic estimates of very large solar proton events, scenarios similar to the Antarctic ozone hole of the 1990s may occur during a magnetic polarity transition.
Author
Geomagnetism; Ozone Depletion; Proton Precipitation; Magnetic Effects; Solar Protons

20030033871 Smithsonian Institution, Cambridge, MA, USA
Metallicity Effects on Stellar Magnetic Activity: Blanco 1 as a Test Case
Harnden, F. R., Jr.; Mushotzky, Richard F., Technical Monitor; March 2003; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10005; No Copyright; Avail: CASI; A01, Hardcopy

We present X-ray Luminosity Distributions (XLDs) of late-type members (dF, dG, dK, dM) of the Blanco 1 cluster, based on ROSAT-HRI data and new astrometric-photometric membership obtained from the GSC-II project. For the first time we present the XLD of dM stars of this cluster. The high metallicity of Blanco 1 allows us to investigate the role of chemical composition on the coronal emission of late-type stars. Comparison between X-ray Luminosity Distributions of Blanco 1 and Pleiades, NGC2516 and alpha Per suggests a possible metallicity effect in dM stars.
Author
X Rays; Luminosity; Spectral Energy Distribution; Pleiades Cluster; Metallicity

20030036984 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Zonal Drifts and Dynamical Study of the Plasma Bubbles Over the Tropical Region
Pimenta, Alexandre Alvares; 2003; 189 pp.; In Portuguese; Original contains black and white illustrations
Report No.(s): INPE-9546-TDI/827; Copyright; Avail: CASI; A09, Hardcopy

All-sky airglow OI 630 nm images obtained at Cachoeira Paulista in the period from January 1989 to December 1991 and January 1995 to December 1997 are analyzed to study the nocturnal and seasonal dynamic behavior, as well as bifurcation variations of plasma bubbles during high and low solar activity. Also, all-sky images from Sao Joao do Cariri and Cachoeira Paulista are analyzed from October 1998 to May 2000 in order to investigate the nocturnal, seasonal, and latitudinal behavior of the ionospheric plasma zonal drift velocities in the tropical region. The statistics show that the occurrence frequency of plasma bubbles is very low during the period May-August and maximizes during October-March for both low and high solar activity periods. However, the occurrence frequency is larger during high solar activity. It is noticed that the occurrence of bifurcation in bubbles is also larger during high solar activity. It is observed that, when the ratio of the electron densities outside and inside the depletion is less than 4, the bifurcation tendency is high, when it is greater than 4, the bifurcation tendency is small. The ionospheric plasma zonal drift velocities in the tropical region, for the period analyzed, show a high eastward velocity during 20:00-22:00 local time and, after midnight, the velocities decrease. Another characteristic observed is a significant latitudinal variation in the ionospheric plasma zonal drift velocities in the tropical region between 20:00-22:00 local time, which may be related to the ionospheric equatorial anomaly and the zonal neutral wind. Also, it is noticed that, during intense geomagnetic storms, the plasma bubbles move westward. This behavior may be due to the effects of magnetospheric electric fields penetrating to tropical latitudes, during enhanced magnetic activity.
Author
Tropical Regions; Nocturnal Variations; Annual Variations; Plasma Bubbles; Plasma Drift; Ionospheric Drift; Dynamic Characteristics; Airglow

20030037006 Lawrence Livermore National Lab., Livermore, CA
Deep Borehole Instrumentation along San Francisco Bay Bridges: 2001
Hutchings, L.; Kasameyer, P.; Long, L.; McEvilly, T.; Clymer, R.; May 01, 2001; 42 pp.; In English
Report No.(s): DE2002-803164; UCRL-ID-132137-01; No Copyright; Avail: Department of Energy Information Bridge
This is a progress report on the Bay Bridges downhole network. Between two and eight instruments have been spaced along the Dumbarton, San Mateo, Bay, and San Rafael bridges in San Francisco Bay, California. The instruments will provide multiple use data that is important to geotechnical, structural engineering, and seismological studies. The holes are between 100 and 1000 ft deep and were drilled by Caltrans. There are twenty-one sensor packages at fifteen sites. The downhole instrument package contains a three component HS-1 seismometer and three orthogonal Wilcox 731 accelerometers, and is capable of recording a micro g from local M =1.0 earthquakes to 0.5 g strong ground motion form large Bay Area earthquakes. This report list earthquakes and stations where recordings were obtained during the period February 29,2000 to November 11,2000. Also, preliminary results on noise analysis for up and down hole recordings at Yerba Buena Island is presented.
NTIS
Boreholes; Seismology; Accelerometers; Bridges (Structures); San Francisco (Ca)

20030037139 Wisconsin Univ.-Madison. Space Science and Engineering Center
History of the University of Wisconsin Atmospheric Emitted Radiance Interferometer (AERI) Prototype During the Period April 1994 Through July 1995
Knuteson, R.; Whitney, B.; Revercomb, H.; Best, F.; Jun. 1999; 52 pp.; In English
Report No.(s): PB2003-102719; ARM-TR-001-1; No Copyright; Avail: CASI; A04, Hardcopy
This document describes reprocessing of data collected with the University of Wisconsin (UW) Atmospheric Emitted Radiance Interferometer (AERI) prototype at the U.S. Department of Energy Atmospheric Radiation Measurement (ARM) Programs Southern Great Plains (SGP) Cloud And Radiation Testbed Central Facility (CART CF) during the period April 1994 through July 1995. Two corrections have been applied to the downwelling atmospheric radiance observed by the AERI prototype during the period April 11, 1994, through April 28, 1995. The first is a small calibration refinement that accounts for an improved characterization of the AERI prototype blackbodies based upon thermal modeling and cavity paint spectral measurements. The second correction was required to remove the effect of an obstruction that was found in the AERI prototype sky field of view. The obstruction caused an error of several percent of ambient radiance, substantially exceeding the AERI calibration uncertainty of less than about 1\%. The basis for the sky field of view obstruction correction came from coincident downwelling radiance data of the AERI facility instrument (AERI-01), which was first deployed to the SGP CART CF in April 1995. The obstruction in the AERI prototype was removed on April 28, 1995. The reprocessing of data from the period April 29, 1995, through May 31, 1995, required only the smaller hot blackbody correction. The real-time processing software was modified at that time such that no correction was required for the AERI prototype data beginning June 1, 1995, through the last full day of operation, July 25, 1995. The data corrections described in this document bring the corrected AERI prototype

(AERI-00) data in the period April 1994 through July 1995 up to a level of quality comparable to the AERI-01 facility instrument, though with somewhat greater absolute uncertainties.
NTIS
Radiance; Interferometers; Airglow

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20030032287 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Precipitation Processes Developed During ARM (1997), TOGA COARE (1992) GATE (1974), SCSMEX (1998), and KWAJEX (1999): Consistent 3D, Semi-3D and 3D Cloud Resolving Model Simulations
Tao, W.-K.; Hou, A.; Atlas, R.; Starr, D.; Sud, Y.; [2003]; 1 pp.; In English; A Second Workshop on the Future of Cloud Parameterization, 7-9 May 2003, Kauai, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

Real clouds and cloud systems are inherently three-dimensional (3D). Because of the limitations in computer resources, however, most cloud-resolving models (CRMs) today are still two-dimensional (2D) have been used to study the response of clouds to large-scale forcing. IN these 3D simulators, the model domain was small, and the integration time was 6 hours. Only recently have 3D experiments been performed for multi-day periods for tropical clouds systems with large horizontal domains at the National Center of Atmospheric Research (NCAR) and at NASA Goddard Space Center. At Goddard, a 3D cumulus Ensemble (GCE) model was used to simulate periods during TOGA COARE, GATE, SCSMEX, ARM, and KWAJEX using a 512 by 512 km domain (with 2-km resolution). The result indicate that surface precipitation and latent heating profiles are very similar between the 2D and 3D GCE model simulation. The major objective of this paper are: (1) to assess the performance of the super-parametrization technique, (2) calculate and examine the surface energy (especially radiation) and water budget, and (3) identify the differences and similarities in the organization and entrainment rates of convection between simulated 2D and 3D cloud systems.
Author
Atmospheric Radiation; Atmospheric Models; Cumulus Clouds; Energy Budgets; Water; Precipitation (Meteorology)

20030032288 Utah Univ., Salt Lake City, UT, USA
[Equipment Inventory Report of Inventions and Subcontracts]
Zipser, Edward J.; [2002]; 4 pp.; In English
Contract(s)/Grant(s): NAG8-1797; No Copyright; Avail: CASI; A01, Hardcopy

This was a joint award to the PI, then of Texas A&M University, and Gerald Heymsfield of NASA GSFC, with co-I's Robbie Hood and Richard Blakeslee of NASA Marshall Space Flight Center (MSFC). Although the PI moved to the University of Utah during year-2 of this grant, it continued to be administered through Texas A&M for the convenience of the Ph.D. student Daniel Cecil until after he defended his dissertation in late 2000. Cecil has assembled a subset of this database for 261 Tropical Rainfall Measuring Mission (TRMM) passes over 45 hurricanes or tropical cyclones. It consists of TRMM Microwave Imager (TMI) ice scattering signatures and TRMM Precipitation Radar (PR) reflectivity profiles and Lightning Imaging Sensor (LIS) flash locations for the rain features associated with all tropical cyclones observed by TRMM from Dec. 1997 through Dec. 1998. Each rain feature has been subjectively cataloged as belonging to a hurricane eyewall, inner rainband, outer rainband, or the inner or outer regions of a developing or non-developing tropical cyclone. This database quantifies the relative abundance of lightning in outer rainbands compared to eyewalls and inner rainbands. The TRMM data set permits studies that can seek more specific physical relationships than Cecil and Zipser were able to find when they related some SSM/I measures of ice scattering to hurricane intensity change.
Derived from text
Trmm Satellite; Meteorological Radar; Hurricanes; Cyclones; Data Bases

20030032302 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Workshop on Spanning Regional-to-Global Pollution
Thompson, Anne M.; Newman, Paul A.; Gleason, James F.; Brune, William H.; Dickerson, Russell R.; January 2002; 8 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

Pollution is often considered a localized phenomenon, but it is now clear that it travels from region-to-region, country to country, and even continent to continent. In addition to urban pollution in developed countries, large emissions from

developing nations and large-scale biomass fires add to the global pollution burden. Ozone and aerosols are two components of pollution that contribute to radiative forcing of the earth s climate. In turn, as climate changes, rates of chemical and microphysical reactions may be perturbed. Considering the earth as a coupled chemical-microphysical-climate system poses challenges for models and observations alike. These issues were the topic of a Workshop held in May 2002 at NASA GSFC s Laboratory for Atmospheres. Highlights of the Workshop are summarized in this article.
Author
Global Air Pollution; Atmospheric Chemistry; Climatology; Meteorology

20030032334 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Rainfall Climate Variability Dynamics Over South America
Parraga, Guillermo Oswaldo Obregon; 2003; 198 pp.; In Portuguese; Original contains color illustrations
Report No.(s): INPE-8604-TDI/789; Copyright; Avail: CASI; A09, Hardcopy

Intraseasonal time-scales of climate variability over Brazil, and interannual and larger time-scales climate variability over South America were studied using daily (1979-1990) and monthly (1951-1990) mean rainfall data and several statistical methods. The results show that the seasonal and interannual rainfall variability over South America have intrinsic regional features with prominent and persistent annual cycle. The semiannual cycle is predominant over northern Amazon (high persistence) and Southern Brazil (low persistence). The seasonal mean rainfall distribution is strongly related to the statistics of probabilities in all seasons. With respect to intraseasonal variability over Brazil, it was found that there are two dominant oscillations with periods of 20 and 40 days with distinct characteristics. The 20 day oscillation shows greater dependence on baroclinic waves, while the 40 day seems to be more related to the global scale oscillations and apparently interacts with greater intensity with the tropical atmosphere. Regarding the interannual variability, it is observed that precipitation over South America is modulated by El Nino/South Oscillation (ENSO). However, this modulation is present in the distinct periods, 3.7 and 5 years. The 5 years oscillation is predominant over equatorial regions, while the 3.7 years oscillation is predominant over Southern Brazil. Both are modulated by Tropical Atlantic, but with different intensities. The linear trends and climate change over South America show coherent space temporal distributions. Negative trends of the annual precipitation over the maximum rainfall area, related to the climatological region of the South Atlantic Convergence Zone (SACZ), and positive trends over Southern Brazil were observed. These patterns are results of the intense negative tendency occurred in summer over the maximum rainfall area and during spring season over Southern Brazil. The trends seem to be associated with the observed climate change in the mid 70's, which is related to the sea surface temperature change, mainly in the Pacific Ocean. This abrupt climate change affected almost the whole South America, except Northeast Brazil, where precipitation shows high interannual variability and apparent quasi-decadal variability.
Author
Climate Change; Brazil; South America; Rain; Periodic Variations

20030032344 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SHADOZ (Southern Hemisphere Additional Ozonesondes): A Tropical Ozonesonde-Radiosonde Network for the Atmospheric Community
Thompson, Anne M.; Witte, Jacquelyn C.; Oltmans, Samuel J.; Schmidlin, Francis J.; [2003]; 27 pp.; In English; Original contains color illustrations
Report No.(s): Paper 1455; Copyright; Avail: CASI; A03, Hardcopy

A lack of sounding data has limited the accuracy of ozone satellite retrievals in the tropics and our understanding of chemical-dynamical interactions in a region strongly influenced by natural variability and anthropogenic activity. In 1998, NASA s Goddard Space Flight Center, NOAA's Climate Monitoring and Diagnostics Laboratory (CMDL) and a team of international sponsors established the SHADOZ (Southern Hemisphere ADditional OZonesondes) project to address the gap in tropical ozone soundings. SHADOZ augments launches at selected sites and provides a public archive of ozonesonde and radiosonde data from twelve tropical and subtropical stations at http://croc.gsfc.nasa.gov/shadoz. Instrumentation, data and a summary of the first scientific findings from SHADOZ are presented.
Author
Radiosondes; Ozone; Southern Hemisphere; Tropical Regions

20030032366 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Preliminary Analysis and Simulations of July 23rd Extended Anvil Case
Lin, R.-F.; Demoz, B.; McGill, M.; Heymsfield, G.; Sassen, K.; Bui, P.; Heymsfield, A.; Halverson, J.; Rickenbach, T.; Poellot, M.; Lare, A.; [2003]; 1 pp.; In English; CRYSTAL Science Team, 24-28 Feb. 2003, Salt Lake City, UT, USA; No Copyright; Avail: Other Sources; Abstract Only

A key focus of CRYSTAL-FACE (Cirrus Regional Study of Tropical Anvils and cirrus Layers - Florida Area Cirrus Experiment) was the generation and subsequent evolution of cirrus outflow from deep convective cloud systems. A preliminary integrated look at the observations of an extended cirrus anvil cloud system observed on 23 July 2002 will be presented, including lidar and millimeter radar observations from NASA's ER-2 and in- situ observations from NASA's WB-57 and University of North Dakota Citation. The observations will be compared to preliminary results of simulations using 1-D and 2-D high-resolution (100 meter) cloud resolving models. The CRMs explicitly account for cirrus microphysical development by resolving the evolving ice crystal size distribution (bin model) in time and space. Both homogeneous and heterogeneous nucleation are allowed in the model. The CRM simulations are driven using the output of regional simulations using MM5 that produces deep convection similar to what was observed. The MM5 model employs a 2 km inner grid (32 layers) over a 360 km domain, nested within a 6 km grid over a 600 km domain. Initial and boundary conditions for the 36-hour MM5 simulation are taken from NCEP Eta model analysis at 32 km resolution. Key issues to be explored are the settling of the observed anvil versus the model simulations, and comparisons of dynamical properties, such as vertical motions, occurring in the observations and models. The former provides an integrated measure of the validity of the model microphysics (fallspeed) while the latter is the key factor in forcing continued ice generation.
Author
Cirrus Clouds; Simulation; Tropical Regions; Anvil Clouds; Heterogeneity; Nucleation; Clouds (Meteorology)

20030032491 NASA Langley Research Center, Hampton, VA, USA
Examination of New CERES Data for Evidence of Tropical Iris Feedback
Chambers, Lin H.; Lin, Bing; Young, David F.; Journal of Climate; December 15, 2002; 15, pp. 3719-3726; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

New data products from the Clouds and the Earth s Radiant Energy System (CERES) instrument on the Tropical Rainfall Measuring Mission Satellite have been examined in the context of the recently proposed adaptive tropical infrared Iris hypothesis. The CERES Single Scanner Footprint data products combine radiative fluxes with cloud properties obtained from a co-orbiting imaging instrument. This enables the use of cloud property- based definitions of the various regions in the simple Iris climate model. Regardless of definition, the radiative properties are found to be different from those assigned in the original Iris hypothesis. As a result, the strength of the feedback effect is reduced by a factor of I O or more. Contrary to the initial Iris hypothesis, most of the definitions tested in this paper result in a small positive feedback. Thus, the existence of an effective infrared iris to counter greenhouse warming is not supported by the CERES data.
Author
Data Processing; Cloud Physics; Infrared Radiation; Radiant Flux Density; Positive Feedback; Rain; Terrestrial Radiation

20030032926 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Global Aerosol Model Forecast for the ACE-Asia Field Experiment
Chin, Mian; Ginoux, Paul; Lucchesi, Robert; Huebert, Barry; Weber, Rodney; Anderson, Tad; Masonis, Sarah; Blomquist, Byron; Bandy, Alan; Thornton, Donald; [2003]; 33 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NSF ATM-00-02698; Copyright; Avail: CASI; A03, Hardcopy

We present the results of aerosol forecast during the Aerosol Characterization Experiment (ACE-Asia) field experiment in spring 2001, using the Georgia Tech/Goddard Global Ozone Chemistry Aerosol Radiation and Transport (GOCART) model and the meteorological forecast fields from the Goddard Earth Observing System Data Assimilation System (GEOS DAS). The aerosol model forecast provides direct information on aerosol optical thickness and concentrations, enabling effective flight planning, while feedbacks from measurements constantly evaluate the model, making successful model improvements. We verify the model forecast skill by comparing model predicted total aerosol extinction, dust, sulfate, and SO2 concentrations with those quantities measured by the C-130 aircraft during the ACE-Asia intensive operation period. The GEOS DAS meteorological forecast system shows excellent skills in predicting winds, relative humidity, and temperature for the ACE-Asia experiment area as well as for each individual flight, with skill scores usually above 0.7. The model is also skillful in forecast of pollution aerosols, with most scores above 0.5. The model correctly predicted the dust outbreak events and their trans-Pacific transport, but it constantly missed the high dust concentrations observed in the boundary layer. We attribute this missing dust source to the desertification regions in the Inner Mongolia Province in China, which have developed in recent years but were not included in the model during forecasting. After incorporating the desertification sources, the model is able to reproduce the observed high dust concentrations at low altitudes over the Yellow Sea. Two key elements for a successful aerosol model forecast are correct source locations that determine where the emissions take place, and realistic forecast winds and convection that determine where the aerosols are transported. We demonstrate that our global model can not only account

for the large-scale intercontinental transport, but also produce the small-scale spatial and temporal variations that are adequate for aircraft measurements planning.
Author
Aerosols; Asia; Atmospheric Models; Weather Forecasting

20030033017 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Global Gridded Data from the Goddard Earth Observing System Data Assimilation System (GEOS-DAS)
November 2001; 2 pp.; In English; Fall 2002 AGU Meeting, Fall 2002; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The Goddard Earth Observing System Data Assimilation System (GEOS-DAS) timeseries is a globally gridded atmospheric data set for use in climate research. This near real-time data set is produced by the Data Assimilation Office (DAO) at the NASA Goddard Space Flight Center in direct support of the operational EOS instrument product generation from the Terra (12/1999 launch), Aqua (05/2002 launch) and Aura (01/2004 launch) spacecrafts. The data is archived in the EOS Core System (ECS) at the Goddard Earth Sciences Data and Information Services Center/Distributed Active Archive Center (GES DISC DAAC). The data is only a selection of the products available from the GEOS-DAS. The data is organized chronologically in timeseries format to facilitate the computation of statistics. GEOS-DAS data will be available for the time period January 1, 2000, through present.
Derived from text
Earth Observing System (Eos); Earth Sciences; Climatology; Data Acquisition; Information Systems

20030033115 Army Research Lab., White Sands Missile Range, NM, USA
Battlescale Forecast Model Sensitivity Study
Sauter, Barbara; Henmi, Teizi; Pedrego, Edgar; Jan. 2003; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410711; ARL-TR-2905; No Copyright; Avail: CASI; A03, Hardcopy

Expendable sensors might be used on the battlefield to report weather data not in conformance with normal weather sensor placement and accuracy standards. The purpose of this study was to investigate the impact of errors in surface measurements on a model forecast initialized with the inaccurate observations. Changes to the surface observations used in the Battlescale Forecast Model initialization led to no significant changes in the resulting forecast values of temperature, relative humidity, wind speed, or wind direction. Some information on the forecast accuracies using the original surface observations is also provided.
DTIC
Meteorological Parameters; Weather Forecasting; Sensors; Military Operations; Sensitivity Analysis

20030033856 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Lightning Return-Stroke Current Waveforms Aloft, From Measured Field Change, Current, and Channel Geometry
Willett, J. C.; LeVine, D. M.; [2002]; 1 pp.; In English; AGU Meeting, 7-10 Dec. 2002, San Francisco, CA, USA; Copyright; Avail: Other Sources; Abstract Only

Direct current measurements are available near the attachment point from both natural cloud-to-ground lightning and rocket-triggered lightning, but little is known about the rise time and peak amplitude of return-stroke currents aloft. We present, as functions of height, current amplitudes, rise times, and effective propagation velocities that have been estimated with a novel remote-sensing technique from data on 24 subsequent return strokes in six different lightning flashes that were triggering at the NASA Kennedy Space Center, FL, during 1987. The unique feature of this data set is the stereo pairs of still photographs, from which three-dimensional channel geometries were determined previously. This has permitted us to calculate the fine structure of the electric-field-change (E) waveforms produced by these strokes, using the current waveforms measured at the channel base together with physically reasonable assumptions about the current distributions aloft. The computed waveforms have been compared with observed E waveforms from the same strokes, and our assumptions have been adjusted to maximize agreement. In spite of the non-uniqueness of solutions derived by this technique, several conclusions seem inescapable: 1) The effective propagation speed of the current up the channel is usually significantly (but not unreasonably) faster than the two-dimensional velocity measured by a streak camera for 14 of these strokes. 2) Given the deduced propagation speed, the peak amplitude of the current waveform often must decrease dramatically with height to prevent the electric field from being over-predicted. 3) The rise time of the current wave front must always increase rapidly with height

in order to keep the fine structure of the calculated field consistent with the observations.
Author
Cloud-To-Ground Discharges; Waveforms; Electric Fields; Propagation Velocity

20030033941 Colorado Univ.
Modeling Aerosol Nucleation
Toon, Owen B.; Klein, Kari; Gamblin, Brandy; [2003]; 2 pp.; In English
Contract(s)/Grant(s): NGT2-52264; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this work has been to understand how nitric acid condenses on cirrus ice cloud particles by analyzing data obtained during the SAGE III Ozone Loss and Validation Experiment (SOLVE) research mission based out of Kiruna, Sweden. Ms. Gamblin simultaneously analyzed gas phase nitric acid data along with particulate NO, data, particulate, vapor and gas-phase water data from several different instruments, particle size data, which included surface area and volume measurements, ozone concentration data as well as temperature, pressure and GPS coordinates of the sampled air parcel. All parameters where held constant with only one allowed to vary in order to determine what controls the extent to which nitric acid will condensation on ice. In addition, this data was compared to theoretical values of nitric acid condensation on ice based upon recent laboratory data. Comparison of these two data sets shows the field data does not agree with what is expected in the laboratory at comparable temperatures and nitric acid pressures. The most significant difference is that surface coverages in the atmosphere were found to be elevated relative to surface coverages measured in the laboratory. The results of this study were accepted for publication by Geophysical Research Letters.
Author
Aerosols; Nucleation; Atmospheric Models; Nitric Acid; Cirrus Clouds; Ice Clouds

20030033958 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: January 2003
January 2003; In English; The CD-ROM conforms to the ISO 9660 standard for volume and file structure; Document files and Satellite observation data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recored in Bit-Map (BMP) format; Copyright; Avail: Other Sources

The CD-ROM concerning the January 2003 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
Derived from text
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

20030034609 Army Research Lab., White Sands Missile Range, NM, USA
Nowcasting Surface Meteorological Parameters Using Successive Correction Method
Henmi, Teizi; Jan. 2002; 29 pp.; In English
Report No.(s): AD-A410433; ARL-TR-2898; No Copyright; Avail: CASI; A03, Hardcopy

The successive correction method was examined and evaluated statistically as a nowcasting method for surface meteorological parameters including temperature, dew point temperature, and horizontal wind vector components. The Battlescale Forecast Model (BFM) forecast fields of the surface meteorological parameters were used as background data. By this method, temperature and dew point temperature could be nowcasted well. The major reason for this is that the BFM forecasting calculation could provide good background fields of surface temperature and dew point temperature. Surface horizontal wind vector fields were really improved by the nowcasting calculation. The BFM forecast calculation alone could not produce reliable surface wind vector fields, but by combining the forecast data with observation, much more reliable wind field could be obtained than what would be determined by the BFM alone.
DTIC
Meteorological Parameters; Nowcasting; Wind (Meteorology); Weather Forecasting; Atmospheric Correction; Mathematical Models

20030034728 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Retrospective Iterated Analysis Scheme for Nonlinear Chaotic Dynamics

Todling, Ricardo; July 11, 2002; 12 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Atmospheric data assimilation is the name scientists give to the techniques of blending atmospheric observations with atmospheric model results to obtain an accurate idea of what the atmosphere looks like at any given time. Because two pieces of information are used, observations and model results, the outcomes of data assimilation procedure should be better than what one would get by using one of these two pieces of information alone. There is a number of different mathematical techniques that fall under the data assimilation jargon. In theory most these techniques accomplish about the same thing. In practice, however, slight differences in the approaches amount to faster algorithms in some cases, more economical algorithms in other cases, and even give better overall results in yet some other cases because of practical uncertainties not accounted for by theory. Therefore, the key is to find the most adequate data assimilation procedure for the problem in hand. In our Data Assimilation group we have been doing extensive research to try and find just such data assimilation procedure. One promising possibility is what we call retrospective iterated analysis (RIA) scheme. This procedure has recently been implemented and studied in the context of a very large data assimilation system built to help predict and study weather and climate. Although the results from that study suggest that the RIA scheme produces quite reasonable results, a complete evaluation of the scheme is very difficult due to the complexity of that problem. The present work steps back a little bit and studies the behavior of the RIA scheme in the context of a small problem. The problem is small enough to allow full assessment of the quality of the RIA scheme, but it still has some of the complexity found in nature, namely, its chaotic-type behavior. We find that the RIA performs very well for this small but still complex problem which is a result that seconds the results of our early studies. Author

Atmospheric Models; Atmospheric Physics; Climate; Numerical Analysis; Data Processing; Data Reduction; Iterative Solution

20030036980 California Energy Commission, Sacramento, ICF, Inc., Washington, DC

Inventory of California Greenhouse Gas Emissions and Sinks: 1990-1999

Birkinshaw, K.; Nov. 2002; In English

Report No.(s): PB2003-102668; PUB-600-02-001F; No Copyright; Avail: National Technical Information Service (NTIS)

In September 2000, the California Legislature passed Senate Bill 1771, Senator Sher (Chapter 1018, Statutes of 2000), requiring the California Energy Commission (Commission), in consultation with other state agencies, to update California's inventory of greenhouse gas emissions in January 2002 and every five years thereafter. The inventory update is to include all emission sources in the State that were identified in the Commission's 1998 report, Historical and Forecasted Greenhouse Gas Emissions Inventories for California. This report, Inventory of California Greenhouse Gas Emissions and Sinks: 1990-1999, presents the Commission's preliminary estimates of emissions and carbon sinks from 1990 to 1999. As Senate Bill 1771 requires, the report includes emissions of greenhouse gases and compares California's emissions with the emissions from other states and nations. Limited information was available to allow a complete and thorough analysis and discussion of the impact of air quality and energy policies and programs on greenhouse gas emissions.

NTIS

Exhaust Emission; Exhaust Gases; Greenhouse Effect; Sinks; California; Inventory Management; Energy Technology; Climatology

20030036985 Department of Energy, Washington, DC

Report on Broadband Solar Radiometer Inconsistencies at the Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) Central Facility During the ARM Enhanced Shortwave Experiment (ARESE)

Long, C. N.; 1996; 20 pp.

Report No.(s): PB2003-102674; ARM-TR-003; No Copyright; Avail: CASI; A03, Hardcopy

Broadband solar radiometer data collected at the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) Central Facility during the ARM Enhanced Shortwave Experiment (ARESE) exhibits inconsistencies and inter-calibration offsets. This report examines these problems, and in some cases, suggests error sources and possible solutions. The data discussed here covers the period from September 28, 1995, through October 30, 1995. Prior to that, the Baseline Surface Radiation Network (BSRN) radiometer data were not being logged for about 2 and one half weeks. This problem was not rectified until we inquired about the data for September 27, 1995, in support of an ARESE analysis. Most of the following discussion is based on 5-minute averages of the data. Site reports state that on October 13, 1995, the BSRN total shortwave (SW) pyranometer was changed to a newly calibrated one; therefore, much of the analysis

has been split into the period before the 14th and after the 14th. The latter is noted on the graphs as after the 14th, but does include the 14th data. Concern was initially raised by an attempt to use BSRN and Solar and Infrared Observing System (SIROS) data to calibrate total and diffuse measurements from a rotating-arm instrument system currently under development at the Pennsylvania State University. In addition, we wanted the most accurate measurements for verification of clear-sky SW irradiance calculations by a model currently undergoing development.
NTIS

20030036986 Department of Energy, Washington, DC
Shortwave (SW) Radiometer Inconsistencies at the Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) Central Facility (CF)
Long, C. N.; Nov. 2000; In English
Report No.(s): PB2003-102673; ARM-TR-002; No Copyright; Avail: National Technical Information Service (NTIS)

There appears to be a problem with the Southern Great Plains (SGP) Central Facility (CF) Baseline Surface Radiation Network (BSRN) shortwave (SW) measurements. An investigation shows there are large differences between the unshaded precision spectral pyranometer (PSP) values and those of the sum of normal incidence pyrheliometer (NIP) + Diffuse. Comparison with the E13 and C01 Solar Infrared Station (SIRS) measurements suggests that the BSRN PSP has an incorrect calibration applied to the data from about October 23, 1998, through December 31, 1999, and probably continues to the present. Not surprisingly, comparison between the three radiometer systems shows that the unshaded PSPs have larger disagreements during the winter months when the local solar noon zenith angles are less than the solar zenith angle value the calibration numbers were chosen to represent. This is likely due to differences in cosine response. This is unfortunate, because we end up with the largest magnitude differences at the same time of year that we experience the smallest magnitude daily average incoming solar energy.
NTIS
Great Plains Corridor (North America); Short Wave Radiation; Atmospheric Radiation; Radiation Measuring Instruments; Solar Radiation; Radiometers

20030036988 Department of Energy, Washington, DC
Shortwave (SW) Clear-Sky Detection and Fitting Algorithm: Algorithm Operational Details and Explanations
Long, C. N.; Dec. 2000; 26 pp.
Report No.(s): PB2003-102675; ARM-TR-004; No Copyright; Avail: CASI; A03, Hardcopy

This document describes some specifics of the algorithm for detecting clear skies and fitting clear-sky shortwave (SW) functions described in Long and Ackerman (2000). This algorithm forms the basis of the ARM SW FLUX ANAL 1Long VAP. In the Atmospheric Radiation Measurement (ARM) case, the value added procedures (VAP) can be described as having three parts: a 'front end,' a 'black box,' and a 'back end.' The 'front end' handles the file management of the processing, what range of data files to process in the run, which configuration file to use for each site, extracting the data from the ARM NetCDF files into an ASCII format for the code to process, etc. The 'back end' produces ARM-format NetCDF files of the output and other file management. The 'black box' is the processing code(s), and is what is discussed in this document. Details on the 'front' and 'back' ends of the ARM VAP are presented elsewhere.
NTIS
Algorithms; Short Wave Radiation; Radiation Measurement; Climatology; Sky Radiation; Detection

20030036991 Pacific Northwest National Lab., Richland, WA
Total Sky Imager Model 880 Status and Testing Results
Long, C. N.; Slater, D. W.; Tooman, T.; Nov. 2001; In English
Report No.(s): PB2003-102676; ARM-TR-006; No Copyright; Avail: National Technical Information Service (NTIS)

The Total Sky Imager (TSI) is manufactured by Yankee Environmental Systems (YES) Incorporated, based in Turner Falls, Massachusetts. The TSI is a commercialized version of the Hemispheric Sky Imager prototype (Long et al. 1998). YES has now produced a more sophisticated (compared to the original model 440) model 880 of the TSI. The first YES TSI 880 was deployed at the Blackwell Tonkawa Airport (BTA) as part of the Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) Program 2000 Cloud intensive operational period (IOP). This TSI 880 collected data from March 2, 2000 through April 6, 2000. This report gives an assessment of the TSI based on the BTA and Southern Great Plane (SGP) Central Facility (CF) data collected to date.
NTIS

20030036993 Pacific Northwest National Lab., Richland, WA

Best Estimate Radiation Flux Value Added Product: Algorithm Operational Details and Explanations

Shi, Y.; Long, C. N.; Oct. 2002; In English

Report No.(s): PB2003-102677; ARM-TR-008; No Copyright; Avail: National Technical Information Service (NTIS)

This document describes some specifics of the algorithm for best estimate evaluation of radiation fluxes at Southern Great Plains (SGP) Central Facility (CF). It uses the data available from the three co-located surface radiometer platforms at the SGP CF to automatically determine the best estimate of the irradiance measurements available. The Best Estimate Flux (BEFlux) value added product (VAP) was previously named Best Estimate ShortWave (BESW) VAP, which included all of the broadband and spectral shortwave (SW) measurements for the SGP CF. In BESW, multiple measurements of the same quantities, were handled simply by designating one as the primary measurement and using all others to merely fill in any gaps. Thus, this BESW is better termed most continuous, since no additional quality assessment was applied. We modified the algorithm in BESW to use the average of the closest two measurements as the best estimate when possible, if these measurements pass all quality assessment criteria.

NTIS

Algorithms; Remote Sensing; Radiometers; Climatology; Heat Flux; Short Wave Radiation

20030036996 Pennsylvania State Univ., University Park, Brookhaven National Lab., Upton, NY, Pacific Northwest National Lab., Richland, WA

ARM Millimeter Wave Cloud Radars (MMCRs) and the Active Remote Sensing of Clouds (ARSCL) Value Added Product (VAP)

Clothiaux, E. E.; Miller, M. A.; Perez, R. C.; Turner, D. D.; Moran, K. P.; Mar. 04, 2001; 60 pp.; In English

Report No.(s): PB2003-102678; DOE/TM-ARM-VAP-002-1; No Copyright; Avail: CASI; A04, Hardcopy

The Millimeter Wave Cloud Radars (MMCRs) are designed as a remote sensing tool that can accurately detect almost all of the hydrometeors present in the atmosphere. To illustrate the difficulty of this task, the various types of hydrometeors that can occur in the atmosphere are considered in the context of detection by the MMCRs. Having outlined the nature of the remote sensing problem, a discussion ensues of the NOAA Environmental Technology Laboratory (ETL) design of the MMCR. Next, we present the operational modes of the MMCRs and discuss them in some detail to illustrate the nature of the cloud products that are, and will be, derived from the MMCRs on a continuous basis.

NTIS

Remote Sensing; Clouds (Meteorology)

20030037179 Lawrence Livermore National Lab., Livermore, CA

Intercomparison of Climate Data Sets as a Measure of Observational Uncertainty

Feb. 22, 2002; In English

Report No.(s): DE2002-15002142; UCRL-ID-147371; No Copyright; Avail: National Technical Information Service (NTIS)

Uncertainties in climate observations are revealed when alternate observationally based data sets are compared. General circulation model-based 'reanalyses' of meteorological observations will yield different results from different models, even if identical sets of raw unanalyzed data form their starting points. We have examined 25 longitude-latitude fields (including selected levels for three-dimensional quantities) encompassing atmospheric climate variables for which the PCMDI observational data base contains two or more high-quality sources. For the most part we compare ECMWF with NCEP reanalysis. In some cases, we compare in situ and/or satellite-derived data with reanalysis. To obtain an overview of the differences for all 25 fields, we use a graphical technique developed for climate model diagnosis: a 'portrait diagram' displaying root-mean-square differences between the alternate data sources. With a few exceptions (arising from the requirement that RMS differences be normalized to accommodate different units of variables) the portrait diagrams indicate areas of agreement and disagreement that can be confirmed by examining traditional graphics such as zonal mean plots. In accord with conventional wisdom, the greatest agreement between alternate data sets - hence the smallest implied observational uncertainty - occurs for upper tropospheric zonal wind. We also find fairly good agreement between reanalysis and more direct measures of precipitation, suggesting that modern observational systems are resolving some longstanding problems with its measurement.

NTIS

Climate Models; Data Processing

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*.

20030032403 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Numerical simulation of the geographical sources of water for Continental Scale Experiments (CSEs) Precipitation
Bosilovich, Michael G.; Sud, Yogesh; Schubert, Siegfried D.; Walker, Gregory K.; [2003]; 8 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

There are several important research questions that the Global Energy and Water Cycle Experiment (GEWEX) is actively pursuing, namely: What is the intensity of the water cycle and how does it change? And what is the sustainability of water resources? Much of the research to address these questions is directed at understanding the atmospheric water cycle. In this paper, we have used a new diagnostic tool, called Water Vapor Tracers (WVTs), to quantify the how much precipitation originated as continental or oceanic evaporation. This shows how long water can remain in the atmosphere and how far it can travel. The model-simulated data are analyzed over regions of interest to the GEWEX community, specifically, their Continental Scale Experiments (CSEs) that are in place in the USA, Europe, Asia, Brazil, Africa and Canada. The paper presents quantitative data on how much each continent and ocean on Earth supplies water for each CSE. Furthermore, the analysis also shows the seasonal variation of the water sources. For example, in the USA, summertime precipitation is dominated by continental (land surface) sources of water, while wintertime precipitation is dominated by the Pacific Ocean sources of water. We also analyze the residence time of water in the atmosphere. The new diagnostic shows a longer residence time for water (9.2 days) than more traditional estimates (7.5 days). We emphasize that the results are based on model simulations and they depend on the model s veracity. However, there are many potential uses for the new diagnostic tool in understanding weather processes and large and small scales.
Author
Water Resources; Precipitation (Meteorology); Oceanography; Simulation; Geographic Distribution

20030032976 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ocean Color Data at the Goddard Earth Sciences (GES) DAAC: CZCS, SeaWiFS, OCTS, MODIS-Terra, MODIS-Aqua
September 2002; 4 pp.; In English; Fall 2002 AGU Meeting, Fall 2002; Original contains color illustrations
Report No.(s): NASA/NP-2002-9-466-GSFC; NAS 1.83:9-466-GSFC; No Copyright; Avail: CASI; A01, Hardcopy

The Goddard Earth Sciences Distributed Active Archive Center (DAAC) is the designated archive for all of the ocean color data produced by NASA satellite missions. The DAAC is a long-term, high volume, secure repository for many different kinds of environmental data. With respect to ocean color, the Goddard DAAC holds all the data obtained during the eight-year mission of the Coastal Zone Color Scanner (CZCS). The DAAC is currently receiving data from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), and the MODIS-Terra instrument. The DAAC recently received reformatted data from the Ocean Color and Temperature Scanner (OCTS) and will also archive MODIS-Aqua Ocean products. In addition to its archive and distribution services, the Goddard DAAC strives to improve data access, ease-of-use, and data applicability for a broad spectrum of customers. The DAAC's data support teams practice dual roles, both insuring the integrity of the DAAC data archive and serving the user community with answers to user inquiries, online and print documentation, and customized data services.
Derived from text
Earth Sciences; Imaging Spectrometers; NASA Programs; Sea-Viewing Wide Field-Of-View Sensor; Coastal Zone Color Scanner; Water Color; Spectroradiometers

20030034626 National Marine Fisheries Service, La Jolla, CA
Ichthyoplankton and Station Data for Manta (Surface) Tows Taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1999
Ambrose, D. A.; Charter, R. L.; Moser, H. G.; May 2002; 52 pp.; In English
Report No.(s): PB2003-101404; NOAA/TM/NMFS/SWFSC-335; No Copyright; Avail: CASI; A04, Hardcopy

This report provides ichthyoplankton data and associated station and tow data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations (CalCOFI) cruises in 1999. It is the 18th report in a series that presents surface tow data for all biological-oceanographic CalCOFI surveys from 1977 to the present. A total of 255 net tow stations were occupied during four quarterly cruises over the survey area which extended from Avila Beach to San Diego,

California and seaward in a southwesterly direction to a maximum of approximately 330 n. mi. The Most seaward station, 90.120, was approximately 400 n. mi. west of Punta Baja, Baja California, and Mexico. A total of 255 Manta net tows were taken during 1999. The data for stations on which Manta tows were taken are listed in a series of four tables; the background, methodology, and information necessary for interpretation of the data are presented in an accompanying text. All pertinent station and tow data, including volumes of water filtered are listed in the first table. Another table lists, by station and month, standardized counts of each of the 56 larval fish categories identified from Manta tows taken on the survey. This series of reports makes the CalCOFI ichthyoplankton and station data available to all investigators and serves as a guide to the computer data base.
NTIS
Data Acquisition; Plankton; Fisheries; Ichthyology; Surveys

20030036920 National Marine Fisheries Service, La Jolla, CA
Ichthyoplankton and Station Data for Manta (Surface) Tows Taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 2000
Watson, W.; Charter, R. L.; Moser, H. G.; May 2002; 52 pp.; In English
Report No.(s): PB2003-101405; NOAA/TM/NMFS/SWFSC-336; No Copyright; Avail: CASI; A04, Hardcopy

This report provides ichthyoplankton data and associated station and tow data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations (CalCOFI) cruises in 2000. It is the 19th report in a series that presents surface tow data for all biological-oceanagraphic CalCOFI surveys from 1977 to the present. A total of 263 net tow stations were occupied during four quarterly cruises over the survey area which extended from Avila Beach to San Diego, California and seaward in a southwesterly direction to a maximum of approximately 330 n. mi. The most seaward station, 90.120, was approximately 400 n. mi. west of Punta Baja, Baja California, and Mexico. A total of 263 Manta net tows were taken during 2000. The data for stations on which Manta tows were taken are listed in a series of four tables; the background, methodology, and information necessary for interpretation of the data are presented in an accompanying text. All pertinent station and tow data, including volumes of water filtered are listed in the first table. Another table lists, by station and month, standardized counts of each of the 65 larval fish categories identified from Manta tows taken on the survey. This series of reports makes the CalCOFI ichthyoplankton and station data available to all investigators and serves as a guide to the computer data base.
NTIS
Fisheries; Lower California (Mexico); Surveys; Surface Water; Plankton

20030036934 National Marine Fisheries Service, La Jolla, CA
Ichthyoplankton and Station Data for Manta (Surface) Tows Taken on California Cooperative Oceanic Fisheries Investigations Survey Cruises in 1998
Ambrose, D. A.; Charter, R. L.; Moser, H. G.; May 2002; 56 pp.; In English
Report No.(s): PB2003-101403; NOAA/TM/NMFS/SWFSC-334; No Copyright; Avail: CASI; A04, Hardcopy

This report provides ichthyoplankton data and associated station and tow data for Manta (surface) tows taken on California Cooperative Oceanic Fisheries Investigations (CalCOFI) cruises in 1998. It is the 17th report in a series that presents surface data for all biological-oceanographic CalCOFI surveys from 1977 to the present. A total 288 net tow stations was occupied during four quarterly cruises over the survey area which extended from Avila Beach (one cruise as far north as Monterey) to San Diego, California and seaward in a southwesterly direction to a maximum of approximately 330 n. mi. The most seaward station, 90. 120 was approximately 400 n. mi. west of Punta Baja, Baja California, and Mexico. A total of 285 Manta net tows were taken during 1998. The data for stations on which Manta tows were taken are listed in a series of four tables; the background, methodology, and information necessary for interpretation of the data are presented in an accompanying text. All pertinent station and tow data, including volumes of water filtered are listed in the first table. Another table lists, by station and month, standardized counts of each of the 70 larval fish categories identified from Manta tows taken on the survey. This series of reports makes the CalCOFI ichthyoplankton and station data available to all investigators and serves as a guide to the computer data base.
NTIS
Fisheries; Oceanography

20030036995 Geological Survey, Menlo Park, CA

Salinity and Temperature in South San Francisco Bay, California, at Dumbarton Bridge: Measurements from the 1995-1998 Water Years and Comparisons with Results from the 1990-1993 Water Years

Schemel, L. E.; 1998; 44 pp.

Report No.(s): PB2003-102706; OFR-98-650; No Copyright; Avail: CASI; A03, Hardcopy

Salinity and temperature of near surface waters were measured during the 1995-1998 water years (WY) at Dumbarton Bridge in South San Francisco Bay. This report presents the methods, describes the results, and provides numerical values for the measurements in ASCII text files on the enclosed IBM formatted disk. The four years of this study were unusual in that they were the first extended period of greater-than-normal rainfall and river inflow to San Francisco Bay since the early 1980's. Results from 1995WY- 1998WY provide detailed information on the influences of freshwater inflows (from the Sacramento-San Joaquin Delta and from local streams) and climate and weather-related events and processes on salinity and temperature at the study site. Earlier records from this site were collected over the 1990-1993 water years, the first three years of which had lower-than-normal rainfalls and freshwater inflows. Comparisons of the 1995WY-1998WY record with measurements from 1990WY-1992WY showed generally higher salinity and less variability in salinity during the dry years. Details show a rapid response to local freshwater inflows and the influence of the general freshening of the bay by Delta outflow during the wet winters. Records from both wet and dry years show that salinity and temperature respond to weather events and climate variations over time scales of days to months.

NTIS

Salinity; San Francisco Bay (Ca); Surface Water; Annual Variations; Bridges (Structures); Hydrology

20030037042 Lawrence Livermore National Lab., Livermore, CA

References to Studies of (137)Cs, (90)Sr and (239+240)Pu In The Pacific Ocean A Bibliography

Noshkin, V. E.; Feb. 01, 2001; 44 pp.

Report No.(s): DE2002-802595; No Copyright; Avail: Department of Energy Information Bridge

This report contains a listing of publications known to this author on reported concentrations, reviews and discussions of (sup 137)Cs,(sup 90)Sr and(sup 239+240)Pu in seawater, sediment and the biota from parts of the North and South Pacific Ocean. Each reference has been assigned an accession number consisting of the first three letters of the first author's last name followed by the first letter of the first name, the year of the publication and an assigned number. Studies in both the coastal areas and the open ocean are included as well as those providing data within lagoons of coral atolls. Some references to the radionuclides in the Indian Ocean are also provided.

NTIS

Pacific Ocean; Radioactive Isotopes; Cesium 137; Plutonium 239; Plutonium 240; Strontium 90; Bibliographies

20030037122 National Marine Fisheries Service, Miami, FL

Analysis of Sea Turtle Bycatch in the Commercial Shrimp Fisheries of Southeast U.S. Waters and the Gulf of Mexico

Epperly, S.; Avens, L.; Garrison, L.; Henwood, T.; Hoggard, W.; Nov. 2002; 96 pp.

Report No.(s): PB2003-102659; NOAA/TM/NMFS/SEFSC-490; No Copyright; Avail: CASI; A05, Hardcopy

This report is organized by sections. We first provide estimates of fishing effort by shrimp trawls. Next we provide estimates of sea turtle CPUE in shrimp trawls and adjust those estimates with aerial survey data. Following those sections, we provide the results: estimates of the number of interactions, the number of interactions resulting in mortalities under current regulations, and the number of interactions which we expect will result in interactions once new TED regulations are enacted. We then discuss the potential for interactions in other gears and in the bait shrimp fisheries. Lastly, we provide the reader a summary discussion and make research recommendations.

NTIS

Fishing; Statistics; Turtles

20030037137 Geological Survey, Menlo Park, CA, California State Dept. of Water Resources, Sacramento

Measurements of Salinity, Temperature, and Tides in South San Francisco Bay, California, at Dumbarton Bridge: 1990-93 Water Years

Schemel, L. E.; 1995; 68 pp.; In English

Report No.(s): PB2003-102705; USGS-OFR-95-326; No Copyright; Avail: CASI; A04, Hardcopy

The U.S. Geological Survey measures salinity, temperature, and water levels (tides) in southern San Francisco Bay at Dumbarton Bridge as part of a cooperative program with the California State Department of Water Resources. During water

years 1990-93, measurements were made at 15-minute intervals with electronic sensors located approximately one meter above the substrate in approximately six meters of water (at mean water level). During March and April of 1991 and 1992, salinity and temperature also were measured with a self-contained system floating one meter below the surface of the water. Sections of the data set were selected to illustrate influences of tidal currents, weather events, and seasonal and interannual variations in climate on salinity, temperature, and water levels at this location. The edited data are provided on high-density disks in comma-delimited, ASCII text files.
NTIS
Salinity; Geological Surveys; Surface Water; Oceanography; Tides; Water Temperature

20030037154 Texas A&M Univ., College Station, TX, Minerals Management Service, New Orleans, LA
Deepwater Program: Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology. Interim Report - Year 2
Rowe, G. T.; Kennicutt, M. C.; Dec. 2002; 166 pp.; In English
Report No.(s): PB2003-102983; No Copyright; Avail: CASI; A08, Hardcopy

This report provides a summary of the progress to date at the end of the second year of the program. At this stage of the program, sample analyses are in progress with only partial data sets finalized. The program is on schedule and planning is in progress for the final years field program which includes a major extension of the sampling and analysis efforts into the deepest regions of the southern Gulf of Mexico. Increasing exploration and exploitation of fossil hydrocarbon resources in the deep-sea prompted the Minerals Management Service of the U.S. Department of the Interior to support an investigation of the structure and function of the assemblages of organisms that live in association with the sea floor in the deep-sea. The program, Deep Gulf of Mexico Benthos or DGoMB, is studying the northern Gulf of Mexico (GOM) continental slope from water depths of 300 meters on the upper continental slope out to greater than 3,000 meters water depth seaward of the base of the Sigsbee and Florida Escarpments. The study is focused on areas that are the most likely targets of future resource exploration and exploitation. However, to develop a Gulfwide perspective of deep-sea communities, sampling in areas beyond those thought to be potential areas for exploration has been included in the study design.
NTIS
Continental Shelves; Ecology; Marine Biology; Ocean Bottom; Gulf Of Mexico; Deep Water

20030037181 Lawrence Livermore National Lab., Livermore, CA
Speciation and Fate of Trace Metals in Estuarine Sediments Under Reduced and Oxidized Conditions, Seaplane Lagoon, Alameda Naval Air Station
Carroll, S.; O'Day, P. A.; Esser, B.; Randall, S.; Oct. 18, 2002; 46 pp.
Report No.(s): DE2002-15002130; UCRL-JC-150548; No Copyright; Avail: Department of Energy Information Bridge

We have identified important chemical reactions that control the fate of metalcontaminated estuarine sediments if they are left undisturbed (in situ) or if they are dredged. We combined information on the molecular bonding of metals in solids from X-ray absorption spectroscopy (XAS) with thermodynamic and kinetic driving forces obtained from dissolved metal concentrations to deduce the dominant reactions under reduced and oxidized conditions. We evaluated the in situ geochemistry of metals (cadmium, chromium, iron, lead, manganese and zinc) as a function of sediment depth (to 100 cm) from a 60-year record of contamination at the Alameda Naval Air Station, California.
NTIS
Chemical Reactions; Sediments; Trace Elements; Metals

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*.

20030032367 California Univ., San Francisco, CA, USA
Membrane-Based Functions in the Origin of Cellular Life
Wilson, Michael A.; [2003]; 17 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-1126; No Copyright; Avail: CASI; A03, Hardcopy

How simple membrane peptides performed such essential proto-cellular functions as transport of ions and organic matter

across membranes separating the interior of the cell from the environment, capture and utilization of energy, and transduction of environmental signals, is a key question in protobiological evolution. On the basis of detailed, molecular-level computer simulations we investigate how these peptides insert into membranes, self-assemble into higher-order structures and acquire functions. We have studied the insertion of an a-helical peptide containing leucine (L) and serine (S) of the form (LSLLLSL)S into a model membrane. The transmembrane state is metastable, and approximately 15 kcal/mol is required to insert the peptide into the membrane. Investigations of dimers formed by (LSLLLSL)S and glycophorin A demonstrate how the favorable free energy of helix association can offset the unfavorable free energy of insertion, leading to self- assembly of peptide helices in the membrane. An example of a self-assembled structure is the tetrameric transmembrane pore of the influenza virus M2 protein, which is an efficient and selective voltage-gated proton channel. Our simulations explain the gating mechanism and provide guidelines how to reengineering the channel to act as a simple proton pump. In general, emergence of integral membrane proteins appears to be quite feasible and may be easier to envision than the emergence of water-soluble proteins.
Author
Biological Evolution; Peptides; Membranes; Ions; Transferring; Organic Materials; Cells (Biology); Protobiology

20030032467 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Optimal Extraction with Sub-sampled Line-Spread Functions
Collins, Nicholas R.; Gull, Theodore; Bowers, Chuck; Lindler, Don; [2002]; 4 pp.; In English; Hubble Space Telescope Workshop, 17-18 Oct. 2002, Baltimore, MD, USA; Copyright; Avail: CASI; A01, Hardcopy

STIS long-slit medium resolution spectra reduced in CALSTIS extended-source mode with narrow extraction heights (GWIDTH=3 pixels) show photometric uncertainties of +/- 3\% relative to point-source extractions. These uncertainties are introduced through interpolation in the spectral image rectification processing stage, and are correlated with the number of pixel crossings the spectral profile core encounters in the spatial direction. The line-spread-function may be determined as a function of pixel crossing- position from calibration data sub-sampled in the spatial direction. This line spread function will be applied to science data to perform optimal extractions and point- source de-blending. Wavelength and breathing effects will be studied. Viability of the method to de-convolve extended source 'blobs' will be investigated.
Author
Image Processing; Spectral Resolution; Line Spectra; Image Analysis; Astronomical Photometry; Data Processing; Computer Programs

20030032964 Oxford Univ., Oxford
ICA-Based Segmentation of the Brain on Perfusion Data
Tasciyan, T. A.; Beckmann, C. F.; Morris, E. D.; Smith, S. M.; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410449; No Copyright; Avail: CASI; A01, Hardcopy

An Independent Component Analysis (ICA) based segmentation technique is presented allowing the quantitative assessment of cerebral blood volume (CBV), cerebral blood flow (CBF) and mean transit time (MTT) from dynamic susceptibility contrast magnetic resonance (MR) images of the brain. Tissue types such as gray matter (GM), white matter (WM), and pathology appear as different ICA components as a result of their distinct temporal response to the first passage of contrast agent through the brain. The average CBV, CBF, and MTT values calculated for each component/tissue type could help evaluate the evolution of pathology and provide the opportunity for intersubject comparisons.
DTIC
Image Processing; Numerical Analysis

20030033088 Army Engineer Research and Development Center, Vicksburg, MS, USA
Development of a Rapid, Inexpensive Bioassay for Screening Contaminant Bioavailability in Sediment Using mRNA Profiling
Perkins, Edward; Frederickson, Herbert L.; Lotufo, Gilherme; Dec. 2002; 8 pp.; In English
Report No.(s): AD-A410566; ERDC/TN EEDP-04-34; No Copyright; Avail: CASI; A02, Hardcopy

This technical note describes how the stress responses of common bioassay organisms can be used to identify toxic contaminants and their bioavailability in sediment. The freshwater non-biting midge, Chironomus tentans, responds to contaminant exposure by making proteins to detoxify chemicals or repair damage, in addition to other responses. Midges make new proteins by transcription, or copying, of genes into messenger RNA (mRNA) that are used to make many copies of a protein. A snapshot of what the midge is sensing and how it is responding can be found by looking at the mRNAs that are

being made (mRNA profiling). Short exposures to common sediment contaminants result in patterns of mRNA profiles that indicate the class and type of the bioavailable chemical. Short analysis time and very high sample throughput enable this approach to be used as a means to rapidly screen large numbers of sediment samples for exposure and/or toxicity. These analyses are faster and cheaper than traditional priority pollutant analysis with the added potential of identifying bioavailable contaminants by the effect they cause in a bioassay organism.
DTIC
Bioassay; Contaminants; Genes; Ribonucleic Acids; Sediments; Organisms; Toxicity

20030033121 Universidad de Vigo, Vigo, Spain
Influence of Gender, Training and Circadian Time of Testing in The Cardiovascular Response to Stress Tests
Alonso, I.; Fernandez, J. R.; Hermida, R. C.; Mojon, A.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410610; No Copyright; Avail: CASI; A01, Hardcopy

Several studies have been performed on the cardiovascular response to physical and psychical stress and their value as early predictors of hypertension. The conclusions of these studies have been discrepant or even opposite. These discrepancies could be due in part to factors such as the time when the test is done, the degree of training of the subject in relation with the test, or the gender, usually ignored in the design of the trials. We have tested the statistically significant influence of these factors in the cardiovascular response to a physical and psychical test repeated several times at different circadian times in normotensive volunteers of both genders.
DTIC
Stress (Physiology); Physiological Tests; Cardiovascular System; Hypertension

20030036916 Iowa State Univ. of Science and Technology, Ames, IA
Nitric Oxide in Astrocyte-Neuron Signaling
Li, N.; 2002; 118 pp.
Report No.(s): DE2002-803739; No Copyright; Avail: Department of Energy Information Bridge

Astrocytes, a subtype of glial cell, have recently been shown to exhibit the elevations in response to neurotransmitters. An evalution can propagate to adjacent astrocytes as the wave, which allows an astrocyte to communicate with its neighbors. Additionally, glutamate can be released from astrocytes via a dependent mechanism, thus modulating neuronal activity and synaptic transmission.
NTIS
Nitrogen Oxides; Neurophysiology

20030037108 Swedish Defence Research Agency, Stockholm
Mental Stress Related to Peacekeeping Missions. A Survey of the Problem Area
Oedlund, A.; Feb. 2001; 32 pp.; In Swedish
Report No.(s): PB2003-101260; FOI-R-0044-SE; No Copyright; Avail: CASI; A03, Hardcopy

Soldiers and other groups of personnel in peacekeeping missions are at risk of getting mentally injured during their service abroad. Conditions including threats against one's own, or the groups, life or security, the suffering of other people and boredom in combination with state of alert create an environment that demand planning and readiness. Carefully prepared countermeasures help the personnel to cope with different kinds of situations without getting mental damages. In that Sweden is prepared to contribute with personnel in conflicts abroad, is there a demand for knowledge and resources in order to cope with this field. The Swedish Armed Forces, National Police Board and National Rescue Services Board have liability due to their personnel during international service. This report presents a survey of the authorities program (2000) for handling mental stress during international missions. The surveys, grouped into before, during and after a mission show great similarities. Differences between the complete programs and how they function in practice have however not been studied.
NTIS
Stress (Psychology); Military Operations; Armed Forces (Foreign)

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*.

20030033056 Duke Univ., Durham, NC, USA
The Effects of Supportive and Nonsupportive Behaviors on the Quality of Life of Prostate Cancer Patients and Their Spouses
Lipkus, Isaac; Feb. 2002; 315 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8597
Report No.(s): AD-A410543; No Copyright; Avail: CASI; A14, Hardcopy

Research on prostate cancer has not, as yet, identified how patients' and their spouses' supportive (e.g., giving advice/emotional support) and non-supportive behaviors (e.g., criticizing/avoiding partner) affect and are affected by their: 1) feelings of illness uncertainty, 2) psychological well-being, and 3) quality of life (QOL). The major aims of this two a half year longitudinal questionnaire study are to address the following questions among 150 early stage prostrate cancer patients and their spouses at time of diagnosis and at one, six and twelve month post-initiation of treatment: 1) does illness uncertainty and perceptions of control predict patient and spouse supportive and non-supportive behavior, QOL and psychological well-being/distress? 2) does perceived inadequacy of partner support predict non-supportive behaviors? and 3) to what extent do supportive and non-supportive behaviors mediate the relationship between illness uncertainty and QOL and illness uncertainty and psychological well-being? We have successfully recruited 186 patients and 166 spouses/partners. One preliminary result suggests that patient perceived disease uncertainty at baseline is highly negatively correlated, with the exception of role limitations, with all dimensions of quality life at the one-month follow-up.
DTIC
Cancer; Prostate Gland; Diagnosis; Human Behavior

20030033085 Kansas State Univ., Manhattan, KS, USA
Information Requirements for Traffic Awareness in a Free-Flight Environment: An Application of the FAIT Analysis
Uhlarik, John; Comerford, Doreen A.; March 2003; 55 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): FAA-98-F80691; AM-A-00-HRR-5 14
Report No.(s): DOT/FAA/AM-03/5; Copyright; Avail: CASI; A04, Hardcopy

The goals of the current research were (1) to identify the information necessary for the pilot of the air carrier to maintain traffic awareness, and (2) to apply and evaluate the utility of a cognitive task analysis called the Function Allocation Issues and Tradeoffs (FAIT) analysis (Riley, 1993) in order to assess a system that included a free-flight traffic environment, a pilot, and a Cockpit Display of Traffic Information (CDTI). One hundred information requirements were identified. The FAIT analysis indicated the following characteristics of the system are highly influential in a free-flight traffk environment: weather, general piloting skills, time of day, terrain, ownship state (e.g., altitude, attitude, speed), level of pilot mental workload, and perceived time pressure. Highly influential characteristics are important because they affect many other characteristics of the system. In using the FAIT analysis, characteristics are categorized as sensitive if they are affected by many other characteristics (i.e., they are vulnerable). Results from the FAIT analysis suggested that the following characteristics were very sensitive: type of action chosen by the pilot, level of pilot mental workload, appropriateness of planned action, ownship state, level of air traffic managers mental workload, accuracy of current machine model, and level of confidence in planned action. Furthermore, the FAIT analysis allowed an identification of potential tradeoffs in the system. Finally, the results indicated that, when compared with operator-driven system design issues, automation issues, and miscellaneous issues, training is the most important issue to address in a free-flight trafic environment.This paper addresses situation awareness (SA) as it relates to surveillance activities in commercial air carriers. The concept of SA and relevant literature are reviewed and critiqued.
Author
Free Flight; Tradeoffs; Situational Awareness; Human Factors Engineering; Aircraft Pilots; Commercial Aircraft; Aerospace Medicine

20030033089 Ioannina Univ., Greece
Intact and Implanted Femur Behavior During Walking and Jogging
Papathanasopoulou, V. A.; Fotiadis, D. I.; Massalas, C. V.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410560; No Copyright; Avail: CASI; A01, Hardcopy

The static position of single leg stance is a generally accepted worst case scenario for hip joint loading. However, it is essential in particular for investigations including temporal effects such as studies on fracture healing, fatigue, micromotion and remodeling to examine the dynamic loading situation not only at a single moment in time, but during the complete range of motion. In this study, a three-dimensional dynamic finite element model of the human femur during the gait cycle is developed. A temporally varying hip joint reaction force distribution during walking and jogging is employed and a temporally varying abductor muscles force is included while the distal end of the femur is constrained in translation only. The distribution of the displacements and stresses throughout the femur during different instants of the gait cycle is obtained in both loading conditions and compared. Also, an intramedullary prosthesis is nailed in the previous model and the femur prosthesis is subjected to a similar type of loading. The results can be used to visualize the mechanical environment in the intact femur during dynamic loading and compare it to that after total hip arthroplasty. Such knowledge is vital for surgical procedures, healing processes as well as therapeutic regimes.
DTIC
Stress (Physiology); Joints (Anatomy); Prosthetic Devices; Gait; Running

20030033097 Defence Research and Development Canada, Ottawa, Ontario, Canada
Assessment of Motion Effects on the FPSO (Floating, Production, Storage and Offloading) Vessel Terra Nova
Cheung, Bob; Brooks, Chris J.; Hofer, Kevin; Oct. 2002; 48 pp.; In English
Report No.(s): AD-A410576; DRDC-TORONTO-TR-2002-144; No Copyright; Avail: CASI; A03, Hardcopy

Current oil and gas exploration requirements to exploit deeper water change the method of oil extraction. Floating Production Storage and Off-loading (FPSO) vessels are increasingly being used to operate in these fields where the environment can be very extreme. The Petro Canada Terra Nova Floating, Production, Storage, Offshore vessel (FPSO) is the first of its kind built for operations on the Grand Banks at the Terra Nova field and is the first to operate in Canadian waters. The crew on these vessels is expected to operate for as long as possible under extreme weather conditions within certain safety margins. Seasickness and its after-effects, motion-induced fatigue and motion-induced interruptions remain a potential threat to crewmembers at sea. Understanding the incidence, severity and the effects of seasickness on performance, can improve effective scheduling and task assignment. This survey attempts to (1) define the incidence and severity of the symptom complex of seasickness, motion-induced fatigue and task performance problems encountered on the Terra Nova FPSO vessel and (2) to examine correlations (if any) between FPSO vessel motions, seasickness, motion-induced fatigue and task performance, towards the development of recommendations to provide operations guidance to ameliorate seasickness and improve comfort and performance in the environment described above. A questionnaire-based survey of motion effects including sleep problems, symptoms and severity of seasickness and task performance was administered at various times during 3-week offshore shifts. Ship motion data provided for this analysis was based on data gathered from the helideck (at the bow of the FPSO vessel) motion analysis and was provided by the radio operator from the FPSO Offshore Installation Office. Based on 911 questionnaires returned, problems reported for sleep disturbance and motion sickness symptoms were slight to moderate.
DTIC
Motion Sickness; Ships

20030033114 Tongji Univ., Shanghai, China
An Analytical Method for Rolling Contact of Articular Cartilages in Diarthrodial Joint
Wu, Jianguo; October 25, 2001; 4 pp.; In English
Report No.(s): AD-A410609; No Copyright; Avail: CASI; A01, Hardcopy

An analytical method is presented to investigate the stresses and strains in the cartilage layers of diarthrodial joint under rolling contact. Each cartilage layer in contact is assumed to be biphasic, composed of a linear elastic solid phase and Newtonian viscous fluid, whereas the subchondral bone is simplified as a rigid body. The contact range of two cartilage layers is discretized, where the surface tractions are piecewise given. A Galerkin-penalty method is applied to form the finite element formulation for the cartilage layers. The surface tractions, stresses and strains in the cartilage layers are then obtained for each time step with a numerical procedure of rolling contact. Results show that the interstitial fluid plays a fundamental role in the distributions of the stresses and strains in the cartilage. The normal solid stress reaches its maximum on the cartilage-subchondral bone interface. The coefficient of friction at the contact surface has a great effect on the tangential traction while it has little effect on the normal traction. The difference of rolling velocity between the two cartilage layers has an increasing effect on the tangential traction as the coefficient of friction increases.
DTIC
Bones; Cartilage; Galerkin Method; Joints (Anatomy); Rolling Contact Loads

20030034731 Nevada Univ., Las Vegas, NV

Analysis of Two Methods of Isometric Muscle Contractions During the Anti-G Straining Maneuver

Annicelli, Lance L.; May 2003; 85 pp.; In English

Report No.(s): AD-A410693; UNLV-CI02-836; No Copyright; Avail: CASI; A05, Hardcopy

This study investigated the difference in Mean Arterial Pressure (MAP) and Cardiac Output (CO) between two methods of isometric muscle contractions during the Anti-G Straining Maneuver (AGSM). 12 subjects (ages 18 to 38 years, height 176.8 plus or minus 7.4 cm, body mass 78.8 plus or minus 15.6 kg, percent body fat 14.3 plus or minus 6.6\%) participated in the study. The study was a one-way within-subject design with test conditions counterbalanced. Two methods of isometric muscle contractions lasting 30 seconds each were assessed; an isometric push contraction and an isometric muscle tensing contraction. The dependent parameters were MAP and CO. The average MAP during the push contraction was 123 mmHg, SD plus or minus 11 and for tense was 118 mmHg, SD plus or minus 8. CO was 7.6 L/min, SD plus or minus 1.6 for push and 7.9 L/min SD plus or minus 2.0 for tense method. Dependent t-tests revealed t(11) = 1.517, p = 0. 157 for MAP and t(11) = 0.875, p = 0.400 for CO. This study demonstrated that the two methods of isometric muscle contractions were not statistically different with regards to MAP and CO. Therefore, both forms of isometric contractions may be potentially useful when performing the muscle contraction portion of the AGSM.

DTIC

Heart Rate; Exercise Physiology; Stress (Biology)

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20030032427 NASA Ames Research Center, Moffett Field, CA, USA

Biologically Inspired Behavioral Strategies for Autonomous Aerial Explorers on Mars

Plice, Laura; Pisanich, Greg; Lau, Benton; Young, Larry A.; December 09, 2002; 16 pp.; In English; IEEE 2003 Aerospace Conference, 8-15 Mar. 2003, Big Sky, MT, USA; Original document is crooked and contains black and white illustrations

Contract(s)/Grant(s): NAS2-00065; RTOP 712-92-43; RTOP 749-50-00; No Copyright; Avail: CASI; A03, Hardcopy

The natural world is a rich source of problem- solving approaches. This paper discusses the feasibility and technical challenges underlying mimicking, or analogously adapting, biological behavioral strategies to mission/flight planning for aerial vehicles engaged in planetary exploration. Two candidate concepts based on natural resource utilization and searching behaviors are adapted io technological applications. Prototypes and test missions addressing the difficulties of implementation and their solutions are also described.

Author

Autonomy; Mars (Planet); Activity (Biology); Aerial Photography

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*.

20030032422 NASA Kennedy Space Center, Cocoa Beach, FL, USA, Dynamac Corp., Cocoa Beach, FL, USA

Crop Production for Advanced Life Support Systems - Observations From the Kennedy Space Center Breadboard Project

Wheeler, R. M.; Sager, J. C.; Prince, R. P.; Knott, W. M.; Mackowiak, C. L.; Stutte, G. W.; Yorio, N. C.; Ruffe, L. M.; Peterson, B. V.; Goins, G. D.; February 2003; 69 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/TM-2003-211184; NAS 1.15:211184; No Copyright; Avail: CASI; A04, Hardcopy

The use of plants for bioregenerative life support for space missions was first studied by the US Air Force in the 1950s and 1960s. Extensive testing was also conducted from the 1960s through the 1980s by Russian researchers located at the Institute of Biophysics in Krasnoyarsk, Siberia, and the Institute for Biomedical Problems in Moscow. NASA initiated bioregenerative research in the 1960s (e.g., Hydrogenomonas) but this research did not include testing with plants until about 1980, with the start of the Controlled Ecological Life Support System (CELSS) Program. The NASA CELSS research was carried out at universities, private corporations, and NASA field centers, including Kennedy Space Center (KSC). The project

at KSC began in 1985 and was called the CELSS Breadboard Project to indicate the capability for plugging in and testing various life support technologies; this name has since been dropped but bioregenerative testing at KSC has continued to the present under the NASA s Advanced Life Support (ALS) Program. A primary objective of the KSC testing was to conduct pre-integration tests with plants (crops) in a large, atmospherically closed test chamber called the Biomass Production Chamber (BPC). Test protocols for the BPC were based on observations and growing procedures developed by university investigators, as well as procedures developed in plant growth chamber studies at KSC. Growth chamber studies to support BPC testing focused on plant responses to different carbon dioxide (CO2) concentrations, different spectral qualities from various electric lamps, and nutrient film hydroponic culture techniques.
Author
Closed Ecological Systems; Crop Growth; Ecosystems; Life Support Systems; Protocol (Computers); Plants (Botany)

20030032921 Wisconsin Univ., Madison, WI
Two-Way Communication Through an Oral-Based Tactile Interface: Preliminary Results
Agarwal, Abhishek K.; Kim, Dongshin; Delisle, Matthew; Tang, Hui; Tyler, Mitchell; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410436; No Copyright; Avail: CASI; A01, Hardcopy

A two-way tactile communication system incorporating oral-based tactile modes is developed. The prototype system allows the user to both receive navigation cues, via a microfabricated flexible electrotactile palate display, and transmit information to the outside environment using a tongue operated device (TOD). The palate display consists of a flexible electrocutaneous-mode 7x7 electrode array for stimulating the palate. The TOD has four switches laid out in the cardinal directions with a fifth switch in the center. An oral-based tactile interface is realized by integrating the palate display and the TOD using a dental palate mold made from a silicone impression material. The system is programmed to test and simulate navigational guidance via two-way tactile communication. Preliminary human subject tests have been performed. Results indicate TOD force requirements influence performance, but adequate performance can be achieved within a relatively large range of input forces (one order of magnitude).
DTIC
Human-Computer Interface; Tongue

20030032953 Ljubljana Univ.
Robot Assisted Standing-Up in Persons with Lower Limb Prostheses
Kuzelicki, J.; Kamnik, R.; Burger, H.; Bajd, T.; Oct 2001; 5 pp.; In English
Report No.(s): AD-A410421; No Copyright; Avail: CASI; A01, Hardcopy

Robot assisted standing-up maneuver was tested in an intact person and a person after above-knee amputation. The subjects were asked to use as much leg activity as possible to lift their body while maintaining contact with the robot. The robot guided the subjects with three reference speeds. Kinematics and external forces acting on the body were recorded. The robot influence on the hip trajectory and the torques of the leg joints were studied. The subjects were able to track the robot movement. Thus, it is possible to use the robot to guide an impaired person along a desired trajectory during the standing-up process. In this way the impaired person can be trained to accomplish an efficient sit-to-stand movement, while different trajectories of raising can be preprogrammed.
DTIC
Robot Dynamics; Prosthetic Devices; Limbs (Anatomy); Human Body

20030032966 Wisconsin Univ., Madison, WI
Tongue-Based Electrotactile Feedback to Perceive Objects Grasped by a Robotic Manipulator: Preliminary Results
Droessler, Nicholas J.; Hall, David K.; Tyler, Mitchell E.; Ferrier, Nicola J.; Oct 2001; 5 pp.; In English
Report No.(s): AD-A410438; No Copyright; Avail: CASI; A01, Hardcopy

A sensate robotic gripper was developed and interfaced to an electrotactile tongue stimulation system. The prototype system permits grasped object recognition by the user without visual sensory input. Modifications of an existing two finger robotic gripper included the addition of six conductive polymer force sensors mounted in a pentagonal (24mm diameter) pattern with the sixth sensor placed in the center. Shape information from the robot gripper in contact with a test object is relayed to the user via patterned electrotactile stimulation on a micro-fabricated flexible tongue array. A previously developed Tongue Display Unit (TDU) provides the electrotactile stimulation, which pattern maps information from the six sensors to discrete groupings of electrodes on the 12 x 12 matrix tongue array. Modification of an existing software program facilitated

a tongue mapping closely resembling the spatial layout of the six force sensors, A preliminary human subject study was performed to demonstrate the accuracy of recognition when presented with one of four basic shapes. Results indicate sensor resolution and orientation influence performance, but even a limited configuration provides highly accurate shape recognition.
DTIC
End Effectors; Robotics; Tongue; Feedback; Stimulation

20030033083 Universidad Politecnica de Catalunya, Barcelona, Spain
Respiratory Pattern Variability Analysis Based on Nonlinear Prediction Methods
Domingo, L.; Caminal, P.; Giraldo, B. F.; Benito, S.; Vallverdu, M.; Kaplan, D.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410559; No Copyright; Avail: CASI; A01, Hardcopy

The traditional techniques of data analysis are often not sufficient to characterize the complex dynamics of respiration. In this study the respiratory pattern variability at different levels of pressure support ventilation (PSV) has been analyzed using nonlinear prediction methods. These methods use the volume signals generated by the respiratory system in order to construct a model of its dynamics, and then to estimate the deterministic level of the system from the quality of the predictions made with the model. Different methods of prediction evaluation and neighborhood definition have been considered. The incidence of different prediction depths and embedding dimensions have been analyzed. A group of 12 patients on weaning trials from mechanical ventilation have been studied at two different PSV levels. High statistically significant differences have been obtained when comparing the mean prediction error at two different PSV levels (p less than 0.002) with non-parametric analysis of variance test (Wilcoxon's signed rank test). The embedding dimension needed to model the system dynamics with low prediction error has also presented significant differences (p less than 0.005) between the complex dynamics of both PSV levels. Therefore, it may be concluded that the respiratory pattern variability depends on the level of pressure support ventilation.
DTIC
Respiratory System; Variability; Nonlinearity; Prediction Analysis Techniques; Ventilation; Breathing Apparatus

20030033825 Army Research Lab., Aberdeen Proving Ground, MD
Thermal Processing and Composite Laminate Formation of Ionic Block Copolymers for Protective Clothing
Harris, James; Elabd, Yossef A.; Napadensky, Eugene; Moy, Paul; Dec. 2002; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410616; ARL-TR-2892; No Copyright; Avail: CASI; A03, Hardcopy

The future U.S. Army soldier will require lightweight, flexible, durable, and selectively protective clothing for the battlefield. Current chemical protective clothing is worn as an overgarment and is impermeable to moisture vapor, imposing unbearable amounts of heat stress on the soldier. A new material, an ionic block copolymer, developed by researchers at the U.S. Army Research Laboratory, is both flexible and a 'breathable' protective barrier. This study focuses on thermally processing and laminating this new material onto the standard baffle dress uniform (BDU). Polymer films were produced by cryogenically grinding the polymer to a powder and then thermally pressing it into a film. Films were pressed at 1.15 x 107 Pa (1668 psi) and 100 deg C and were uniform in thickness, with thicknesses ranging from 254 to 300 micrometers (10-13 mils) from film to film. Films were then laminated onto a standard cotton/nylon BDU fabric using a similar pressure, but lower temperature (50 deg C). The polymer/fabric composite nearly doubled the thickness of the fabric and increased the weight threefold. Additionally, infrared spectroscopy revealed no chemical change occurred in the pressed polymer films due to thermal processing.
DTIC
Armed Forces (United States); Protective Clothing

20030033919 NASA Johnson Space Center, Houston, TX, USA
Guidelines and Capabilities for Designing Human Missions
Allen, Christopher S.; Burnett, Rebeka; Charles, John; Cucinotta, Frank; Fullerton, Richard; Goodman, Jerry R.; Griffith, Anthony D., Sr.; Kosmo, Joseph J.; Perchonok, Michele; Railsback, Jan; January 2003; 103 pp.; In English
Report No.(s): NASA/TM-2003-210785; NAS 1.15:210785; S-895; Copyright; Avail: CASI; A06, Hardcopy

These guidelines and capabilities identify the points of intersection between human spaceflight crews and mission considerations such as architecture, vehicle design, technologies, operations, and science requirements. In these chapters, we will provide clear, top-level guidelines for human-related exploration studies and technology research that will address

common questions and requirements. As a result, we hope that ongoing mission trade studies will consider common, standard, and practical criteria for human interfaces.
Author
Human-Computer Interface; Human Factors Engineering; Human Performance

20030034674 Tokai Univ., Kanagawa, Japan
The Development of the Navigation System for Visually Impaired Persons
Hashimoto, Hideki; Magatani, Kazushige; Yanashima, Kenji; Oct 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410485; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this study is the development of auto-navigation system which supports activities of the visually impaired without help of others. This system navigates the subject by using information about three sensors (acceleration sensor, terestrial magnetism sensor and gyro sensor), DGPS(Differential Global Positioning System), maps and a traffic data base. In our navigation system, after inputting the destination, position of the suer is estimated, the most suitable route to the destination is calculated, and the user is guided along this route. In this report, we assess the developed method which estimates the movement of the subject.
DTIC
Vision; Automatic Control; Disabilities; Navigation Aids

20030034720 Human Systems Information Analysis Center, Wright-Patterson AFB, OH, USA
Human Systems IAC Gateway, Volume 13, No. 2
Jan. 2002; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410689; No Copyright; Avail: CASI; A03, Hardcopy

This newsletter contains information on human factors challenges after September 11th, how the DoD and Human Factors Engineering is changing, collaborations between human systems and information systems personnel, web-based customer support, SAFE symposium. The newsletter also contains HSIAC products and a calendar of upcoming, human-systems events.
DTIC
Human Factors Engineering; Information Systems

20030034885 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands
Transition Region Between Adsorption and Filtration in NBC Filters
Kievit, O.; vanBokhoven, J. J. G. M.; October 2002; 29 pp.; In English
Contract(s)/Grant(s): B02/KL/479; TNO Proj. 014.12965
Report No.(s): PML-2002-A68; TD-2002-156; Copyright; Avail: Other Sources

This project focuses on C and B agents, smaller than conventional aerosols but larger than most gas molecules (e.g. biotoxins and viruses). It studies how well current respiratory protection systems can deal with challenges in this transition region (2-100 nm). For the aerosol filter, the diffusion coefficient is large enough to ensure that a particle will collide several times with the fibers. In a worst case scenario (hard particles, hard filtering media and low specific adhesion energy) particle bounce occurs below some 30 nm. This suggests that the aerosol filter may not be able to capture all particles in the transition region efficiently. If we assume that botulinium toxin behaves similar to rubber, the theory predicts good adhesion and no bounce. For the activated carbon filter, the characteristic time for diffusion can be much longer than the residence time. This indicates that transport phenomena limit the effectiveness of the filter. The required protection level is thus not feasible by using just an adsorptive filter. Furthermore, adsorption can only take place in meso- and macro- pores, which contribute little to the capacity.
Author
Activated Carbon; Filtration; Adsorption; Toxins And Antitoxins; Protection; Viruses

20030037112 Michigan Univ., Ann Arbor, MI
Reaction Time to Clear-Lens Turn Signals Under Sun-Loaded Conditions
Sullivan, J. M.; Flannagan, M. J.; Sep. 2001; 22 pp.; In English
Report No.(s): PB2003-101390; UMTRI-2001-30; No Copyright; Avail: CASI; A03, Hardcopy

The use of clear-lens signal lamps on automobiles, motivated largely by styling considerations, has prompted interest in whether there are any safety consequences associated with these lamps. In a previous report (UMTRI-98-2), it was found that under bright, sunny conditions, luminance contrast between the off and on states of clear-lens turn signal lamps is smaller than

for lamps using amber lenses. On the other hand, color contrast between the off and on states is greater with clear-lens turn signals. An experiment was conducted to compare the reaction time of drivers to signal lamps using clear and amber lenses. The results indicate that luminance contrast is the primary characteristic influencing driver performance and that no compensatory advantage appears to be obtained with increases in color contrast. This result is also consistent with evidence from basic research on visual search.
NTIS
Sunlight; Reaction Time; Visual Signals

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*.

20030036949 Tours Univ. (France), Miami Univ., Coral Gables, FL, South Carolina Univ., Columbia. Dept. of Mathematics
Area Theorem
Chrusciel, P.; Delay, E.; Galloway, G. J.; Howard, R.; Jan. 01, 2000; 76 pp.; In English
Report No.(s): PB2003-102611; Copyright; Avail: National Technical Information Service (NTIS)

We prove that the area of sections of future event horizons in space-times satisfying the null energy condition is non-decreasing towards the future under the following circumstances: (1) the horizon is future geodesically complete; (2) the horizon is a black hole event horizon in a globally hyperbolic space-time and there exists a conformal completion with a 'H-regular' J+; (3) the horizon is a black hole event horizon in a space-time which has a globally hyperbolic conformal completion. (Some related results under less restrictive hypotheses are also established.) This extends a theorem of Hawking, in which piecewise smoothness of the event horizon seems to have been assumed. We prove smoothness or analyticity of the relevant part of the event horizon when equality in the area inequality is attained - this has applications to the theory of stationary black holes, as well as to the structure of compact Cauchy horizons. In the course of the proof we establish several new results concerning the differentiability properties of horizons.
NTIS
Theorem Proving; Space-Time Functions; Event Horizon; Celestial Geodesy

20030036953 Tours Univ. (France), Royal Inst. of Tech., Stockholm (Sweden)
Ricci Curvature in the Neighbourhood of Rank-One Symmetric Spaces
Delay, E.; Herzlich, M.; 2002; 22 pp.; In English
Report No.(s): PB2003-102638; Copyright; Avail: National Technical Information Service (NTIS)

We study the Ricci curvature of a Riemannian metric as a differential operator acting on the space of metrics close (in a weighted functional spaces topology) to the standard metric of a rank-one noncompact symmetric space. We prove that any symmetric bilinear field close enough to the standard may be realized as the Ricci curvature of a unique close metric if its decay rate at infinity (its weight) belongs to some precisely known interval. We also study what happens if the decay rate is too small or too large.
NTIS
Curvature; Metric Space; Operators (Mathematics); Topology; Symmetry; Riemann Manifold

20030036962 Center for Mathematics and Computer Science, Amsterdam
Algebraic Framework for Linear and Morphological Scale-Spaces. Probability, Networks and Algorithms
Heijmans, H. J. A.; van den Boomgaard, R.; Feb. 29, 2000; 40 pp.
Report No.(s): PB2003-102642; PNA-R0003; Copyright; Avail: National Technical Information Service (NTIS)

This paper proposes a general algebraic construction technique for image scale-spaces. The basic idea is to first downscale the image by some factor using an invertible scaling, then apply an image operator (linear or morphological) at a unit scale, and finally resize the image to its original scale. It is then required that the resulting one-parameter family of image operators satisfes the semigroup property. Such an approach encompasses linear as well as nonlinear (morphological) operators. Furthermore, there exists some freedom as to which semigroup operation on the scale- (or time-) axis is being chosen. Particular attention is given to additive and supremal semigroups. A large part of the paper is devoted to morphological

scale-spaces, in particular to scale-spaces associated with an erosion or an opening. In these cases, classical tools from convex analysis, such as the (Young-Fenchel) conjugate, play an important role.
NTIS
Algebra; Probability Theory; Group Theory; Algorithms

20030038799 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette
Membranes and Matrix Models
Hoppe, J.; Jun. 2002; 40 pp.
Report No.(s): PB2003-102080; IHES/P/02/47; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
NTIS
Membranes; Matrices

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*.

20030032404 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
A Program to Detect and Characterize Extra-Solar Giant Planets
Lindstrom, David, Technical Monitor; Noyes, Robert W.; March 2003; 6 pp.; In English
Contract(s)/Grant(s): NAG5-10854; No Copyright; Avail: CASI; A02, Hardcopy

We initiated a significant hardware upgrade to the AFOE, to increase its efficiency for precise radial velocity studies to the level where we can continue to contribute usefully to extrasolar planet research on relatively bright stars. The AFOE, at a 1.5-m telescope, will of course not have the sensitivity of radial velocity instruments at larger telescopes, such as the HIRES on Keck or the Hectochelle on the MMT telescope (about to come on line). However, it has been possible to increase its efficiency for precise radial velocity studies by a factor of 4 to 5, which-combined with the large amount of telescope time available at the 1.5-m telescope-will permit us to do intensive follow-up observations of stars brighter than about 8 magnitude. The AFOE was originally designed primarily for asteroseismology using a ThAr reference. This provided useful wavelength stability over tens of minutes as required for asteroseismology, but we were unable to get a long-term (month-to-month) velocity precision better than about 15 m/s with that setup. Hence, we implemented an iodine cell as a wavelength reference for extrasolar planet studies. However, the optical design of the original AFOE did not completely span the wavelength range covered by the iodine absorption spectrum, and furthermore the optics suffered significant light loss through optical obscuration in the camera secondary. To remedy this, we replaced the AFOE grating with a new one that covered the entire iodine spectral range at somewhat lower spectral resolution, and replaced the camera with a transmitting lens. (The use of a lens was made possible by restricting the spectral range covered by the upgraded AFOE to only the iodine region.) These upgrades were successfully completed, and the instrument was tested for three nights in fall of 2002. The expected improvement in sensitivity by a factor of 4 to 5 was observed: that is, the same velocity precision as previously attained (of order 5 to 7 m/s) was now obtained on a stars that are about 4 to 5 times fainter. Unfortunately, just after installing the new AFOE optics, there was a catastrophic failure of the old Tektronix CCD. A careful investigation was made, and it was determined that the failure was probably due to too many thermal cyclings over the previous 8 years. The only solution was to purchase a new CCD. Internal funds of $16,000 were found for this purpose, and the new CCD (a thinned, back-illuminated Marconi 2K x 2K device with 13.5 micron pixels, and employing dual readout channels to keep the readout time as short as 20 seconds) was ordered, has now arrived, and is currently under test before 1 being installed in the AFOE liquid nitrogen dewar. At the same time, we expect to implement new CCD control electronics. This system should be better in many ways than the previous detector (including eliminating the need for UV flashing to maximize the quantum efficiency). We plan to install the detector on the telescope and begin operations again in April of this year.
Author
Asteroseismology; Computers; Radial Velocity; Telescopes; Design Analysis

20030033048 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Advanced Data Acquisition Systems

Perotti, J.; [2003]; 5 pp.; In English; Propulsion Measurement Sensor Development Workshop, 13-15 May 2003, Huntsville, AL, USA; Original contains black and white illustrations

Report No.(s): KSC-2003-049; No Copyright; Avail: CASI; A01, Hardcopy

Current and future requirements of the aerospace sensors and transducers field make it necessary for the design and development of new data acquisition devices and instrumentation systems. New designs are sought to incorporate self-health, self-calibrating, self-repair capabilities, allowing greater measurement reliability and extended calibration cycles. With the addition of power management schemes, state-of-the-art data acquisition systems allow data to be processed and presented to the users with increased efficiency and accuracy. The design architecture presented in this paper displays an innovative approach to data acquisition systems. The design incorporates: electronic health self-check, device/system self-calibration, electronics and function self-repair, failure detection and prediction, and power management (reduced power consumption). These requirements are driven by the aerospace industry need to reduce operations and maintenance costs, to accelerate processing time and to provide reliable hardware with minimum costs. The project's design architecture incorporates some commercially available components identified during the market research investigation like: Field Programmable Gate Arrays (FPGA) Programmable Analog Integrated Circuits (PAC IC) and Field Programmable Analog Arrays (FPAA); Digital Signal Processing (DSP) electronic/system control and investigation of specific characteristics found in technologies like: Electronic Component Mean Time Between Failure (MTBF); and Radiation Hardened Component Availability. There are three main sections discussed in the design architecture presented in this document. They are the following: (a) Analog Signal Module Section, (b) Digital Signal/Control Module Section and (c) Power Management Module Section. These sections are discussed in detail in the following pages. This approach to data acquisition systems has resulted in the assignment of patent rights to Kennedy Space Center under U.S. patent # 6,462,684. Furthermore, NASA KSC commercialization office has issued licensing rights to Circuit Avenue Netrepreneurs, LLC , a minority-owned business founded in 1999 located in Camden, NJ.

Derived from text

Systems Health Monitoring; Smart Structures; Data Acquisition; Architecture (Computers); Maintenance; Fault Detection; Calibrating

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.

20030032283 NASA Ames Research Center, Moffett Field, CA, USA

Using Grid Benchmarks for Dynamic Scheduling of Grid Applications

Frumkin, Michael; Hood, Robert; [2003]; 11 pp.; In English; HPDC12, 22-24 Jun. 2003, Seattle, WA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 704-42-42; Copyright; Avail: CASI; A03, Hardcopy

Navigation or dynamic scheduling of applications on computational grids can be improved through the use of an application-specific characterization of grid resources. Current grid information systems provide a description of the resources, but do not contain any application-specific information. We define a GridScape as dynamic state of the grid resources. We measure the dynamic performance of these resources using the grid benchmarks. Then we use the GridScape for automatic assignment of the tasks of a grid application to grid resources. The scalability of the system is achieved by limiting the navigation overhead to a few percent of the application resource requirements. Our task submission and assignment protocol guarantees that the navigation system does not cause grid congestion. On a synthetic data mining application we demonstrate that Gridscape-based task assignment reduces the application tunaround time.

Author

Computational Grids; Architecture (Computers); Automatic Control; Programming (Scheduling); Computer Systems Programs; Machine Learning

20030032435 NASA Ames Research Center, Moffett Field, CA, USA

Characterization of Model-Based Reasoning Strategies for Use in IVHM Architectures

Poll, Scott; Iverson, David; Patterson-Hine, Ann; [2003]; 13 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Open architectures are gaining popularity for Integrated Vehicle Health Management (IVHM) applications due to the diversity of subsystem health monitoring strategies in use and the need to integrate a variety of techniques at the system health management level. The basic concept of an open architecture suggests that whatever monitoring or reasoning strategy a subsystem wishes to deploy, the system architecture will support the needs of that subsystem and will be capable of transmitting subsystem health status across subsystem boundaries and up to the system level for system-wide fault identification and diagnosis. There is a need to understand the capabilities of various reasoning engines and how they, coupled with intelligent monitoring techniques, can support fault detection and system level fault management. Researchers in IVHM at NASA Ames Research Center are supporting the development of an IVHM system for liquefying-fuel hybrid rockets. In the initial stage of this project, a few readily available reasoning engines were studied to assess candidate technologies for application in next generation launch systems. Three tools representing the spectrum of model-based reasoning approaches, from a quantitative simulation based approach to a graph-based fault propagation technique, were applied to model the behavior of the Hybrid Combustion Facility testbed at Ames. This paper summarizes the characterization of the modeling process for each of the techniques.
Author
Architecture (Computers); Diagnosis; Fault Detection; Health; Support Systems

20030032525 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GFO Altimeter Engineering Assessment Report
Lockwood, Dennis W.; Hancock, David W., III; Hayne, George S.; Brooks, Ronald L.; March 2002; 82 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): 622-47-36-02
Report No.(s): NASA/TM-2002-209984/VER1/VOL3; NAS 1.15:209984/VER1/VOL3; Copyright; Avail: CASI; A05, Hardcopy

The U.S. Navy's Geosat Follow-On (GFO) Mission, launched on February 20, 1998, is one of a series of altimetric satellites which include Seasat, Geosat, ERS-1, and TOPEX/POSEIDON (T/P). The purpose of this report is to document the GFO altimeter performance determined from the analyses and results performed by NASA's GSFC and Wallops altimeter, calibration team. It is the second of an anticipated series of NASA's GSFC and Wallops GFO performance documents, each of which will update assessment results. This report covers the performance from instrument acceptance by the Navy on November 29, 2000, to the end of Cycle 20 on November 21, 2001. Data derived from GFO will lead to improvements in the knowledge of ocean circulation, ice sheet topography, and climate change. In order to capture the maximum amount of information from the GFO data, accurate altimeter calibrations are required for the civilian data set which NOAA will produce. Wallops Flight Facility has provided similar products for the Geosat and T/P missions and is doing the same for GFO.
Author
Satellite Altimetry; Satellite-Borne Radar; Computer Programs; Software Reliability; Component Reliability; Reliability Analysis; Satellite Instruments; Data Processing

20030032937 Memphis Univ., Memphis, TN
Simulation-Based Teaching and Learning for Electrophysiology by iCell
Demir, Semahat S.; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410410; No Copyright; Avail: CASI; A01, Hardcopy

An interactive cell modeling web site, iCell, that integrates research and education, was developed as a simulation-based teaching and learning tool for electrophysiology. The site consists of JAVA applets representing models of various cardiac cells and neurons, and provides simulation data of their bioelectric activities at cellular level. Each JAVA-based model allows the user to go through menu options to change model parameters, run and view simulation results. The site also has a glossary section for the scientific tens. iCell has been used as a teaching and learning tool for four graduate courses at the Joint Biomedical Engineering Program of University of Memphis and University of Tennessee. This modeling tool was also used as a collaboration site among our colleagues interested in simulations of cell membrane activities. Scientists from the fields of biosciences, engineering, life sciences and medical sciences in USA, Canada, China, Brazil, England, Ireland, the Netherlands, New Zealand, Spain and Turkey have tested and utilized iCell as a simulation-based teaching, learning and collaboration environment. The platform-independent software, iCell, provides us with an interactive and user-friendly teaching and learning tool, and also a collaboration environment for electrophysiology to be shared over the Internet.
DTIC
Applications Programs (Computers); Electrophysiology; Education; Computerized Simulation; Cells (Biology)

20030032970 Massachusetts Inst. of Tech., Cambridge, MA

A Database Federation Platform for Gene Chips and the Human Genome Database

Fu, B.; Zhang, S.; Chuang, W.; Dewey, C. F., Jr; Oct 2001; 5 pp.; In English

Report No.(s): AD-A410356; No Copyright; Avail: CASI; A01, Hardcopy

Data sources that are typical of the next generation of biological information entities are gene chips that identify the individual genes in a given biological sample. These data are currently stored in a database format defined by the Genetic Analysis Technology Consortium (GATC). To interpret the chip data, we also need information about the genes themselves, as found in the Human Genome Database (HGDB). These two databases were conceived at different times to serve different purposes, and their designs differ significantly. Extracting information simultaneously from multiple databases has proved to be a very difficult problem. We have developed a system that will intelligently direct a single client query against a federation of databases. Our solution uses software standards common in the field today - XML, CORBA, and Java - but these standards by themselves are not sufficient. We have developed a new component called the Class Mapper, a software layer unique to each database. Each Class Mapper represents its database as an object-oriented schema consistent with the schema level of the federation. A Federation Platform reads the query, the Class Mappers execute the query across their respective databases, and the Federation Platform returns results to the client.

DTIC

Data Bases; Genes; Genome; Chips (Electronics); Computer Programs; Human Beings

20030032971 Army Southeastern Regional Medical Command, Fort Gordon, GA, USA

Develop and Operationally Test a Digital Internet Based Information System for Theater Digital Force Health Protection and Disease Surveillance

Whitlock, Warren; September 2002; 6 pp.; In English

Report No.(s): AD-A410209; No Copyright; Avail: CASI; A02, Hardcopy

The medical objective was to provide for current command priorities which included daily DNBI reports by medical units to the C2. The current DNBl reporting was performed in theater and used a daily handwritten count collected by visiting each medical unit - BAS to the CSH in theater. Human error created several problems that could be solved utilizing a digital system with primary identification data capability and automatic compiling for reporting. The system must meet with user needs and with command needs, as well as fit the communications architecture and be supportable based on the level of personnel training in theater.

DTIC

Information Systems; Internets; Diseases

20030032981 NASA Goddard Space Flight Center, Greenbelt, MD, USA

GALPROP: New Developments in CR Propagation Code

Moskalenko, I. V.; Jones, F. C.; Mashnik, S. G.; Strong, A. W.; Ptuskin, V. S.; 7 Mar. 2003; 1 pp.; In English; 28th ICRC, 31 Jul. - 7 Aug. 2003, Japan; Copyright; Avail: Other Sources; Abstract Only

The numerical Galactic CR propagation code GALPROP has been shown to reproduce simultaneously observational data of many kinds related to CR origin and propagation. It has been validated on direct measurements of nuclei, antiprotons, electrons, positrons as well as on astronomical measurements of gamma rays and synchrotron radiation. Such data provide many independent constraints on model parameters while revealing some contradictions in the conventional view of Galactic CR propagation. Using a new version of GALPROP we study new effects such as processes of wave-particle interactions in the interstellar medium. We also report about other developments in the CR propagation code.

Author

Wave-Particle Interactions; Applications Programs (Computers); Computerized Simulation; Proving; Cosmic Rays

20030033007 Uniformed Services Univ. of the Health Sciences, Bethesda, MD

Integrating Computerized Virtual Reality With Traditional Methods of Teaching Skull Anatomy

Todd, Bruce D.; Atchely, Karla; Dec. 2002; 67 pp.; In English

Report No.(s): AD-A410677; No Copyright; Avail: CASI; A04, Hardcopy

No abstract available.

Education; Anatomy; Skull; Virtual Reality

20030033022 Sandia National Labs., Albuquerque, NM
Distributed Sensing & Cooperative Control for Plume Tracing
Hurtado, John E.; Jan 2000; 4 pp.; In English
Contract(s)/Grant(s): N00014-99-F-0086
Report No.(s): AD-A410645; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this proposed research was to apply distributed sensing and cooperative control algorithms developed by Sandia researchers (under separate DOE contracts) to the problem of chemical plume localization. The distributed sensing and cooperative control algorithms were tested against mathematically modeled simulated plumes and against real plume data.
DTIC
Plumes; Position (Location)

20030033043 Air Force Research Lab., Edwards AFB, CA, USA
Development of SMART Layer Technology for Health Monitoring of Structures
Kumar, Amrita; Beard, Shawn; June 05, 2001; 4 pp.; In English
Contract(s)/Grant(s): F04611-00-C-0026; AF Proj. 3005
Report No.(s): AD-A410538; AFRL/PRS-ED-VG-2001-128; No Copyright; Avail: CASI; A01, Hardcopy

No abstract available
DTIC
Systems Health Monitoring; Rocket Engines; Smart Structures; Technology Utilization

20030033051 ASRC Aerospace Corp., Greenbelt, MD, USA
Jell-Molds and Cookie-cutters: Shrinkwrap Isn't Just for Leftovers Anymore
Randazzo, John; [2003]; 10 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS10-03006
Report No.(s): KSC-2003-054; No Copyright; Avail: CASI; A02, Hardcopy

So what is Shrinkwrap all about? For those of you who may not know about it, Shrinkwrap is a type of data structure that can manifest itself as a feature or model. It is cleverly covered up, almost hidden, and doesn't get the press or widespread use of a solid or surface. The shrinkwrap feature is located under the data sharing submenu of the feature menu. The shrinkwrap feature, as described by PTC, is a collection of surfaces and datum features of a model that represents the exterior of the model . The advantages and applications of the shrinkwrap feature are in the creation of minimal memory guzzling representations of assemblies. These can be used to represent subassemblies in parent assemblies, and can handle control of dependency issues, geometry represented, and additional references through the use of the shrinkwrap feature options. The shrinkwrap model is an option available under the save as umbrella. Its function, as described by PTC, is to share data with internal and external design groups and improve performance in large assembly design . Some of the benefits of the shrinkwrap model include being able to represent complex assemblies with a single, lightweight part that protects design intent and parametric data, and the ability to improve performance of large assembly modeling in the area of less load time. The proper-scale models can be saved as IGES, STEP, and VRML (for fly-throughs).
Derived from text
Data Structures; Models; Computer Aided Design

20030033930 Pontifical Catholic Univ. of Puerto Rico, Ponce, Puerto Rico
Computerized System to Aid Deaf Children in Speech Learning
Riella, Rodrigo J.; Linarth, Andre G.; Lippman, Lourival, Jr.; Nohama, Percy; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410403; No Copyright; Avail: CASI; A01, Hardcopy

This paper describes a voice analyzer, whose purpose is deaf children's assistance in the process of speech learning. The processing of the user's speech signal is performed in real time in order to get an instantaneous feedback of the result of speech training. The aim of this analyzer is not to find the distinction between spoken words, main objective of a speech recognizer but to calculate a level of correctness in the toggle of a specific word. Voice signal analysis was developed through a digital signal processor (DSP), applying spectral analysis processes, extraction of voice's formants, adaptation of formants to the standard levels in domain of time and frequency and statistical matching of the acquired speech signal and the standard one, resulted from training. After calculating the correctness coefficient, the system goes off a visual feedback to the user in the

form of a graphical animation, in accordance with the matching ratio, that will determine the progression on speech training.
DTIC
Signal Processing; Computer Systems Programs; Children; Telephony; Auditory Defects; Articulation (Speech)

20030033935 NeoCore, Inc., Colorado Springs, CO, USA
Knowledge Management through a Fully Extensible, Schema Independent, XML Database
Direen, H.; Brandin, C.; Jones, M.; Hedgepeth, C.; Shin, D.; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410659; No Copyright; Avail: CASI; A01, Hardcopy

Information in any field, including bioinformatics, is a combination of data and the data's context. A system that manages information must be able to handle both aspects of information: context and data. The problem with most systems (databases in particular) is that the context must be predefined. In a field that is developing as fast as bioinformatics, it is as impossible to predefine all of the context as it is to predefine all of the data that is being generated. A knowledge management system must handle context or metadata as freely and flexibly as it handles data. NeoCore has developed a fully extensible, schema independent, XML-based information management system that meets this requirement.
DTIC
Information Management; Data Bases; Systems Engineering; Document Markup Languages

20030033956 Fluor Hanford, Richland, WA
Automated Mapping/Facilities Management (AM/FM) Version 8.4 Acceptance Test Plan
2002; 24 pp.; In English
Report No.(s): DE2002-801120; HNF-5321; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this document is to describe the tests that will be performed to the Automated Mapping/Facilities Management (AMIFM software), Revision 8.4, for the purpose of verifying and validating that the software functions as intended and in agreement with the design.
NTIS
Computer Aided Mapping; Program Verification (Computers)

20030033965 Fluor Hanford, Richland, WA
Automated Mapping/Facilities Management (AM/FM) Version 8.4 Acceptance Test Report
2002; 18 pp.; In English
Report No.(s): DE2002-801121; HNF-5322; No Copyright; Avail: Department of Energy Information Bridge

This document provides the results of testing activities performed in order to verify that version 8.4 of the AM/FM software meets the user's requirements.
NTIS
Computer Aided Mapping; Program Verification (Computers); Logistics Management

20030033966 Kestrel Technology, LLC, Palo Alto, CA, USA
DANDE: Deductive Anomaly Detection With Program Synthesis
Westfold, Stephen; Waldinger, Richard; January 14, 2003; 16 pp.; In English
Contract(s)/Grant(s): DAAH01-02-C-R; ARPA ORDER-K475
Report No.(s): AD-A410674; No Copyright; Avail: CASI; A03, Hardcopy

The core problem we are facing in this project is detecting qualitative anomalies. Qualitative anomalies are combinations of conditions or events that violate some standards of safety or normalcy. The essence of the current project is to coordinate multiple online data sources, including public records and Web-sites, using a theory of the relevant world knowledge, and deductive inference methods. The theory and methods are incorporated into Specware, the Kestrel software-development environment, Data sources include employment histories and qualifications, educational histories, Visa trails, organizations and affiliations, residence addresses, immigration records, radar tracks, security cameras, and flight-departure information. These sources, which are continually being updated, are linked to the Specware theory via a procedural attachment mechanism; this means that the inference mechanism can draw conclusions from the data sources just as if they were incorporated into the Specware theory.
DTIC
Computer Programs; Information Retrieval; Logic

20030034587 Army Research Lab., White Sands Missile Range, NM, USA
Web-Based Mesoscale Model Execution and Evaluation Tool: A Prototype
Kirby, Stephen F.; Jan. 2003; 19 pp.; In English
Report No.(s): AD-A410678; ARL-MR-548; No Copyright; Avail: CASI; A03, Hardcopy

U.S. Army personnel are highly dependent on receiving the highest quality meteorological data possible, either for missions or for training. This data may be input to a tactical decision aid ((TDA) a software component intended to assist military personnel in formulating plans), the basis on which troop movements are made, a determining factor on how armaments are employed, etc. Thus, when the required data is derived from models, the models must be thoroughly evaluated for the accuracy of the output prior to integration into training scenarios and the battlefield. To provide a more streamlined method by which U. S. Army Research Laboratory researchers can both execute and evaluate mesoscale models, a prototype Java Server Pages-based Web site has been developed.
DTIC
Prototypes; Statistical Analysis; Java (Programming Language)

20030034592 California Univ., San Francisco, CA
Use of Intelligent Agents to Include Signal Analysis Data
Hudson, Donna L.; Cohen, Maurice E.; October 25, 2001; 5 pp.; In English
Contract(s)/Grant(s): ISO6GM61223-01
Report No.(s): AD-A410426; No Copyright; Avail: CASI; A01, Hardcopy

Signal analysis data, especially electrocardiogram (ECG) and electroencephalogram (EEG) data, provide important information for clinical decision-making. In order to arrive at a diagnosis, it is often necessary to combine these results with other clinical parameters. Problems remain in the automation of this process for the development of computer-assisted diagnosis tools. A promising approach includes the use of intelligent agents, a procedure that involves the development of a central mechanism to provide communications among differing methodologies and different information types to provide a comprehensive solution to the problem. This methodology is illustrated in a decision model for diagnosis of dementia emphasizing the inclusion of summary measures for EEG data.
DTIC
Electrocardiography; Electroencephalography; Signal Analysis; Medical Electronics; Artificial Intelligence

20030034600 Instituto Politecnico Nacional, Mexico City, Mexico
Inverse Kinematics for a Parallel Myoelectric Elbow
Escudero, A. Z.; Alvarez, Ja; Leija, L.; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410318; No Copyright; Avail: CASI; A01, Hardcopy

Nowadays, myoelectric prostheses for replacement above elbow are serial mechanisms driven by a DC motor and they include only one active articulation for the elbow 1. Parallel mechanisms are more robust and produce a greater force than serial mechanisms since every actuator participates in the desired movement of the system. Calculating the position of every actuator is more complicated than in serial mechanisms, and as a result, the mathematical models for parallel mechanisms are rather scarce 2. The inverse kinematics model of a 3-degree of freedom parallel prosthetic elbow mechanism is reported. The mathematical model is required in order to design an above elbow myoelectric prosthesis. The prosthesis under design will have 4 active degrees of freedom and the elbow will employ a parallel mechanical system. The flexion of the elbow, the pronosupination and the humeral rotation are produced by the simultaneous participation of 3 actuators. The grasp is produced by a fourth independent motor. Different derivations of the mathematical model will improve the design of the mechanism of the elbow, with savings in experimentation. Finally, this inverse kinematics model will be employed, using interpolation, in the first control program for the final prosthesis.
DTIC
Inverse Kinematics; Mathematical Models; Myoelectric Potentials; Prosthetic Devices; Elbow (Anatomy); Robotics

20030034616 Moscow State Univ., Russia
A Distributed Component-Oriented Architecture for Real-Time ECG Data Acquisition Systems
Nagin, V. A.; Potapov, I. V.; Selishchev, S. V.; October 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410406; No Copyright; Avail: CASI; A01, Hardcopy

The paper presents a distributed component-oriented multi-tier architecture as applied to the multifunctional ECG software system development. This approach makes it possible to design flexible and manageable ECG applications with the

functionality that can be dynamically changed or extended. As a practical implementation of the elaborated architecture a realtime ECG system was developed and its performance parameters were investigated. A set of implemented components includes several realtime data acquisition modules, fast visualization and printing components as well as noise suppression and QRS detection and survey modules. The modular structure of the application with support of transparent integration of new components enabled us to develop additional add-on modules for carrying out specific experiments with ECG transmission methods.
DTIC
Computer Programming; Data Acquisition; Electrocardiography; Real Time Operation; Distributed Processing; Architecture (Computers)

20030034617 Seville Univ., Spain
Virtual Center for Renal Support: Definition of a Novel Knowledge-Based Telemedicine System
Prado, M.; Roa, L.; Reina-Tosina, J.; Palma, A.; Milan, J. A.; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410409; No Copyright; Avail: CASI; A01, Hardcopy

The Biomedical Engineering Group of the University of Seville (GIB) is developing new strategies to apply the home health care program within End Stage Renal Disease (ESRD) Patients. In this paper we first review the current status of ESRD patients in Spain, Europe and USA. In the second part, the formal definition of the novel Virtual Center for Renal Support (VCRS) is done, Design of VCRS relies on a model-based system analysis methodology. The knowledge-based assistance to be provided by VCRS is carried on the Patient Physiological Image Component (PPI Component), This is a computing component based on cutting-edge Modelling & Simulation Technology, which gives the physician the ability to predict clinical events, infer technical and physiological problems, compute no previously measured variables and is also an aid for diagnosis, prescription and supervision of therapies.
DTIC
Telemedicine; Kidney Diseases; Knowledge Based Systems

20030034632 NATIONAL YANG-MING UNIV TAIPEI (TAIWAN)
An Orthopedics Clinic Assistant System
Tang, Shih-Tsang; Huang, Yueh-Fang; Hsiao, Ming-Liang; Lee, Tsung-Chieh; Young, Shuenn-Tsong; October 25, 2001; 3 pp.; In English
Report No.(s): AD-A410343; No Copyright; Avail: CASI; A01, Hardcopy

This research proposed a system, which integrated the complete patient information, including the medical images, for assisting orthopedics clinic diagnosis. The system concurrently operated with legacy systems and conformed itself to correspond with the current environment. It was unnecessary to modify the present systems for our system implementation. The system resulted in minimal impact to the current healthcare institutes, and promoted the communication of medical images among departments. It offered a valuable reference for PACS implementation.
DTIC
Information Systems; Orthopedics

20030034643 Bogazici Univ., Istanbul, Turkey
Feature Extraction from Mammographic Mass Shapes and Development of a Mammogram Database
Ertas, G.; Guelcur, H. O.; Aribal, E.; Semiz, A.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410302; No Copyright; Avail: CASI; A01, Hardcopy

Breast cancer is one of the most common malignancies in women and a rare malignancy in men. Women who are diagnosed at an early stage can survive this often deadly disease. Mammography provides the best screening modality for detecting early breast cancer, even before a lesion is palpable. Because of the malignant mass pathology, the shape of the mammographic mass can be used to discriminate between malignant and benign masses. In this study the use of shape features to classify breast masses has been investigated and a classification scheme has been developed to classify masses as either benign or malignant. A mammogram database designed to store the images of the masses, calculated shape descriptor parameters and some additional data, such as patient history, category of the mass and biopsy report if performed which are required in BI-RADS is also introduced A touch on memory system has been used as a tool that permits access to the electronic patient record in the mammogram database. The software is written in Delphi and runs on Windows operation systems.
DTIC
Mammary Glands; Pattern Recognition

20030034702 Newcastle-upon-Tyne Univ., Newcastle
Algebraic Prototyping Tools for Petri Nets with Time
Steggles, L. H.; Feb. 25, 2002; 32 pp.
Report No.(s): PB2003-102606; Copyright; Avail: National Technical Information Service (NTIS)

Rewriting logic (RL) is an extension of standard algebraic specification techniques which uses rewrite rules to model the dynamic behavior of a system. In this paper we consider using RL and the associated support tool Elan as an environment for specifying, rapidly prototyping and analyzing Petri nets with time. Our flexible approach allows the wide range of possible time extensions presented in the literature to be investigated and thus overcomes one of the major drawbacks of the current hardwired tools. The authors demonstrate their ideas by considering two different time extensions: time Petri nets in which transitions are associated with a firing interval and time Petri nets in which a firing delay is associated with transitions. In each case the authors demonstrate the flexibility of their approach by examining a range of semantic choices detailed in the literature.

NTIS
Algebra; Burning Time; Petri Nets; Dynamic Characteristics

20030034706 Pacific Northwest National Lab., Richland, WA
User Instructions for the Systems Assessment Capability, Rev. O, Computer Codes. Volume 1: Inventory, Release, and Transport Modules
Eslinger, P. W.; Engel, D. W.; Gerhardstein, L. H.; Lo Presti, C. A.; Nichols, W. E.; Jun. 2002; 258 pp.; In English
Report No.(s): DE2002-15001419; No Copyright; Avail: Department of Energy Information Bridge

In late 1997, the U.S. Department of Energy (DOE) established the Groundwater/Vadose Zone Integration Project (Integration Project). One activity of the Integration Project is an assessment of cumulative impacts for Hanford Site wastes on the subsurface environment and the Columbia River. Through the application of a system assessment capability (SAC), decisions for each cleanup and disposal action will be able to take into account the composite effect of other cleanup and disposal actions.

NTIS
Computer Programs; Water Pollution; Environment Protection

20030034725 Army Research Lab., Aberdeen Proving Ground, MD, USA
Dynamic Analysis and Design System Modeling of the Experimental Unmanned Vehicle
Fazio, Peter J.; Dec. 2002; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410703; ARL-TR-2841; No Copyright; Avail: CASI; A03, Hardcopy

The Weapons Analysis Branch, Ballistics and Weapons Concepts Division, Weapons and Materials Research Directorate of the U.S. Army Research Laboratory (ARL) built a multi-body engineering-level model of the unmanned ground vehicle platform used in the Office of the Secretary of Defense Demo III Robotics program during fiscal years 2000 and 2001. The intended role of the autonomous robotic vehicle was to be a technology demonstrator to assess the possibility of an unmanned vehicle performing the armor scout mission. The unaided vehicle would travel ahead of the troop section and provide scout reconnaissance without the need for placing a human being into a hostile environment. The vehicle platform used as the basis for the model was the experimental unmanned vehicle (XUV) developed and built by General Dynamics Robotic Systems (GDRS). The XUV is a four-wheeled, Ackerman-steered, all-wheel-drive autonomous vehicle that is approximately 10 feet long, 5 feet wide, and 4 feet high and has a curb weight of=3000 pounds. The XUV uses a four-cylinder, 78-hp diesel engine that powers a four-wheel hydraulic drive system. A computer model of the XUV was subsequently developed as a further extension of the modeling tools used for analyzing robotic vehicle off-highway mobility and chassis dynamics and to further enhance the fidelity of battlefield simulations in which these vehicles are employed. The XUV is shown in Figure 1 and the XUV with revised body structure is shown in Figure 2.

DTIC
Unmanned Ground Vehicles; Robotics; Robot Dynamics; Dynamic Control

20030036946 Newcastle-upon-Tyne Univ., Newcastle, Colorado Univ. at Colorado Springs
Except for Exception Handling
Romanovsky, A.; Sanden, B.; 2003; 18 pp.; In English
Report No.(s): PB2003-102607; Copyright; Avail: National Technical Information Service (NTIS)

Exception handling in Ada has a number of well-known problems. It allows for the propagation of unhandled and

anonymous exceptions, it is error-prone and it is inappropriate for some language features including tasking and tagged types. Ada programs with exceptions are difficult to understand, develop, modify or analyze, and the exception handling features can be misused in a number of ways. In this paper we introduce the requirements for good exception handling features. We classify the problems with Ada exception handling into two subsets: serious conceptual problems that require an improvement of the language features, and problems attributable to the misuse of the existing features. Problems in the second category can be solved by improving programmers' understanding of the features and ways of using them.
NTIS
Ada (Programming Language); Computer Programming; Data Processing; Software Engineering

20030037150 Pacific Northwest National Lab., Richland, WA
User Instructions for the Systems Assessment Capability, Rev. O. Computer Codes. Volume 2: Impact Modules
Eslinger, P. W.; Arimescu, C.; Kanyid, B. A.; Miley, T. B.; Jun. 2002; 274 pp.; In English
Report No.(s): DE2002-15001052; No Copyright; Avail: Department of Energy Information Bridge

In late 1997, the U.S. Department of Energy (DOE) established the Groundwater/Vadose Zone Integration Project (Integration Project). One activity of the Integration Project is an assessment of cumulative impacts for Hanford Site wastes on the subsurface environment and the Columbia River. Through the application of a system assessment capability (SAC), decisions for each cleanup and disposal action will be able to take into account the composite effect of other cleanup and disposal actions. The SAC Systems Code is a tool used to simulate the migration of contaminants (analytes) present on the Hanford Site and assess the potential impacts of the analytes, including dose to humans, socio-cultural impacts, economic impacts, and ecological impacts. The system of codes includes existing computer programs, new computer programs, electronic data libraries, and data formatting processors (or data translators).
NTIS
System Effectiveness; Systems Analysis; Ground Water; Vadose Water; Computer Programs

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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.

20030032342 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Wireless Sensor Networks Approach
Perotti, Jose M.; January 2003; 27 pp.; In English; National Design Engineering Show (NDES): National Technology Transfer, 3-6 Mar. 2003, Chicago, IL, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides information on hardware and software configurations for a network architecture for sensors. The hardware configuration uses a central station and remote stations. The software configuration uses the 'lost station' software algorithm. The presentation profiles a couple current examples of this network architecture in use.
CASI
Sensors; Networks; Architecture (Computers)

20030032374 Medical Coll. of Pennsylvania, Philadelphia, PA
Remote Monitoring of Cellular Network Assembly and Function
Noronha, Vijay; Yarman, Can Everan; Kresh, J. Y.; Onaral, Banu; Oct 2001; ISBN0309084997; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410180; No Copyright; Avail: CASI; A01, Hardcopy

A video microscopy based collaboratory has been developed to study cellular network dynamics, in particular, to monitor live-cell spatio-temporal organization in real-time. The aim is to investigate the effects of intercellular communication on tissue genesis, differentiation and cell survival. The platform enables multiple researchers to remotely access a digital microscopy system consisting of very high-resolution CCD-imaging technology coupled with real-time (^1Gbps) data transfer throughput. Remote control and image acquisition facilitates collaboration between cellular biologists, tissue engineers and computational scientists studying complex cellular organization dynamics and assembly. The remote control microscope is connected to a local Server' such that a Client' using any web browser that supports Java can access it. The Server' software is written in Java 2 (jdk 1.3). Any Internet user can control the microscope and interact with other users who are on-line or

are directly connected. This interactive environment does not impose any hardware or software limitations on the Clients'. A remote user can control the movement of the stage in X-Y axes, control focus (Z axis), change magnification, change excitation and light emission filters and their corresponding shutters, acquire topographic and fluorescent images from the microscope and process theses images. The tele-microscopy based environment serves as a focal point for investigators with different expertise to collaborate synergistically on projects that require multi-disciplinary approaches.
DTIC
Cytology; Remote Control; Networks; Imaging Techniques

20030032386 College of William and Mary, Williamsburg, VA, USA
An Advanced Hierarchical Hybrid Environment for Reliability and Performance Modeling
Ciardo, Gianfranco; [2003]; 5 pp.; In English
Contract(s)/Grant(s): NAG1-2168; No Copyright; Avail: CASI; A01, Hardcopy

The key issue we intended to address in our proposed research project was the ability to model and study logical and probabilistic aspects of large computer systems. In particular, we wanted to focus mostly on automatic solution algorithms based on a state-space exploration as their first step, in addition to the more traditional discrete-event simulation approaches commonly employed in industry. One explicitly-stated goal was to extend by several orders of magnitude the size of models that can be solved exactly, using a combination of techniques: 1) Efficient exploration and storage of the state space using new data structures that require an amount of memory sublinear in the number states; and 2) Exploitation of the existing symmetries in the matrices describing the system behavior using Kronecker operators. Not only we have been successful in achieving the above goals, but we exceeded them in many respects.
Derived from text
Computer Systems Programs; Reliability Analysis; Performance Prediction; Mathematical Models; Hybrid Computers

20030032943 Defence Science and Technology Organisation, Edinburgh, Australia
IP Convergence in Global Telecommunications: Mobility in IP Networks
Jayasinghe, Sana; February 2003; 30 pp.; In English
Report No.(s): DSTO-TR-1393; DODA-AR-012-593; Copyright; Avail: Other Sources

The paper describes the main techniques for providing mobility in an Internet Protocol (IP) network. Towards this end the Mobile IP protocol is described in both its guises, namely MIPv4 and MIPv6. Fast mobility is addressed, and Cellular IP is chosen as the representative protocol. Then, the methods of providing mobility by using a cellular network is presented, and the paper concludes with the description of some common wireless standards.
Author
Protocol (Computers); Mobility; Internets

20030032956 SRI International Corp., Menlo Park, CA, USA
A Comparison of Bus Architectures for Safety-Critical Embedded Systems
Rushby, John; Miner, Paul S., Technical Monitor; March 2003; 59 pp.; In English
Contract(s)/Grant(s): NCC1-377; RTOP 728-30-10-01
Report No.(s): NASA/CR-2003-212161; NAS 1.26:212161; No Copyright; Avail: CASI; A04, Hardcopy

We describe and compare the architectures of four fault-tolerant, safety-critical buses with a view to deducing principles common to all of them, the main differences in their design choices, and the tradeoffs made. Two of the buses come from an avionics heritage, and two from automobiles, though all four strive for similar levels of reliability and assurance. The avionics buses considered are the Honeywell SAFEbus (the backplane data bus used in the Boeing 777 Airplane Information Management System) and the NASA SPIDER (an architecture being developed as a demonstrator for certification under the new DO-254 guidelines); the automobile buses considered are the TTTech Time-Triggered Architecture (TTA), recently adopted by Audi for automobile applications, and by Honeywell for avionics and aircraft control functions, and FlexRay, which is being developed by a consortium of BMW, DaimlerChrysler, Motorola, and Philips.
Author
Avionics; Flight Management Systems; Channels (Data Transmission); Protocol (Computers); Data Processing; Fault Tolerance; Systems Engineering

20030032973 Massachusetts Inst. of Tech., Cambridge, MA
An Information Architecture for Physiological Models, Clients and Databases
Dewey, C. F., Jr.; Fu, B.; Zhang, S.; Dao, N.; Chuang, W.; Oct 2001; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410358; No Copyright; Avail: CASI; A02, Hardcopy

The comprehensiveness and complexity of physiological models will increase dramatically during the next decade. Advances in computer power, biological pathway information, information on molecular mechanisms, and new genetic data are all driving factors for these changes. This paper proposes an information system to support complex physiological information models. The system architecture requires three essential parts: a networked Client that generates a request for information; a Computation Server that performs the calculation; and a Model Database that provides detailed parameters to the Computation Server to facilitate solution. The Model Database is organized as an object-oriented hierarchy following the design used to store medical images and their metadata in accordance with the international DICOM standard for medical images. A fourth critical component is also defined: a Case Database that archives the input data that has been used by the Client to define the case to be computed, and archives the output from the solution. This system is applied to a complex contemporary model of the electrophysiology of cardiac myocyte cells, the WIJ model.
DTIC
Data Bases; Physiology; Architecture (Computers); Client Server Systems

20030032978 Tampere Univ. of Technology
Feasibility and User Acceptance of a Personal Weight Management System Based on Ubiquitous Computing
VAN Gils, M.; Parkka, J.; Lappalainen, R.; Ahonen, A.; Maukonen, A.; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410383; No Copyright; Avail: CASI; A01, Hardcopy

With the fast development of information and communications technology, devices with some computing power are becoming increasingly abundant in the average home, The trend for these devices to also be provided with intercommunication functionality opens up new possibilities for health care, The availability of ubiquitous computing allows the individual to perform health-related measurements, review data or consult guidelines independent of place or time, thus providing the individual with a better means to follow certain treatment programs In this study, we set out to implement a system based on ubiquitous computing for the application of weight management using behavioral feedback, The goals were a) to gain insights in the technical feasibility and caveats of such a system as a basis for setting up more advanced and generic infrastructures, and b) to study the degree to whether people are actually willing to use such a technology-laden system for their health management The results lead us to the conclusion that such a system is possible with the current technology, although many issues need to be solved before generic architectures and implementations are a reality, and that many people, especially those who have serious weight problems, are eager to use such a system.
DTIC
Applications Programs (Computers); Management Systems; Body Weight

20030033010 Kwangju Inst. of Science and Technology, Kwangju, Korea, Republic of
The Internet- and Digital Signature-Based Prescription Order Communication System Using Synchronized Smart Cards in the 2-Way Type Terminal
Song, Won Jay; Ahn, Byung Ha; October 25, 2001; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410533; No Copyright; Avail: CASI; A02, Hardcopy

Advanced research is needed to improve another efficiency and solve serious problems of privacy and management of drug history for patients, security for medical professionals, and unpredictable disconnection of the Internet such as the off-line status. Therefore, this research paper presents a new system's design and development of the prescription order communication system (POCS) based on the Internet between the hospital and the pharmacy, on the public-key infrastructure, and on the concurrently parallel co-operation with both medical professional's and patient's smart cards in the 2-way type terminal under the synchronized status. Then we will implement the proposed system for 'The government project for the separation of the dispensary from the doctors office in the Republic of Korea.' A patient's prescription data merged with a professional's digital signature used in the developed prototype system have been stored on the patient's smart card tinder the network- and PKC-based fusion environments. Concurrently parallel co-operation method at the synchronized status has been proposed in order to merge the digital signature generated by a medical professional with a patient's prescription data, i.e., the proposed system should feature the secure transmission of a patient's medical prescription from the hospital to the pharmacy via the Internet/Intranet under the on-line status and the concurrently parallel co-operation with both patient's and professional's smart cards in the 2-way type terminal under the synchronized status, The digital signatures written by the medical professionals (doctors and pharmacists) holding and using their individually master smart cards are applied to all contents of the prescription stored on a patient's slave smart card at the synchronized status in the 2-way type terminal.
DTIC
Computer Networks; Data Transmission; Security; Internets; Synchronism; Computer Systems Design

20030033111 Massachusetts Inst. of Tech., Cambridge, MA

An IEEE-1394 Based Outlet for Home Automation and Health Care Networks

Martel, S.; Hunter, I.; Oct 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410603; No Copyright; Avail: CASI; A01, Hardcopy

This paper describes a new outlet intended for a future home and/or office network based on the IEEE-1394 serial bus. The new outlet has been built and tested. Several units can be distributed throughout the home to provide high-speed inter connection among various systems designed for home automation and/or health care applications.

DTIC

Computer Networks; Connectors

20030034656 Patras Univ., Greece

Tele-Medicine Applications of an ISDN-Based Tele-Working Platform

Economou, G.; Sotiriades, P.; Charokopos, N.; Lymberopoulos, D.; Oct 2001; 6 pp.; In English

Report No.(s): AD-A410372; No Copyright; Avail: CASI; A02, Hardcopy

The Tele-Medicine sub-services backed up by a novel, open-architecture Tele-Working platform, are evaluated. This multimedia platform, developed over the Hellenic Integrated Services Digital Network (ISDN), is based on user terminals (personal computers), networking apparatus, and a central database. The developed product equips the Hellenic PTT Organization (OTE) with a ready-to-be applied novel service that would supply future subscribers (MDs) the means to remotely collaborate in real time, exchange data on- and off-line, enhance their diagnoses, electronically fix, accept, or modify patient visits, build' virtual rooms to meet, etc. The platform, especially focused to implement a Tele-Medicine system, was tested for a period of over nine (9) months through a network of twenty-two (22) nodes situated in remote counties of Hellas.

DTIC

Communication Networks; Data Transmission; Multimedia; Telemedicine

20030034691 Naval Surface Warfare Center, Dahlgren, VA

Initial Requirements for a Software Tool to Support the Use of Operational Sequence Diagrams (OSDs)

Wallace, Daniels; Winters, John; Nov. 2001; 30 pp.; In English

Report No.(s): AD-A410509; NSWCDD/TR-01/134; No Copyright; Avail: CASI; A03, Hardcopy

In order to produce systems to meet the needs of the end users, frequent and detailed inputs and feedback from the user community and domain experts should be integrated into the development process. Current methods for soliciting user input are largely anecdotal or reactive, but a structured tool to document and organize such information can permit the systematic integration of the real end-user requirements. Based on experiences in using a modified version of operational sequence diagrams (OSDs) on several projects at the Dahlgren Laboratory of the Naval Surface Warfare Center, Dahlgren Division (NSWCDD), proposed requirements for a software tool to support the use of OSDs were produced as part of the ONR/SC-21 Science and Technology Manning Affordability Initiative. This report documents the initial requirements for a software tool to support this process. An introductory description of the revised OSD symbology is also provided.

DTIC

Human Factors Engineering; Software Development Tools; Diagrams; Operations

20030038790 Federal Highway Administration, Washington, DC

Database Design for Developing Pavement Performance Equations (on CD-ROM)

Aug. 04, 1998; In English

Report No.(s): PB2002-500116; FHWA/OH-99/002; No Copyright; Avail: National Technical Information Service (NTIS)

A comprehensive Database Management System (DBMS) software called 'RESEARCH' was developed to manage the data which will be collected by ODOT to develop the Pavement Performance Prediction Models. This software uses 'Visual FoxPro Version 5.0, Windows' and incorporates all the latest features of a PC-based DBMS as well as Windows. The database was designed to perform all the necessary functions of a comprehensive DBMS, such as: data entry and editing, retrieval of the data, and reports. To facilitate the data entry, a menu driven feature call 'FORM' was used in this system. Each data table is displayed on the screen as a Form and valid data entry is displayed as the user enters the data. This allows the user to check the data immediately and correct any typing errors before storing the data in the database. It also contains lookup tables to help the user in entering the proper codes, when necessary. A description of various fields of the database is also included in

the report. This report contains recommendations regarding the selection of the test sections, guidelines for data collection, and methods of data analysis.
NTIS
Data Bases; Data Management; Pavements; Performance Prediction

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*.

20030032355 NASA Ames Research Center, Moffett Field, CA, USA
Lessons Learned From Developing A Streaming Data Framework for Scientific Analysis
Wheeler. Kevin R.; Allan, Mark; Curry, Charles; [2003]; 10 pp.; In English; SIAM International Conference on Datamining, 1-3 May 2002, San Fransisco, CA, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

We describe the development and usage of a streaming data analysis software framework. The framework is used for three different applications: Earth science hyper-spectral imaging analysis, Electromyograph pattern detection, and Electroencephalogram state determination. In each application the framework was used to answer a series of science questions which evolved with each subsequent answer. This evolution is summarized in the form of lessons learned.
Author
Machine Learning; Artificial Intelligence; Human-Computer Interface; Applications Programs (Computers); Computer Programming; Data Mining; Trend Analysis; Systems Analysis

20030032442 NASA Glenn Research Center, Cleveland, OH, USA
Robots and Humans: Synergy in Planetary Exploration
Landis, Geoffrey A.; January 2003; 8 pp.; In English; Conference on Human Space Exploration, Space Technology and Applications International Forum, 2-6 Feb. 2003, Albuquerque, NM, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

How will humans and robots cooperate in future planetary exploration? Are humans and robots fundamentally separate modes of exploration, or can humans and robots work together to synergistically explore the solar system? It is proposed that humans and robots can work together in exploring the planets by use of telerobotic operation to expand the function and usefulness of human explorers, and to extend the range of human exploration to hostile environments.
Author
Space Exploration; Robots; Man Machine Systems

20030033018 Rowan Univ., Glassboro, NJ, USA
Learn++: An Incremental Learning Algorithm Based on Psycho-Physiological Models of Learning
Polikar, R.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410628; No Copyright; Avail: CASI; A01, Hardcopy

An incremental learning algorithm, Learn++, which allows supervised classification algorithms to learn from new data without forgetting previously acquired knowledge, is introduced. Learn++ is based on generating multiple classifiers using strategically chosen distributions of the training data and combining these classifiers through weighted majority voting. Learn++ shares various notions with psycho-physiological models of learning. The Learn++ algorithm, simulation results, and how the algorithm is related to various concepts in psycho-physiological learning models are discussed.
DTIC
Algorithms; Classifications

20030033038 Virginia Commonwealth Univ., Richmond, VA
Neural Network for Visual Search Classification
Raju, H.; Hobson, R. S.; Wetzel, P. A.; Oct 2001; 4 pp.; In English
Report No.(s): AD-A410536; No Copyright; Avail: CASI; A01, Hardcopy

Visual search describes the process of how the eyes move in a visual field in order to acquire a target. Visual search needs to be quantified to improve future search strategies. This paper describes a hybrid neural network used to perform visual search

classification. The neural network consists of a Learning vector quantization network (LVQ) and a single layer perceptron. The objective of this neural network is to classify the various human visual search patterns into predetermined classes. The classes signify the different search strategies used by individuals to scan the same target pattern. The input search patterns are quantified with respect to an ideal search pattern, determined by the user. A supervised learning rule, Learning vector quantization (lvq1) is used to train the network.
DTIC
Neural Nets; Vector Quantization; Visual Fields; Saccadic Eye Movements; Classifications

20030033100 Universidad Politecnica de Madrid, Madrid
Automatic Detection of Voice Impairments Due to Vocal Misuse by Means of Gaussian Mixture Models
Godino-Llorente, Juan I.; Aguilera-Navarro, Santiago; Gomez-Vilda, Pedro; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410587; No Copyright; Avail: CASI; A01, Hardcopy

There is an increasing risk of vocal and voice diseases due to the modern way of life. It is well known that most of the vocal and voice diseases cause changes in the acoustic voice signal. These diseases have to be diagnosed and treated at an early stage. Acoustic analysis is a non-invasive technique based on digital processing of speech signal. Acoustic analysis could be a useful tool to diagnose this kind of diseases, furthermore it presents several advantages: it is a non-invasive tool, provides an objective diagnostic, moreover, it can be used for the evaluation of surgical and pharmacological treatments and rehabilitation processes. ENT clinicians use acoustic voice analysis to characterize pathological voices. In this paper, we study a well known classification approach -in speaker recognition and identification- applied to the automatic detection of voice disorders. Former and actual works demonstrate that impaired voice detection can be carried out by means of supervised neural nets: MLP (Multilayer perceptron). We have focused our task in detection of impaired voices by means of gaussian mixture models (GMMs) and parameters such mel frequency coefficients (MFFC) extracted from the windowed voice signal.
DTIC
Diagnosis; Speech Recognition

20030033849 NASA Ames Research Center, Moffett Field, CA, USA
Advantages of Brahms for Specifying and Implementing a Multiagent Human-Robotic Exploration System
Clancey, William J.; Sierhuis, Maarten; Kaskiris, Charis; vanHoof, Ron; February 01, 2003; 5 pp.; In English; FLAIRS 2003, May 2003, Saint Augustine, FL, USA; No Copyright; Avail: CASI; A01, Hardcopy

We have developed a model-based, distributed architecture that integrates diverse components in a system designed for lunar and planetary surface operations: an astronaut's space suit, cameras, all-terrain vehicles, robotic assistant, crew in a local habitat, and mission support team. Software processes ('agents') implemented in the Brahms language, run on multiple, mobile platforms. These mobile agents interpret and transform available data to help people and robotic systems coordinate their actions to make operations more safe and efficient. The Brahms-based mobile agent architecture (MAA) uses a novel combination of agent types so the software agents may understand and facilitate communications between people and between system components. A state-of-the-art spoken dialogue interface is integrated with Brahms models, supporting a speech-driven field observation record and rover command system. An important aspect of the methodology involves first simulating the entire system in Brahms, then configuring the agents into a runtime system Thus, Brahms provides a language, engine, and system builder's toolkit for specifying and implementing multiagent systems.
CASI
Software Engineering; Communication Networks; Systems Integration; Human-Computer Interface; Artificial Intelligence; Applications Programs (Computers); Robotics; Knowledge Based Systems

20030033905 New South Wales Univ., Sydney, Australia
A Neural Network for Estimation of Aortic Pressure from the Radial Artery Pressure Pulse
Qasem, A.; Avolio, A.; Frangakis, G.; October 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410382; No Copyright; Avail: CASI; A01, Hardcopy

A neural network is developed to estimate aortic pressure from the radial artery pressure pulse waveform. Invasively measured aortic and radial artery pressure in 51 adult subjects were used to train the network. Tests in a separate group of 21 subjects of similar age range showed a high correlation (r greater than 0.93) between measured and estimated systolic, diastolic and pulse pressure, with mean absolute errors (%) of 2.5 plus/minus 0.3, 3.5 plus/minus 0.6, 4.8 plus/minus 0.7 respectively. This method has potential applications in obtaining accurate estimates of central aortic pressure values from noninvasive radial

artery pulse measurements. Such neural networks can be trained in specific subgroups (e.g. diabetics) to improve the estimation of central aortic pressure from the peripheral pulse.
DTIC
Neural Nets; Pressure Measurement; Blood Pressure

20030034593 Seluk Univ., Konya, Turkey
A Recognition of ECG Arrhythmias Using Artificial Neural Networks
Oezbay, Yueksel; Karlik, Bekir; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410236; No Copyright; Avail: CASI; A01, Hardcopy

In this study, Artificial Neural Networks (ANN) has been used to classify the ECG arrhythmias. Types of arrhythmias chosen from MIT-BIH ECG database to train ANN include normal sinus rhythm, sinus bradycardia, ventricular tachycardia, sinus arrhythmia, atrial premature contraction, paced beat, right bundle branch block, left bundle branch block, atrial fibrillation, and atrial flutter have been as. The different structures of ANN have been trained by arrhythmia separately and also by mixing these 10 different arrhythmias. The most appropriate ANN structure is used for each class to test patients' records. The ECG records of 17 patients whose average age is 38.6 were made in the Cardiology Department, Faculty of Medicine at Selcuk University. Forty-two different test patterns were extracted from these records. These patterns were tested with the most appropriate ANN structures of single classification case and mixed classification cases. The average error of single classifications was found to be 4.3\% and the average error of mixed classification 2.2\%.
DTIC
Arrhythmia; Electrocardiography; Neural Nets; Artificial Intelligence; Computer Networks

20030034657 University Hospital, Berlin, German
Development Aspects of a Robotised Gait Trainer for Neurological Rehabilitation
Schmidt, H.; Sorowka, D.; Hesse, S.; Bernhardt, R.; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410368; No Copyright; Avail: CASI; A01, Hardcopy

The restoration of gait is a key goal after stroke, traumatic brain injury and spinal cord injury. Conventional training methods, e.g. treadmill training, require great physical effort from the therapists to assist the patient After the successful development and application of a mechanised gait trainer, a new research project of constructing a sensorised robot gait trainer is under way. The aim of this project is to build a robotic device which enables the therapist to let the machine move the patients feet, fixed on two footplates, on programmable foot trajectories (e.g. walking on the ground, stepping stairs up and down, disturbances during walking). Furthermore impedance control algorithms will be incorporated for online adaptation of the foot trajectories to the patients walking capabilities. Another important feature is the compliance control to simulate virtual ground conditions, i.e. the machine acts as a haptic foot device. Due to the partially high dynamic foot movements during normal walking, conventional industrial robots are not suitable for this task. This paper describes development aspects and problems that have to be dealt with during the design process of the robotised gait training machine.
DTIC
Robotics; Training Devices; Walking

20030034704 Newcastle-upon-Tyne Univ., Newcastle
Taxonomy and Evaluation for Systems Analysis Methodologies in a Workflow Context: Structured Systems Analysis Design Method (SSADM), Unified Modeling Language (UML), Unified Process, Soft Systems Methodology (SSM) and Organization Process Modeling
Al-Humaidan, F.; Rossiter, B. N.; 2003; 36 pp.
Report No.(s): PB2003-102609; Copyright; Avail: National Technical Information Service (NTIS)

Complex information systems require a methodology for their development in a structured manner. Many different methodologies exist, each suitable for a particular type of application. In this report we develop a taxonomy covering 14 different classification features for methodologies targeted at the workflow area. Features identified include concerns, method structure, data gathering means, people involved, notations, decomposition, policies, reuse, adaptability, flexibility, exception handling, method output, CASE tool and quality assurance. The capabilities of a number of methodologies are expressed in tabular form relative to this taxonomy for workflow systems and to a more general taxonomy dealing with both hard- and soft-system aspects. The results show that there is no methodology that covers all of the taxonomic aspects identified. Organizational Process Modeling (OPM) and Soft Systems Methodology (SSM) are relatively strong on soft aspects and weak on hard aspects. Unified Modeling Language (UML) and Unified Process are relatively strong on hard aspects and weak on

soft aspects. Structured Systems Analysis and Design Method (SSADM) is perhaps the most comprehensive but some soft aspects are omitted. The combination of techniques such as UML and Workflow is identified as a way forward.
NTIS
Systems Analysis; Evaluation; Information Systems; Work Capacity; Taxonomy; Complex Systems

20030034751 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Information Warfare, Cyber-Terrorism and Community Values
Moore, Joe W.; Jul. 2002; 155 pp.; In English
Report No.(s): AD-A410710; No Copyright; Avail: CASI; A08, Hardcopy

Information Warfare involves the attack and defense of information and information systems, both in time of armed conflict and in operations short of war. While information technology provides the promise of a new class of less lethal military instruments, it also presents vulnerabilities occasioned by widespread dependence on an increasingly complex and interconnected global information infrastructure. These vulnerabilities, when exploited by those who would target civilians in order to inspire widespread fear in hopes of accomplishing a political agenda, can be understood as cyberterrorism. As information warfare techniques evolve, those employing them should look to several relevant sources for normative guidance. Relevant, internationally shared values can be found in international custom, the U.N. Charter, treaties dealing with the subject of 'cybercrime,' those governing the communication media likely to be utilized by information warriors, UNGA Resolutions and those treaties and customary norms that make up the Law of Armed Conflict.
DTIC
Information Systems; Warfare; Terrorism

20030034817 Massachusetts Univ., Amherst, MA, USA
Reinforcement Learning for Weakly-Coupled MDPs and an Application to Planetary Rover Control
Bernstein, Daniel S.; Zilberstein, Shlomo; [2003]; 6 pp.; In English
Contract(s)/Grant(s): NAG2-1463; NAG2-1394; NSF IRI-96-24992; NSF IIS-99-07331; No Copyright; Avail: CASI; A02, Hardcopy

Weakly-coupled Markov decision processes can be decomposed into subprocesses that interact only through a small set of bottleneck states. We study a hierarchical reinforcement learning algorithm designed to take advantage of this particular type of decomposability. To test our algorithm, we use a decision-making problem faced by autonomous planetary rovers. In this problem, a Mars rover must decide which activities to perform and when to traverse between science sites in order to make the best use of its limited resources. In our experiments, the hierarchical algorithm performs better than Q-learning in the early stages of learning, but unlike Q-learning it converges to a suboptimal policy. This suggests that it may be advantageous to use the hierarchical algorithm when training time is limited.
Author
Decision Making; Markov Processes; Mars Surface; Roving Vehicles

20030034825 Massachusetts Univ., Amherst, MA, USA
Self-Directed Cooperative Planetary Rovers
Zilberstein, Shlomo; Morris, Robert, Technical Monitor; April 2003; 6 pp.; In English
Contract(s)/Grant(s): NAG2-1463; No Copyright; Avail: CASI; A02, Hardcopy

The project is concerned with the development of decision-theoretic techniques to optimize the scientific return of planetary rovers. Planetary rovers are small unmanned vehicles equipped with cameras and a variety of sensors used for scientific experiments. They must operate under tight constraints over such resources as operation time, power, storage capacity, and communication bandwidth. Moreover, the limited computational resources of the rover limit the complexity of on-line planning and scheduling. We have developed a comprehensive solution to this problem that involves high-level tools to describe a mission; a compiler that maps a mission description and additional probabilistic models of the components of the rover into a Markov decision problem; and algorithms for solving the rover control problem that are sensitive to the limited computational resources and high-level of uncertainty in this domain.
Author
Roving Vehicles; Space Exploration; Autonomy; Networks; Decision Theory

20030034862 Physics and Electronics Lab. TNO, The Hague, Netherlands

Towards a Coalition BMD C4I Architecture

vanHekken, M. C.; Smallegange, J. A. P.; Treurniet, W.; December 2002; 105 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): A01/D/658; TNO Proj. 015.31162

Report No.(s): FEL-02-A066; TD01-0289; Copyright; Avail: Other Sources

In order to substantially contribute to the NATO Feasibility Study on Active Layered Theatre Ballistic Missile Defence (TBMD) the BMC4I and Interoperability aspects have been explored. The results of this exploration are captured in an information architecture. This information architecture can be used as a reference and assessment framework in the national evaluation of the results of the above-mentioned feasibility study.

Author

Interoperability; Command And Control; Missile Defense; Antimissile Defense; Artificial Intelligence; Architecture (Computers); Ballistics

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20030032298 Maryland Univ. Baltimore County, Catonsville, MD, USA

A Stochastic Approach For Extending The Dimensionality Of Observed Datasets

Varnai, Tamas; September 2002; 13 pp.; In English

Contract(s)/Grant(s): NAG5-6675; No Copyright; Avail: CASI; A03, Hardcopy

This paper addresses the problem that in many cases, observations cannot provide complete fields of the measured quantities, because they yield data only along a single cross-section through the examined fields. The paper describes a new Fourier-adjustment technique that allows existing fractal models to build realistic surroundings to the measured cross-sections. This new approach allows more representative calculations of cloud radiative processes and may be used in other areas as well.

Author

Stochastic Processes; Cross Sections; Fourier Transformation

20030032375 Kuopio Univ., Finland

Tracking of Nonstationary EEG With Kalman Smoother Approach

Tarvainen, M. P.; Ranta-aho, P. O.; Karjalainen, P. A.; October 25, 2001; 5 pp.; In English; 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, Istanbul, Turkey; Original contains color illustrations

Report No.(s): AD-A410184; No Copyright; Avail: CASI; A01, Hardcopy

An adaptive autoregressive moving average (ARMA) modelling of nonstationary EEG (Electroencephalography) by means of Kalman smoother is presented. The main advantage of the Kalman smoother approach compared to other adaptive algorithms such as LMS or RLS is that the tracking lag can be avoided. This advantage is clearly presented with simulations. Kalman smoother is also applied to tracking of alpha band characteristics of real EEG during an eyes open/closed test. The observed tracking ability of Kalman smoother, compared to other methods considered, seemed to be better.

DTIC

Kalman Filters; Electroencephalography; Algorithms

20030032535 NASA Ames Research Center, Moffett Field, CA, USA

A Discontinuous Galerkin Discretization of the Eikonal Equation on Curved Piecewise Isoparametric Triangulated Manifolds

Barth, TIm; [2002]; 26 pp.; In English; SIAM Conference on Mathematical and Computational Issues in the Geosciences, 17-20 Mar. 2002, Austin, TX, USA; Pages are crooked and of poor quality in the original document as well; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides information on optimizing the travel distance between two points on a curved surface. The presentation addresses the single source shortest path problem, fast algorithms for estimating the eikonal equation, fast schemes and barrier theorems, and the discontinuous Galerkin method, including hyperbolic causality, finite

element method, scalars, and marching the discontinuous Galerkin Eikonal approximation.
CASI
Galerkin Method; Discretization (Mathematics); Eikonal Equation; Triangulation; Manifolds (Mathematics); Curves (Geometry); Isoparametric Finite Elements; Discontinuity

20030032918 Ohio State Univ., Columbus, OH
Optimal Array Geometries for Wideband DOA Estimation
Baysal, Ulku; Moses, Randolph L.; Oct. 2001; 13 pp.; In English
Contract(s)/Grant(s): DAAH-96-C-0086
Report No.(s): AD-A410303; No Copyright; Avail: CASI; A03, Hardcopy

We consider the role of array geometry on the Direction of Arrival (DOA) estimating performance of the array where the impinging signal is wideband. We concentrate on arrays that have isotropic performance. An isotropic array is one whose Cramer Rao bound (CRB) on the DOA of a single source is uniform for all angles. We derive the necessary and sufficient conditions on the location of array elements so that the array is isotropic. Both planar arrays and three dimensional arrays are considered. We also present several designs of isotropic planar and volume arrays and give example geometries.
DTIC
Arrays; Signal Processing

20030032946 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Heuristic Location-Allocation for Facilities Location Problems
Arakaki, Reinaldo Gen Ichiro; 2003; 72 pp.; In Portuguese
Report No.(s): INPE-9572-TDI/837; Copyright; Avail: CASI; A04, Hardcopy

New location-allocation heuristic (LAH) algorithms applied in facility location problems are presented in this thesis. Such algorithms approach is based on clustering and its main objective is to find out a facility (object) in a space by minimizing a function. The LAH developed throughout this work was employed in two problems: the first problem is the Maximal Covering Location Problem (MCLP) and the second one is the Capacitated p-Median Problems (CPMP) with the purpose of a possible integration to Geographic Information Systems (GIS). A set of test problems was chosen to validate this LAH. Good results were obtained for small and large-scale problems in MCLP cases. Good results were also obtained for small-scale problems in CPMP cases. The LAH were also applied as a mutation process in Constructive Genetic Algorithms for the same problems. The good results demonstrate that LAH, being quick and fast, may be usefully applicable to GIS.
Author
Genetic Algorithms; Geographic Information Systems; Heuristic Methods; Position (Location); Problem Solving

20030032955 Army Research Lab., Adelphi, MD
Shockwave and Muzzle Blast Classification Via Joint Time Frequency and Wavelet Analysis
Mays, Brian T.; Sep 2001; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410324; No Copyright; Avail: CASI; A03, Hardcopy

This paper will apply various joint time-frequency (JTF) and wavelet techniques to extract features from shockwave and muzzle blast signatures for the purpose of classification. The techniques used will include short-time Fourier transform (STFT), Smoothed Pseudo Wigner-Ville distribution (SPWVD) and wavelet multi-scale analysis. A projectile's trajectory can be estimated by measuring the arrival times of the acoustic energy at several locations in space. In the case of a supersonic projectile fired from a gun, both the acoustic shockwave and muzzle blast may be observed. For acoustic sensor systems attempting to determine a projectile's trajectory, the challenge is to first, correctly classify the transient signal as either a shockwave or a muzzle blast and then, calculate the direction-of-arrival via appropriate arrival times across a sensor array. This can be extremely challenging when the shockwave has lost substantial high frequency content. The change in spectral characteristics can stem from propagation over a long distance, propagation over snow covered terrain or arriving from a non-perfect reflector. An incorrect classification will result in large estimation errors of the projectile's trajectory. Experimental results are presented for proper classification over various miss distances from the sensors for all of the above techniques mentioned.
DTIC
Fourier Transformation; Sound Detecting And Ranging

20030032957 Silesian Technical Univ., Gliwice

A New Approach to the P-Wave Detection and Classification Based Upon Application of Wavelet Neural Network

Domider, T.; Tkacz, E. J.; Kostka, P.; Wrzesniowski, A.; Oct 2001; 4 pp.; In English

Report No.(s): AD-A410247; No Copyright; Avail: CASI; A01, Hardcopy

Paper presents a new approach to P wave classification problem which is based upon the application of a new recently develop and widely described tool such as Wavelet Neural Network, The novel idea of classification is based on creation of own non-standard wavelet exactly as a P wave morphology template and then calculation of wavelet transform being a first layer of classical multi-layer perceptron. The mentioned first layer works as a feature selector and extractor.

DTIC

Neural Nets; Wavelet Analysis; Electrocardiography

20030032986 Sophia Univ., Tokyo

Reconstruction of Bio-Conductivity Distribution from Tangential Magnet Field Measurements

Sumi, C.; Nagumo, K.; Oct 2001; 7 pp.; In English

Report No.(s): AD-A410510; No Copyright; Avail: CASI; A02, Hardcopy

We proposed a technique for reconstructing bio-electric conductivity distribution from measured tangential magnet field data. That is, in the 2D ROI with an arbitrary depth two orthogonal tangential components of 3D current vector field were respectively estimated from the synthetically measured two tangential magnetic fields, from which the 2D conductivity distribution was estimated. To cope with inevitable measurement errors, a robust numerical solution was developed, in which the modification method and the regularization method were efficiently utilized. By performing this 2D reconstruction at each depth, 3D conductivity distribution could be estimated. As typical applications, pathological state and/or bio-electric conductive path can be evaluated by monitoring the temporal change of the reconstructed 3D conductivity distribution. The feasibility of this technique was briefly verified by reconstructing a conductivity distribution using simulated noise-filled magnetic field data, with resultant reconstruction indicating that the approach could provide a practical means for robustly reconstructing a conductivity distribution.

DTIC

Bioelectricity; Magnetic Fields; Electrical Resistivity; Numerical Analysis; Estimating

20030033101 Aristotle Univ. of Thessaloniki, Greece

Alignment of Serially Acquired Slices Using a Global Energy Function

Krinidis, Stelio; Nikou, Christophoros; Pitas, Ioannis; October 25, 2001; 5 pp.; In English

Report No.(s): AD-A410239; No Copyright; Avail: CASI; A01, Hardcopy

An accurate, computationally efficient and fully-automated algorithm for the alignment of 2D serially acquired sections forming a 3D volume is presented. The method accounts for the main shortcomings of 3D image alignment: corrupted data (cuts and tears), dissimilarities or discontinuities between slices, non parallel or missing slices. The approach relies on the optimization of a global energy function, based on the object shape, measuring the similarity between a slice and its neighborhood in the 3D volume. Slice similarity is computed using the distance transform measure in both directions. No particular direction is privileged in the method avoiding global offsets, biases in the estimation and error propagation. The method was evaluated on real images (medical and biological 3D data) and the experimental results demonstrated the method's accuracy as reconstruction errors are less than 1 degree in rotation and less than 1 pixel in translation.

DTIC

Algorithms; Alignment; Autonomy; Numerical Analysis; Optimization

20030033866 Inha Univ., Inchon, Korea, Republic of

A Speckle Reduction Filter Using Wavelet-Based Methods for Medical Imaging Application

Kang, Su Cheol; Hong, Seung Hong; October 25, 2001; 5 pp.; In English

Report No.(s): AD-A410299; No Copyright; Avail: CASI; A01, Hardcopy

One of the most significant features of diagnostic echocardiographic images is to reduce speckle noise and make better image quality. In this paper we proposed a simple and effective filter design for image denoising and contrast enhancement based on multiscale wavelet denoising method. Wavelet threshold algorithms replace wavelet coefficients with small magnitude by zero and keep or shrink the other coefficients. This is basically a local procedure since wavelet coefficients characterize the local regularity of a function. After we estimate distribution of noise within echocardiographic image then apply to fitness Wavelet threshold algorithm. A common way of the estimating the speckle noise level in coherent imaging

is to calculate the mean-to-standard-deviation ratio of the pixel intensity often termed the Equivalent Number of Looks (ENL) over a uniform image area. Unfortunately we found this measure not very robust mainly because of the difficulty to identify a uniform area in a real image. For this reason we will only use here the S/MSE ratio and which corresponds to the standard SNR in case of additive noise. We have simulated some echocardiographic images by specialized hardware for real-time application; processing of a 512*512 images takes about 1 minute. Our experiments show that the optimal threshold level depends on the spectral content of the image. High spectral Content tends to over-estimate the noise standard deviation estimation performed at the finest level of the DWT. As a result a lower threshold parameter is required to get the optimal S/MSE. The standard WCS theory predicts a threshold flat depends on the number of signal samples only.
DTIC
Algorithms; Noise Reduction; Echocardiography; Image Processing; Bandpass Filters; Speckle Patterns; Numerical Analysis; Wavelet Analysis

20030033890 Salvatore Maugeri Foundation, Montescano, Italy
Baroreflex Sensitivity Estimation by the Transfer Function Method Revised: Effect of Changing the Coherence Criterion
Pinna, G. D.; Maestri, R.; Raczak, G.; Swenne, C. A.; LaRovere, M. T.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410367; No Copyright; Avail: CASI; A01, Hardcopy

In this study we appraised three new criteria for the computation of baroreflex sensitivity (BRS) using the transfer function magnitude (TFM) method, with the aim of overcoming the conventional requirement of a coherence greater than 0.5 between arterial pressure and RR interval time series. Measurements were carried out in a sample of 44 post-myocardial infarction patients at risk of malignant arrhythmias. The three proposed TFM criteria dramatically increased the number of measurable BRSs compared to the traditional coherence-based method and provided substantially equivalent BRS measurements. The agreement between these new indexes and BRS obtained by the phenylephrine test was similar to that of the traditional coherence method.
DTIC
Transfer Functions; Pressure Measurement

20030033901 Universite de Technologie de Compiegne, France
Inverse Problem in the Surface EMG: A Feasibility Study
Chauvet, E.; Fokapu, O.; Gamet, D.; October 25, 2001; 4 pp.; In English
Report No.(s): AD-A410381; No Copyright; Avail: CASI; A01, Hardcopy

The aim of this work is the development of a localisation algorithm of the bioelectric sources using surface electromyographic (SEMG). in this paper, a feasibility study is presented: we simulate the resolution of the SEMG inverse problem. First, we developed a program modeling the SEMG signal of the biceps brachii. To resolve the inverse problem, the localisation algorithm uses an estimation procedure. We minimize the difference between calculated potential and observed potential by successive iterations. The procedure is applied successively to the defined zones of the geometrical arm cross-section. The program locates accurately an active motor unit in a given zone, regardless of time and distance.
DTIC
Mathematical Models; Numerical Analysis; Electromyography

20030033945 Universidad de Las Palmas de Gran Canaria, Las Palmas, Spain
A General Approach to Nonrigid Registration: Decoupled Optimization
Suarez, Eduardo; Cardenes, Ruben; Alberola, Carlos; Westin, C. F.; Ruiz-Alzola, Juan; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410661; No Copyright; Avail: CASI; A01, Hardcopy

To a great extent the success of advanced image-guided medical procedures hinges on non-rigid volume registration. For example non-rigid registration must be applied in interventional approaches where intra-operative information is used to update high-quality preoperative data; in follow-up studies in order to assess time-evolution of development; aging pathology or treatment; and in many other applications including intersubject variability and population-based atlas construction. In this paper we examine several computational schemes that warps one volumetric dataset onto another. We also explore the inevitable trade-off between the computational load and the incorporation of sophisticated similarity measures necessary for multimodal volumes. Estimated deformation fields are based on the variational formulation of Partial Derivative Equations

(PDEs) which includes a similarity, and a regularization term. We compare numerical solutions to this problem using the Euler-Lagrange equations (EL) the Finite Elements discretization (FE) and Decoupled Optimization over the possible deformations (DO).
DTIC
Numerical Analysis; Image Processing

20030034594 Pontificia Univ. Catolica, Allegre, Brazil
Tomography Simulation and Reconstruction Tools Applied in the Evaluation of Parameters and Techniques
DeAzevedo, D. F.; Helegda, S.; Godoy, P. C.; deCastro, F.; deCastro, M. C.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410244; No Copyright; Avail: CASI; A01, Hardcopy

In this paper we introduce a tomography platform consisting of a new set of programs written in ANSI C++ to help researchers to develop and to evaluate tomography simulation/reconstruction based on the Direct Fourier Method. We applied these tools in the evaluation of tomographic techniques. We describe and compare two techniques to overcome the inferior image quality due to the inherent artifacts of the Direct Fourier Method: the increase of the zero-padding factor and the resampling grid density factor.
DTIC
Computerized Simulation; Tomography; Parameterization; Computer Techniques; Image Reconstruction; Software Development Tools

20030034612 Wake Forest Univ., Winston-Salem, NC, USA
Extraction of the Hemodynamic Response in Randomized Event-Related Functional MRI
Ari, Narter; Yen, Yi-Fen; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410256; No Copyright; Avail: CASI; A01, Hardcopy

Signal detection in noisy data set is a common problem in signal processing. Detection of the hemodynamic response function (HRF) embedded in randomized event-related fMRI (rER-fMRI) time series is an example of this problem. So far, most studies that set out to obtain unbiased HRF use some forms of time-window (TW) averaging method to extract HRF from the rER-fMRI data. In this paper we applied two methods, Cepstral Analysis and Conjugate Gradients (CG) for Deconvolution to extract HRF. These methods depend only on the knowledge of when events occurred and do not require any a priori information about the HRF. These methods and the popular TW averaging method are tested on simulated data, as well as in vivo data obtained from rER-fMRI experiments. All three methods identified timing of HRF accurately, but only CG for Deconvolution method was robust in reproducing the shape under varying experimental conditions.
DTIC
Magnetic Resonance; Imaging Techniques; Blood Vessels

20030034618 Bogazici Univ., Istanbul, Turkey
Comparison of Two Distance Based Alignment Method in Medical Imaging
Bulan, G.; Osturk, C.; October 25, 2001; 4 pp.; In English
Report No.(s): AD-A410306; No Copyright; Avail: CASI; A01, Hardcopy

A k-dimensional (k-d) tree based alignment and its comparison with the standard distance map based alignment is presented. We first describe a brief outline of both distance based iterative alignment algorithms. The new k-d based technique uses modified. Approximate Nearest Neighbor (ANN) Library, which is designed for both exact and approximate nearest neighbor searching in multidimensional space. We performed self-alignment tests of the k-d tree based alignment and compared two different alignment methods using a large 3D dataset of a rodent brain. The results indicate that the k-d based image alignment is highly effective, accurate, reliable, and provides compatible errors with the distance map based alignment method. On the other hand, as a big advantage, k-d tree alignment requires significantly less virtual or physical memory; a critical issue for large datasets.
DTIC
Imaging Techniques; Telemedicine; Trees (Mathematics); Self Alignment; Three Dimensional Models

20030034654 Budapest Univ. of Technology and Economics, Budapest, Hungary
On-Line QRS Complex Detection Using Wavelet Filtering
Szilagyi, L.; Benyo, Z.; Szilagyi, S. M.; Nagy, L.; October 25, 2001; 4 pp.; In English
Report No.(s): AD-A410412; No Copyright; Avail: CASI; A01, Hardcopy

This paper presents a new QRS complex detection algorithm that can be applied in various on-line FCC processing systems. The algorithm is performed in two steps: first a wavelet transform filtering is applied to the signal, then QRS complex localization is performed using a maximum detection and peak classification algorithm The algorithm has been tested in two phases, First the QRS detection in FCC registrations from the MIT-BIH database has been performed, which led to an average detection ratio of 99,50\%, Then, the algorithm has been implemented into a microcontroller-driven portable Holter device.
DTIC
Electrocardiography; Wavelet Analysis

20030034655 Dicle Univ., Diyarbakir, Turkey
A New Approach for Diagnosing Epilepsy by Using Wavelet Transform and Neural Networks
Akin, M.; Arserim, M. A.; Kiymik, M. K.; Turkoglu, I.; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410462; No Copyright; Avail: CASI; A01, Hardcopy

Today, epilepsy keeps its importance as a major brain disorder. However, although some devices such as magnetic resonance (MR), brain tomography (BT) are used to diagnose the structural disorders of brain, for observing some special illnesses especially such as epilepsy, EEG is routinely used for observing the epileptic seizures, in neurology clinics. In our study, we aimed to classify the EEG signals and diagnose the epileptic seizures directly by using wavelet transform and an artificial neural network model. EEG signals are separated into delta, theta, alpha, and beta spectral components by using wavelet transform. These spectral components are applied to the inputs of the neural network. Then, neural network is trained to give three outputs to signify the health situation of the patients
DTIC
Neural Nets; Electroencephalography; Wavelet Analysis; Signal Processing

20030034658 Ecole Nationale Superieure des Telecommunications, Brest, France
Medical Image Indexing and Compression Based on Vector Quantization: Image Retrieval Efficiency Evaluation
Ordonez, J. R.; Cazuguel, G.; Puentes, J.; Solaiman, B.; Cauvin, J. M.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410470; X5-X5; No Copyright; Avail: CASI; A01, Hardcopy

This paper addresses the problem of efficient image retrieval from a compressed image database, using information derived from the compression process. Images in the database are compressed applying two approaches: Vector Quantization (VQ) and Quadtree image decomposition. Both are based on Konohen's Self-Organizing Feature Maps (SOFM) for creating vector quantization codebooks. However, while VQ uses one codebook of one resolution to compress the images, Quadtree decomposition uses simultaneously 4 codebooks of four different resolutions. Image indexing is implemented by generating a Feature Vector (FV) for each compressed image. Accordingly, images are retrieved by means of FVs similarity evaluation between the query image and the images in the database, depending on a distance measure. Three distance measures have been analyzed to assess FV index similarity: Euclidean, Intersection and Correlation distances. Distance measures efficiency retrieval is evaluated for different VQ resolutions and different Quadtree image descriptors. Experimental results using real data, esophageal ultrasound and eye angiography images, are presented.
DTIC
Vector Quantization; Angiography; Ultrasonics; Image Processing

20030034661 Air Force Research Lab., Edwards AFB, CA
The Accuracy of Remapping Irregularly Spaced Velocity Data onto a Regular Grid and the Computation of Vorticity
Cohn, Richard K.; Koochesfahani, Manoochehr M.; March 15, 1999; 4 pp.; In English
Contract(s)/Grant(s): AF Proj. 3058
Report No.(s): AD-A410461; AFRL-PR-ED-TP-FY99-0060; No Copyright; Avail: CASI; A01, Hardcopy

The velocity data obtained from Molecular Tagging Velocimetry (MTV) are typically located on an irregularly spaced measurement grid. In this method of velocimetry, the flowing medium is premixed with a molecular complex that can be turned into a long life-time tracer upon excitation by photons. The velocity vector is determined from the displacement of small regions 'tagged' by a pulsed laser that are imaged at two successive times within the lifetime of the tracer. This technique may be viewed as the molecular counterpart of PIV. To take advantage of standard data processing techniques, the MTV data need to be remapped onto a regular grid with a uniform spacing. This study examined the accuracy and noise issues related to the use of various low-order polynomial least-square fits for remapping and the subsequent computation of vorticity from these data. The information obtained has relevance to PIV data processing as well. As noted by Spedding and Rignot, the best

estimate of the location of the velocity vector acquired through the use of tracer techniques, such as PIV, is at the midpoint of the displacement vector. Thus, unless special care is taken, PIV data also are initially obtained on an irregular grid. This study considered the use of 2nd, 3rd, or 4th order polynomials to remap the velocity field by performing a local least-squares fit of the irregularly spaced data within region of radius R. Four approaches were assessed for computing the out-of-plane vorticity field from the in-plane velocity measurements: direct differentiation of the polynomial fits used in the remapping process, lst and 2nd order finite difference techniques (2nd and 4th order accurate, respectively), and an 8-point circulation method on the regular data. Results show that the most accurate vorticity results are achieved by either directly differentiating the 3rd order polynomial fit to the original irregular data, or by the 2nd order finite difference technique. (5 refs.)
DTIC
Velocity Measurement; Vorticity; Interpolation; Computational Grids; Marking; Mathematical Models; Algorithms; Vortices; Laser Applications

20030034717 Universidad Nacional Autonoma de Mexico, Mexico City
Magnetic Resonance Image Wavelet Enhancer
Rodriguez, A. O.; Mansfield, P.; Azpiroz, J.; Oct 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410347; No Copyright; Avail: CASI; A01, Hardcopy

Echo-Planar Imaging is able to generate images in less than 80 ms, however, images have poor quality since they have an intrinsic poor Signal-to-Noise ratio. Filtering techniques can be applied to enhance the image quality such as Fourier transform. Another natural tool is the so-called wavelet transform, this is an analytical tool capable of generating an analysis in time and frequency simultaneously. The two-dimensional wavelet transform is applied to blood flow maps produced with a flow encoding Echo-Planar Imaging sequence to improve the image Signal-to-Noise ratio. Enhanced flow maps and contour maps are presented. The wavelet transform shows that flow magnetic resonance images can be improved without detriment of the spatial resolution and unmasking the relevant anatomical and physiological information.
DTIC
Blood Flow; Image Resolution; Imaging Techniques; Magnetic Resonance

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STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20030032922 City Univ., London
Virtues and Vices of Source Separation Using Linear Independent Component Analysis for Blind Source Separation of Non-Linearly Coupled and Synchronised Fetal and Mother ECGs
Sabry-Rizk, M.; Zgallai, W.; McLean, A.; Carson, E. R.; Grattan, K. T.; Oct 2001; 6 pp.; In English
Report No.(s): AD-A410440; No Copyright; Avail: CASI; A02, Hardcopy

In this paper, we address the imminent problem which arises when researchers unjudiciously use a linear and instantaneous (memoryless) model for the source mixing structures of independent component analysis (ICA), also known as blind source separation (BSS), in pursuit of separating noisy and frequently non stationary combined mother and fetal electrocardiogram (ECG) signals from cutaneous measurements under the following false assumptions. (1) Sensors (electrodes) are instantaneous linear mixtures of mother and fetal source signals. (2) Noise is an additive Gaussian perturbation. (3) Mother and fetal ECG signals are assumed to be stationary and linear, mutually statistically independent and statistically independent from noise. (4) Most of the second-order (SO) and fourth-order (FO) blind source separation (BSS) methods developed this last decade assume that third-order cumulants vanish hence the need to use FO. All these assumptions are not valid and will be challenged. We will expose these vices without providing any significant contributions for overcoming them. Rather, we provide a framework for investigations which are based on conformal mapping of nonlinear mixtures and novel dynamic nonlinear structures with time-variant memory to cater for quadratic coupling between mother and fetal which is quasi-periodical and the concomitant (quasi) cyclostationarity. Results given here show linear ICA shortfalls in non stationary environment which is precipitated by quadratic coupling between mother and fetal ECGs during events of synchronised QRS complexes and P-waves and account for more than 20\% of the 100,000 maternal cardiac cycles obtained from several clinical trials.
DTIC
Electrocardiography; Signal Processing; Statistical Analysis

20030032949 Medical Coll. of Pennsylvania, Philadelphia, PA

Quantization of Motor Activity into Primitives and Time-Frequency Atoms Using Independent Component Analysis and Matching Pursuit Algorithms

Giszter, Simon F.; Oct 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410416; No Copyright; Avail: CASI; A01, Hardcopy

It has been proposed that the segmental spinal nervous system may organize movement using a collection of force-field primitives. The temporal organization of primitives has not been examined in detail. Recent data examining muscle activity underlying corrections of motor patterns suggested that primitives might be recruited into motor programs as waveforms with a constant duration. Here we test the idea that each primitive or premotor drive comprising part of the motor patterns might be expressed as the combination of a small number of time-frequency atoms from some orthonormal basis. We analyze the temporal organization of pre-motor drives extracted from the motor pattern by the Bell-Sejnowski algorithm for independent component analysis. We then use matching pursuit cosine packet analysis to examine the time series of the activation waveforms of each of the independent components. The analysis confirms that the motor pattern can be described as a combination of a small number of time-frequency atoms. These atoms combine to generate the temporal structure and activation of the individual components or premotor drives that generate individual muscle activity.

DTIC

Factor Analysis; Muscular Function

20030033060 Universite Catholique de Louvain, Belgium

Automatic Fibrosis Quantification By Using a k-NN Classificator

Romero, E.; Raymackers, J. M.; Macq, B.; Cuisenaire, O.; October 25, 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410548; No Copyright; Avail: CASI; A01, Hardcopy

This work presents an automatic algorithm to measure fibrosis in muscle sections of mdx mice, a mutant species used as a model of the Duchenne dystrophy. The algorithm described herein automatically segments three different tissues: Muscle cell tissue (MT), Pure collagen fiber deposit (CD) and cellular infiltrates surrounded by loose collagen deposit (CI), by using a statistical classifier based on the k-Nearest Neighbour (k-NN) decision rule in the RGB color space. The algorithm is trained by selecting a number of correctly classified pixels from each class. The k-NN rule classifies other pixels in the class that is most represented among the k nearest training samples in the RGB space, which is efficiently implemented with a fast k-distance transform algorithm. All extracted areas are quantified in absolute (micrometer squared) and relative (%) values. For validation of this method, the different tissues were manually segmented and their qualifications statistically compared with those obtained automatically. Statistical analysis showed interoperator variability in manual segmentation. Automatic qualifications of the same areas did not differ significantly from their mean manual evaluations. In conclusion, this method produce fast, reliable and reproducible results.

DTIC

Algorithms; Classifiers; Fibrosis; Statistical Analysis; Automatic Control

20030033850 Tongji Univ., Shanghai, China

A Distinguish Method of Epileptic EEG and Deglutition EEG Based on Chaotic Noise-Reduction

Ouyang, Guanghua; Li, Chunyan; Jiang, Guotai; October 25, 2001; 5 pp.; In English

Report No.(s): AD-A410230; No Copyright; Avail: CASI; A01, Hardcopy

A new method for recovering epileptic EEG and deglutition EEG's nonnoise trajectory and distinguishing these two waveforms is presented. The main aim of this paper is to introduce the theory and establish math model of a simple recovering EEG's nonnoise trajectory. This method is finally used to experiment. Our results prove that chaotic dynamics does exist in EEG and signal-noise of EEG marked improves. Furthermore, it is also successful to recover structural characteristic of strange attractor destroyed by noise. The paper obtains the real chaotic trajectory of EEG with which it can calculate dipole of EEG. According to the different parameters of dipole, a method of distinguishing epileptic EEG and deglutition EEG using the measurement of nonlinear dynamics is obtained.

DTIC

Electroencephalography; Mathematical Models; Noise Reduction; Waveforms; Chaos

20030033872 Illinois Univ., Chicago, IL, USA

Automated Quantitation of Non-Steady Flow and Lumen Area Based on Temporal Correlation

Lee, Sang H.; Alperin, Noam; October 25, 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410357; No Copyright; Avail: CASI; A01, Hardcopy

A robust method for automated quantitation of nonsteady flow and lumen area is presented. The method utilizes temporal information to differentiate between pixels within the lumen and a background region. Cross correlation (CC) is applied to identify the pixels with temporal information similar to a reference obtained from a pixel within the lumen region. The new method incorporates a computation of an optimal threshold; therefore, it provides an unbiased observer-independent quantitation. We have conducted in vitro and in vivo experiments to evaluate the reproducibility and accuracy of the method.
DTIC
Automatic Control; Fluid Flow; Robustness (Mathematics); Unsteady Flow; Lumens

20030033896 Lebanese Univ., Tripoli, Lebanon
Adaptive Approach for Change Detection in EMG Recordings
El Falou, W.; Khalil, M.; Duchene, J.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410375; No Copyright; Avail: CASI; A01, Hardcopy

In this paper we present a new algorithm to detect abrupt changes in a signal when there is no a priori knowledge of the hypotheses on the process to be detected. This algorithm is based on the CUSUM algorithm. It can be applied in case of frequency and energy changes. This algorithm works when the samples are dependant and autoregressive modeling is needed. It is used to distinguish EMG segments from noise segments.
DTIC
Electromyography; Signal Processing

20030033942 Auvergne Univ., Clermont-Ferrand, France
Reciprocal Influence of Slow Waves Extracted in Intracranial Pressure, Arterial Pressure and Cerebral Blood Velocity Signals
Cervenansky, F.; Lemaire, J. J.; Boire, J. Y.; October 25, 2001; 4 pp.; In English
Report No.(s): AD-A410660; No Copyright; Avail: CASI; A01, Hardcopy

Slow waves in intracranial pressure (ICP) and related signals seems of interest to evaluate the dynamic autoregulation, i.e. by comparison of the frequency links between an intracranial signal e.g. ICP, cerebral blood velocity (CBV), and arterial blood pressure (ABP). To clarify the links, we compared two frequency methods based on coherence function to estimate the influence of ICP, ABP, and CBV on couples, respectively CBV-ABP, ICP-CBV and ICP-ABP, of slow waves in the B and the UB bands. We found that B and UB waves activity in ICP, CBV and ABP had reciprocal influences, except for the UB activity in ICP-CBV link which seems to be less sensitive to ABP. These data confirmed the interest of to analyze the slow wave activity to evaluate dynamic autoregulation. The interest of taking into account the reciprocal influence of the signals must be evaluated.
DTIC
Arteries; Blood Pressure; Intracranial Pressure; Cerebrum; Blood Flow; Signal Transmission

20030034607 University of Technology, Sydney, Australia
Comparison of Near Infrared Spectroscopy (NIRS) Signal Quantitation by Multilinear Regression and Neural Networks
Martinez-Coll, A.; Nguyen, H. T.; October 25, 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410249; No Copyright; Avail: CASI; A01, Hardcopy

Signal quantitation in most near infrared spectroscopy (NIRS) instruments is achieved through solving simultaneous equations or multiple regression analysis. The aim of this study was to compare NIRS signal quantitation by conventional multiple regression to artificial neural networks. Sixteen adult sheep were used in the study of the effects of changes in cerebral blood flow and metabolism through induction of seizures, ischemia, and hypercapnia. NIRS-derived signal attenuation for relative blood volume (BV) and oxygen desaturation (DESAT) were compared to simultaneous blood flow values measured by laser Doppler flowmetry and venous oxygen saturation (SvO2) determined from direct blood gas analysis. The regression for flow provided a zero p-value, a variance S=17.57 and F statistic=50.49. The residuals vs. fits plots suggest that the current model would underestimate values below the mean and overestimate those above the mean. An improved regression model for SvO2 provided a zero p-value, a variance S=14.1 and F statistic=4.26. Two different neural networks were implemented for flow and oxygen saturation. Both networks tracked their values closely and with low cycle errors. Neural networks are powerful tools for evaluation of rapidly changing, variable environments.
DTIC
Infrared Spectroscopy; Mathematical Models; Near Infrared Radiation; Neural Nets; Regression Analysis; Blood Flow

20030034610 Aristotle Univ. of Thessaloniki, Greece

Enhancement of R-Wave Detection in ECG Data Analysis Using Higher-Order Statistics

Panoulas, Kostas I.; Hadjileontiadis, Leontios J.; Panas, Stavros M.; Oct 2001; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410250; No Copyright; Avail: CASI; A01, Hardcopy

A new way of detecting R-wave in QRS complex of electrocardiogram (ECG) based on higher-order statistics (HOS) is presented in this paper. The proposed method employs HOS-based parameters, such as skewness and kurtosis, in order to formulate an adaptive detector of R peak with high accuracy. Experimental results, when applying the proposed method to pre-classified ECG data from the Massachusetts Institute of Technology/Beth Israel Hospital (MIT/BIH) FCC database, prove that the proposed method exhibits over 99\% of detectability, even when the ECG data are contaminated with noise. Due to its simplicity it could be feasible in a real-time context and it could be applied in routine ambulatory and/or clinical heart rate screening.

DTIC

Electrocardiography; Statistical Analysis

20030034630 Positron Medical Center, Tokyo, Japan

Formation of Parametric Images in Positron Emission Tomography Using a Clustering-Based Kinetic Analysis With Statistical Clustering

Kimura, Yuichi; Noshi, Yasuhiro; Oda, Keiichi; Ishii, Kenji; October 25, 2001; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410339; No Copyright; Avail: CASI; A01, Hardcopy

A method is proposed for forming parametric images in position emission tomography, using clustering kinetic analysis. To overcome the dual problems experienced in voxel-based data, of signal noise and the very long computational time, the data are clustered before parameter estimation, and then estimation procedure is applied to the averaged data in each cluster. Using this algorithm, PET data are optimally clustered, depending on the noise that is present, by hierarchically applying a statistical-clustering algorithm based on Mixed Gaussian model. In a computer simulation, the proposed method correctly clustered noise-contaminated data. Applying the proposed algorithm to (18)F-FDG clinical data, physiologically acceptable parametric images of glucose metabolism in a brain were obtained in a practical calculation time.

DTIC

Image Processing; Cluster Analysis; Statistical Analysis; Positrons; Tomography

20030034640 National Taiwan Univ., Taipei, Taiwan, Province of China

Estimation of Evoked Potentials Using High Order Statistic-Based Adaptive Filter

Lin, Bor-Shyh; Lin, Bor-Shing; Wu, Shu-Mei; Chien, Jen-Chien; Chong, Fok-Ching; October 25, 2001; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A410300; No Copyright; Avail: CASI; A01, Hardcopy

This paper is to present a high order statistics-based adaptive interference cancel filter (AIC-HOS) to process evoked potential (EP). In conventional ensemble averaging method, experiments have to conduct repetitively to record the required data. In normalized LMS adaptive filter, inappropriate step size always causes deficiency. This AIC-HOS system has none of the above disadvantages. This system was experimented in somatosensory evoked potential corrupted with EEG. Gradient type algorithm is used in this AIC-HOS structure to regulate the SNR of EEG and EP. This method is also simulated with visual evoked potential and audio evoked potential. The results obtained are satisfactory and acceptable in clinical usage. The AIC-HOS is superior to normalized LMS using adaptive filter in that it converges easily. Moreover, it is not sensitive to selection of step size in stabilities in convergency.

DTIC

Adaptive Filters; Statistical Analysis; Electroencephalography; Evoked Response (Psychophysiology)

20030034769 Massachusetts Univ., Amherst, MA, USA

Symbolic Heuristic Search for Factored Markov Decision Processes

Morris, Robert, Technical Monitor; Feng, Zheng-Zhu; Hansen, Eric A.; [2003]; 6 pp.; In English

Contract(s)/Grant(s): NAG2-1463; NAG2-1394; NSF IIS-99-84952; Copyright; Avail: CASI; A02, Hardcopy

We describe a planning algorithm that integrates two approaches to solving Markov decision processes with large state spaces. State abstraction is used to avoid evaluating states individually. Forward search from a start state, guided by an

admissible heuristic, is used to avoid evaluating all states. We combine these two approaches in a novel way that exploits symbolic model-checking techniques and demonstrates their usefulness for decision-theoretic planning.
Author
Algorithms; Decision Theory; Heuristic Methods; Markov Processes; Symbols

20030034795 Massachusetts Univ., Amherst, MA, USA
Transition-Independent Decentralized Markov Decision Processes
Becker, Raphen; Silberstein, Shlomo; Lesser, Victor; Goldman, Claudia V.; Morris, Robert, Technical Monitor; [2003]; 8 pp.; In English; Second International Joint Conference on Autonomous Agents and Multi-Agent Systems; Original contains black and white illustrations
Contract(s)/Grant(s): NAG2-1463; NAG2-1394; NSF IIS-99-07331; No Copyright; Avail: CASI; A02, Hardcopy

There has been substantial progress with formal models for sequential decision making by individual agents using the Markov decision process (MDP). However, similar treatment of multi-agent systems is lacking. A recent complexity result, showing that solving decentralized MDPs is NEXP-hard, provides a partial explanation. To overcome this complexity barrier, we identify a general class of transition-independent decentralized MDPs that is widely applicable. The class consists of independent collaborating agents that are tied up by a global reward function that depends on both of their histories. We present a novel algorithm for solving this class of problems and examine its properties. The result is the first effective technique to solve optimally a class of decentralized MDPs. This lays the foundation for further work in this area on both exact and approximate solutions.
Author
Decision Making; Markov Processes

20030038363 Lawrence Livermore National Lab., Livermore, CA
Stochastic Engine Initiative: Improving Prediction of Behavior in Geologic Environments We Cannot Directly Observe
Aines, R.; Nitao, J.; Newmark, R.; Carle, S.; Ramirez, A.; Sep. 30, 2001; In English
Report No.(s): DE2002-15002143; UCRL-ID-148221; No Copyright; Avail: National Technical Information Service (NTIS)

The stochastic engine uses modern computational capabilities to combine simulations with observations. We integrate the general knowledge represented by models with specific knowledge represented by data, using Bayesian inferencing and a highly efficient staged Metropolis-type search algorithm. From this, we obtain a probability distribution characterizing the likely configurations of the system consistent with existing data. The primary use will be optimizing knowledge about the configuration of a system for which sufficient direct observations cannot be made. Programmatic applications include underground systems ranging from environmental contamination to military bunkers, optimization of complex nonlinear systems, and timely decision-making for complex, hostile environments such as battlefields or the detection of secret facilities.
NTIS
Stochastic Processes; Hydrogeology; Computerized Simulation; Radioactive Isotopes; Migration

20030038798 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette
Random Walk in Random Groups
Gromov, M.; Jan. 2002; 78 pp.
Report No.(s): PB2003-102078; IHES/M/02/03; No Copyright; Avail: CASI; A05, Hardcopy

Contents include the following: Random groups associated with graphs; Small cancellation; Diffusion and contraction; Scaling limits and entropy.
NTIS
Random Walk; Groups

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030032278 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Generalized Extremal Optimization: A New Stochastic Algorithm for Optimal Design
LuisdeSouza, Fabiano; 2003; 144 pp.; In Portuguese; Original contains color illustrations
Report No.(s): INPE-9564-TDI/836; Copyright; Avail: CASI; A07, Hardcopy

In this work a new numerical tool for application on optimal design is presented. Based on the theory of Self-Organized Criticality (SOC), it is intended to be used in problems that present complex characteristics such as a non-convex or even disjoint design space, the presence of multiple sub-optimal solutions on it, severe non-linearities on the objective function or on the constraints and the use of a combination of continuos, discrete and integer variables. Called the Generalized Extremal Optimization algorithm (GEO), it extends the Extremal Optimization (EO) method in a way that it can be readly applied to a broad class of optimal design problems. Altought being a stochastic algorithm, it has only one free parameter to be set, diferently to other popular algorithms, such as the Genetic Algorithm (GA) or the Simulated Annealing (SA), that each have at least three of them. This is an a priori advantage of the GEO over the GA and the SA, since the setting process of the free parameter would present a lesser computional cost for the GEO than for the others. The generalized extremal optimization algorithm is presented here in its canonical form and in an alternative implementation called GEOvar. The performance of both implementations was assessed for a set of test functions and compared to versions of the GA and SA, showing to be competitive to both algorithms. Used to tackle optimal design problems in aerospace engineering, the generalized extremal optimization algorithm showed to be capable to find high quality solutions (in some cases probably the optimal), even starting from infeasible designs. Moreover, it identified characteristics of these problems that were not intuitively obvious at first sight. From the point of view of the theory that inspired the algorithm, a preliminar analisys of the search dynamics to find the optimal, showed that it can present characteristics of SOC. Finaly, it can be said that the generalized extremal optimization algorithm showed to be a highly potential candidate to be incorporated to the optimization numerical tool box of the engineer and of the scientist.

Author

Design Optimization; Algorithms; Stochastic Processes

20030032962 Naval Surface Warfare Center, Bethesda, MD

Scaling of Noise Generation Due to a Single Bubble in a Cavitating Trailing Vortex

Shen, Y. T.; Chahine, G. L.; Hsiao, C-T.; Jessup, S. D.; Nov. 2002; 34 pp.; In English

Report No.(s): AD-A410257; NSWCCD-50-TR-2002/053; No Copyright; Avail: CASI; A03, Hardcopy

Scaling of noise generation due to a single bubble in a cavitating trailing vortex is studied. Vortex core dynamics between full-scale and model is mathematically formulated based on a similarity flow approach and McCormick's hypothesis. Acoustic frequency and amplitude scaling formulas to obtain full scale acoustic spectrum from model data are derived. The acoustic scaling formulas are also compared with bubble dynamic calculations with encouraging results. The numerical calculations are obtained from a Dynaflow Inc. computer code. The acoustic scaling formulas are compared with Strasberg's classic lambda scaling and noise level scaling.

DTIC

Bubbles; Cavitation Flow; Noise Generators; Scale Models; Acoustics; Vortices

20030032969 Georgia Inst. of Tech., Atlanta, GA, USA

TIES for Dummies 3rd Edition (Technology Identification, Evaluation, and Selection) Basic how to's to implement the TIES method

Kirby, Michelle R.; August 02, 2002; 121 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-2235; No Copyright; Avail: CASI; A06, Hardcopy

The TIES method is a forecasting environment whereby the decision-maker has the ability to easily assess and trade-off the impact of various technologies without sophisticated and time-consuming mathematical formulations. TIES provides a methodical approach where technically feasible alternatives can be identified with accuracy and speed to reduce design cycle time, and subsequently, life cycle costs, and was achieved through the use of various probabilistic methods, such as Response Surface Methodology and Monte Carlo Simulations. Furthermore, structured and systematic techniques are utilized from other fields to identify possible concepts and evaluation criteria by which comparisons can be made. This objective is achieved by employing the use of Morphological Matrices and Multi-Attribute Decision Making techniques. Through the execution of each step, a family of design alternatives for a given set of customer requirements can be identified and assessed subjectively or objectively. This methodology allows for more information (knowledge) to be brought into the earlier phases of the design process and will have direct implications on the affordability of the system. The increased knowledge allows for optimum allocation of company resources and quantitative justification for program decisions. Finally, the TIES method provided novel results and quantitative justification to facilitate decision making in the early stages of design so as to produce affordable and quality products.

Derived from text

Technology Utilization; Methodology; Computer Programs; Systems Engineering; Aerospace Systems

20030033002 Research and Technology Organization, Neuilly-sur-Seine, France
Handbook on Long Term Defence Planning
Bakken, Bent Erik; April 2003; 54 pp.; In English; Original contains color illustrations
Report No.(s): RTO-TR-069; AC/323(SAS-025)TP/41; Copyright; Avail: CASI; A04, Hardcopy

Common force planning practices are critical to NATO cohesiveness, also operationally. This Handbook is based on a review of current long-term planning practices in many NATO bodies and nations. Long-term refers the issues where planning focus is more than ten, typically twenty, years into the future. A common framework is provided to help planners in understanding the context and content of their work. It is hoped that the framework will enable increased and shared processual understanding within the alliance and PfP nations. The framework is described in detail; consisting in ten sequential steps. From Analysis of the future environment at the beginning until Establishing a force structure at the end. The Book contains one appendix where current NATO long term force planning is explained and commented in light of the framework. A second appendix lists various referenced analytical models, simulations and tools that are used in NATO and the nations. Author

Military Operations; Military Technology; Armed Forces (United States); Armed Forces (Foreign); North Atlantic Treaty Organization (NATO); Resources Management; Forecasting

20030033014 Research and Technology Organization, Neuilly-sur-Seine, France
Urban Operations in the Year 2020
April 2003; 140 pp.; In English; Original contains color illustrations; CD-ROM contains full text in PDF format
Report No.(s): RTO-TR-071; AC/323(SAS-030)TP/35; Copyright; Avail: CASI; A07, Hardcopy

This is the final report by the SAS-030 Study Group into Urban Operations in the year 2020. In this study recommendations are given to RTA and NATO. The recommendations are based upon the approach as explained underneath. The study group examined the future urban environment, stresses the growing importance of Urban Operations and derived capabilities needed at the operational level to successfully operate in such an environment. In the study the conceptual framework USECT (Understand, Shape, Engage, Consolidate, Transition) was analyzed and future and more traditional operational concepts were developed and selected. Based on the operational level capabilities, new System Concepts were developed and these materiel solutions were analysed during an Urban Seminar Wargame where also non-materiel solutions were examined. During the study extensive ranking was helpful to determine the most promising System Concepts and other solutions.
Author

Military Operations; Cities; War Games; Operations Research; Interoperability

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20030032974 Pennsylvania Univ., Philadelphia, PA
Parallel, Rapid Diffuse Optical Tomography of Breast
Yodh, Arjun G.; Chance, Britton; Jul. 2002; 63 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0408
Report No.(s): AD-A410364; No Copyright; Avail: CASI; A04, Hardcopy

During the last year we have experimentally and computationally investigated rapid acquisition and analysis of informationally dense diffuse optical data sets in the parallel plate compressed breast geometry. We have developed and tested a 3-dimensional image reconstruction algorithm for the diffusive wave inverse problem that runs on a parallel computer cluster. This code uses a finite difference method in the forward calculation, a novel Integro-Differential equation, previously developed by this group, in the reconstruction. There has been a significant improvement in our instrumentation and measurement capabilities. A hybrid RF/CW diffuse optical tomography (DOT) system measures limited number of frequency-domain reemission data and significantly larger continuous wave transmission data by a lens coupled CCD simultaneously. The wavelength of the light source is optically switched from 690, 750, 786 and 830 nm and then its position is switched among 45 different positions on the compression plate. The instrument and reconstruction algorithm performance have been tested using small silicone tissue phantoms as a tumor of various size and optical properties suspended into the liquid tissue phantom. The study of the effect of boundary between the matching fluid and breast has been initiated by building

and taking measurements from tissue phantoms with breast shape, embedded with small objects with higher absorption or scattering.
DTIC
Optical Properties; Differential Equations; Diffusion; Tomography; Cancer; Mammary Glands

20030034652 Universite de Technologie de Compiegne, France
A Method of EMG Decomposition Based on Fuzzy Logic
Chauvet, E.; Fokapu, O.; Hogrel, J. Y.; Gamet, D.; Duchene, J.; October 25, 2001; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410305; No Copyright; Avail: CASI; A01, Hardcopy

A new method for decomposing the EMG signal into their constituent motor unit action potentials (MUAPs) is presented. We propose a specific iterative algorithm with a classification method using fuzzy logic techniques. A statistical analysis of Inter-pulses Interval (IPI) and amplitude detected MUAPs is realised before its classification step. The algorithm was evaluated on simulated surface EMG signals (SEMG) before its application to real SEMG. On simulated signals, the rate of successfully classified MUAP was 88.4\%. On real Laplacien SEMG, the algorithm identified correctly 21 MUAP trains (MUAPTs) on the 29 MUAPTs identified by an expert. The efficiency of the decomposition on Surface EMG makes the method very attractive for non invasive investigations.
DTIC
Electromyography; Fuzzy Systems; Signal Processing

20030038802 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette
A-Genus on Non-Spin Manifolds with S1 Actions and the Classification of Positive Quaternion-Kaehler 12-Manifolds
Herrera, H.; Herrera, R.; Oct. 2001; 38 pp.
Report No.(s): PB2003-102091; IHES/M/01/46; No Copyright; Avail: CASI; A03, Hardcopy

The authors prove that the A-genus vanishes on certain non-spin manifolds. Namely, A(M) vanishes on any oriented, compact, connected, smooth manifold M with finite second homotopy group and endowed with non-trivial (isometric) smooth S1 actions. This result extends that of Atiyah and Hirzebruch on spin manifolds endowed with smooth S1 actions, to manifolds which are not necessarily spin. We do this by means of the elliptic genus defined by Ochanine and Witten showing that it also has the special property of being 'rigid under S1 actions' on these manifolds, although they are not necessarily spin as is the usual assumption. The authors conclude with a beautiful application of this new vanishing theorem by classifying all positive quaternion-Kahler 12-manifolds. Namey, the authors prove that every quaternion-Kahler 12-manifold with a complete metric of positive scalar curvature must be a symmetric space.
NTIS
Rigidity; Quaternions; Manifolds (Mathematics)

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*.

20030032289 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Aura Mission and the 'A-Train'
Schoeberl, Mark R.; [2002]; 1 pp.; In English; The World Space Congress, 10-19 Oct. 2002, Houston, TX, USA; No Copyright; Avail: Other Sources; Abstract Only

By the end of 2004 the A-Train will have been assembled in orbit. The A-Train consists of five low earth orbit satellites flying within 15 minutes of each other. The first in the train is Aqua, launched early this year, in an ascending node orbit with 1 :30 PM crossing time. In January 2004, Aura will be launched, following 15 minutes behind Aqua. Aura's focus is atmospheric chemistry, with both forward looking, and backward looking instruments along with nadir sounders. Aura's limb microwave instrument will also be able to make temperature and humidity measurements into the troposphere. By mid-2004, CALIPSO, a cloud lidar mission and CloudSat, a cloud radar mission will be co-manifested. These two spacecraft will follow, and maneuver about 1 minute behind Aqua. The lidar on CALIPSO will provide aerosol and cloud height information which can enhance the aerosol information from Aqua s MODIS instrument. CloudSat s radar will enhance the information from

AMSR-E, AIRS and HSB on Aqua. The fifth satellite to be launched in 2004 is PARASOL which will use the POLDER instrument to provide polarization information which can be used to determine aerosol composition and size distribution.
Author
Atmospheric Chemistry; Aerosols; Atmospheric Temperature; Cloud Height Indicators; Optical Radar

20030032370 Air Force Research Lab., Edwards AFB, CA, USA
Estimating the Equivalent Initial Crack Size in a Particulate Composite Material Under a Multi-Axial Loading Condition
Liu, C. T.; Yang, J. N.; Smith, G.; Wickham, D.; June 27, 2002; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AFRL-PR-ED-VG-2002-167; AF Proj. 2302
Report No.(s): AD-A410165; No Copyright; Avail: CASI; A03, Hardcopy

The objectives of this viewgraph report are to: investigate the effect of confirmed pressure on the equivalent initial crack size in a particulate composite material under a constant strain rate of 18.18 in/in/min., and to determine the statistical distribution function of the equivalent initial crack size,
DTIC
Strain Rate; Composite Materials; Cracks

20030032371 Air Force Research Lab., Edwards AFB, CA, USA
Observation of Damage Process in a Particulate Composite Material by Real-Time Radiographic Techniques
Liu, C. T.; August 2000; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410166; AFRL-PR-ED-TP-2000-157; No Copyright; Avail: CASI; A03, Hardcopy

The damage initiation and evolution processes in pre-cracked sheet specimens subjected to different loading conditions, constant strain rate and constant strain, were investigated using real-time x-ray techniques. The specimens were made of a particulate composite material containing hard particles embedded in a rubber matrix. The x-ray data were analyzed and the results are discussed.
DTIC
Radiography; Real Time Operation; Composite Materials

20030032373 Air Force Research Lab., Edwards AFB, CA, USA
Investigating the Deformation and Failure Mechanisms in Bi-Material Systems Under Tension
Liu, C. T.; Chiang, Fu-Pen; March 11, 2002; 3 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410168; AFRL-PR-ED-AB-2002-051; No Copyright; Avail: CASI; A01, Hardcopy

Bonded sandwich laminates are being used widely in various industries. They have been successfully used in aircraft and space structures, pipes, chemical tanks, ship hulls, and in other structural applications in which a high strength-to-weight ratio is a desirable feature. Joining structural components with adhesives provides a number of advantages. Bonding does not require rivet holes, which are stress raisers and may cause premature failure either under static or fatigue loading. In fact, it has been shown that the fatigue strength of a stiffened panel in an aircraft structure is considerably improved when the stiffeners are bonded to the panel. The bonding of damping materials to metal sheets, to form a sandwich structure, currently is being considered as an effective way to control noise-induced fatigue (sonic fatigue) of airframes. In solid rocket motor design, the bonding of insulation materials to motor casings is used to protect the casing from high temperature after the motor is fired.
DTIC
Bonded Joints; Acoustic Fatigue; Sandwich Structures; Structural Design; Laminates

20030032384 Air Force Research Lab., Edwards AFB, CA, USA
Predicting the Initial Crack Length in a Solid Propellant
Liu, C. T.; Kwon, Y. G.; Hendrickson, T. L.; January 30, 2001; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AFRL-PR-ED-TP-2001-031; AF Proj. 2302
Report No.(s): AD-A410143; No Copyright; Avail: CASI; A03, Hardcopy

In this study, numerical analyses were performed to predict the initial crack length of specimens with two different sizes of holes using multi-level simulation techniques. The specimens were subjected to a constant strain rate of 0.33 in/in/min at room temperature. The criterion for determining the initial crack length was based on the instability of the material near the

edge of the hole. The results of the analyses show that the predicted initial crack lengths compared well with the experimental measurements.
DTIC
Cracks; Crack Propagation; Solid Propellants; Strain Rate; Holes (Mechanics); Structural Analysis

20030032977 Brookhaven National Lab., Upton, NY
Creating an 'Electromagnetic Interference Risk Distribution Map' In the Modern Hospital
Spyropoulos, B.; Glotsos, D.; Batistatos, D.; Marneris, I.; Oct 2001; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410469; No Copyright; Avail: CASI; A01, Hardcopy

Electromagnetic Interference (EMI) from various sources can cause medical monitoring equipment and other hospital devices to malfunction, that can range from mere inconvenience to serious problems. Comprehensive induced Magnetic Field and Real Electromotive Force measurements have been carried out and properly documented in the form of an 'on line risk distribution map' covering all departments in the General District Anti-Cancer Hospital of Piraeus 'Metaxa'.
DTIC
Electromagnetic Interference; Medical Equipment

20030033000 Air Force Research Lab., Edwards AFB, CA, USA
The Effects of Pressure on Fracture of a Rubbery Particulate Composite
Miller, T. C.; Liu, C. T.; Jun. 2000; 18 pp.; In English
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A410517; AFRL-PR-ED-TP-2000-044; No Copyright; Avail: CASI; A03, Hardcopy

There is a need for studying the effects of pressure on fractures. Recommendations for future work: examination of short crack fracture phenomena (why do short cracks behave differently?) Surface crack growth analysis: find a way to measure crack depth and width in pressurized environment. Links between microstructure and pressure effect (establish a connection between pressure effect and microstructural phenomena such as void nucleation, growth, and coalescence).
DTIC
Crack Propagation; Fracture Mechanics; Pressure Effects

20030033023 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Stress Intensity Factors and Paths for Cracks in Photoelastic Motor Grain Models Under Internal Pressure
Smith, C. W.; Constantinescu, D. M.; Liu, C. T.; April 20, 2001; 11 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410574; AFRL-PR-ED-TP-2001-100; No Copyright; Avail: CASI; A03, Hardcopy

Computational analysis and two-dimensional tensile tests on single motor grain fins suggest that cracks in fin tips are most likely to originate at the coalescence of a fin end tip radius, with a small radius from the side of the fin. Some manufacturers have also noticed defects formed during casting at the fin tip on the fin axis. The following is an experimental investigation utilizing frozen stress photoelastic models of an existing motor grain geometry in order to clarify stress intensity factor (SIF) values and crack growth paths for cracks emanating from the two above- noted potential critical loci. Comparisons between results from cracks grown from the two loci will be made, suggesting interesting conclusions.
DTIC
Crack Propagation; Rocket Engines; Internal Pressure; Stress Intensity Factors; Photoelasticity

20030034597 Air Force Research Lab., Edwards AFB, CA, USA
Crack Growth Rates in a Propellant Under Various Conditions
Miller, Tim; March 27, 2001; 18 pp.; In English
Report No.(s): AD-A410423; AFRL-PR-ED-VG-2001-053; No Copyright; Avail: CASI; A03, Hardcopy

Cracks develop during manufacturing, handling and storage of rubbery particulate composites. During the service life, the cracks may begin to grow, but may still be subcritical because the cracks may grow slower than the burn rate of the propellant. Results for three types of specimens are described. This is done both at ambient and 1000 psi (6895 kPa) pressure.
DTIC
Crack Propagation; Manufacturing; Pressure Dependence; Rocket Propellants

20030034637 Air Force Research Lab., Edwards AFB, CA, USA

Stress Intensity Factors for Cracks Within and Near to Bondlines in Soft Incompressible Materials

Smith, C. W.; Gloss, K. T.; Constantinescu, D. M.; Liu, C. T.; June 16, 2000; 15 pp.; In English

Contract(s)/Grant(s): AF Proj. 2302

Report No.(s): AD-A410444; AFRL-PR-ED-TP-2000-132; No Copyright; Avail: CASI; A03, Hardcopy

Using a polyurethane photoelastic material, thick test specimens of several configurations with bonded end tabs are examined for measuring stress intensity factors (SIFs) for cracks within and near to bondlines in bonded photoelastic models. Effects of specimen height, glued end tabs, bondline and crack size and location are studied and analyzed using a two parameter model for extracting the SIFs and results are compared with cracked, homogeneous model results.

DTIC

Cracks; Photoelastic Materials; Stress Intensity Factors

20030034641 Air Force Research Lab., Edwards AFB, CA, USA

Effects of Damage on Interfacial Crack Tip Fields

Miller, T.C.; Aug. 2000; 24 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A410447; AFRL-PR-ED-TP-2000-134; No Copyright; Avail: CASI; A03, Hardcopy

Under applied stress, damage occurs by separation of the matrix from the hard particles. Damage can occur during processing, transpiration, and storage. After the damage event, removal of stresses may conceal this type of damage. The size and extent of damage may be difficult to assess. Damage can determine whether a nearby crack grows, and if so, how it grows (both trajectory and speed). Cracks can promote uneven burning and can alter propulsion behavior, resulting in inaccurate delivery of payload. Catastrophic destruction of both rocket and payload is possible. Collateral damage to surrounding equipment and personnel is also possible.

DTIC

Damage; Crack Tips; Cracking (Fracturing); Interfacial Tension

20030034644 Air Force Research Lab., Eglin AFB, FL, USA

Crack Growth Data Collection and Reduction Methodology Survey

Miller, Tim; January 30, 2001; 13 pp.; In English

Contract(s)/Grant(s): AF Proj. 2302

Report No.(s): AD-A410451; AFRL-PR-ED-VG-2001-052; No Copyright; Avail: CASI; A03, Hardcopy

This methodology survey discusses crack growth data collection and reduction. Complications in the measurement process include inhomogeneity of microstructure, large deformations, and material nonuniformity complicate the analysis of cracks in propellant. Microstructure-void nucleation, growth, and coalescence at the crack tip causes sporadic crack growth. Large deformations-blunting at crack tip and large dimensional changes make measuring crack size somewhat subjective. Variation of specimen properties due to trouble maintaining uniformity during processing of large rocket grains also a problem. These complications give the crack growth rates scatter. Some of the scatter reflects real instantaneous changes in crack speed, while some are related to the measurement techniques used.

DTIC

Crack Propagation; Microstructure; Methodology; Nonuniformity; Data Reduction; Surveys

20030034668 Technische Hochschule, Stuttgart, Germany

Virtual Nonlinear Multibody Systems, NATO Advanced Study Institute. Volume 2

Schiehlen, Werner; Valasek, Michael; Jul. 2002; 278 pp.; In English

Contract(s)/Grant(s): N62358-02-M-6031

Report No.(s): AD-A410222; R/D-9315-AN-02; No Copyright; Avail: CASI; A13, Hardcopy

Multibody system dynamics is based on classical mechanics and its engineering applications ranging from mechanisms, gyroscopes, satellites and robots to biomechanics and vehicle engineering. Multibody systems dynamics is characterized by algorithms or formalisms, respectively, ready for computer implementation. The simulation of multibody systems demands for adequate dynamic models and takes into account various phenomena. Classical dynamics does not regard all nonlinear effects that appear as a result of the action of multibody systems, as well as their mutual interaction. The virtual prototyping and dynamic modeling of such systems are, from an economical point of view, perspective fields of scientific investigations having in mind the huge expenses for their design and manufacturing. Complex multibody systems composed of rigid and flexible

bodies performing spatial motion and various complex tasks are up-to-date objects of virtual prototyping. As a result simulation and animation featuring virtual reality are most important. Recent research fields in multibody dynamics include standardization of data, coupling with CAD systems, parameter identification, real-time animation, contact and impact problems, extension to electronic and mechatronic systems, optimal system design, strength analysis and interaction with fluids. Further, there is a strong interest on multibody systems in analytical and numerical mathematics resulting in reduction methods for the rigorous treatment of simple models and special integration codes for Ordinary Differential Equation (ODE) and Differential Algebraic Equation (DAE) representations supporting the numerical efficiency. New software engineering tools with modular approaches improve the efficiency still required for the more demanding needs in biomechanics, robotics and vehicle dynamics.
DTIC
Classical Mechanics; Differential Calculus; Differential Equations; Dynamics; Nonlinear Systems; Virtual Reality

20030034669 Brookhaven National Lab., Upton, NY
Color Glass Condensate, RHIC and HERA
McLerran, L.; 2002; 12 pp.; In English
Report No.(s): DE2002-801703; BNL-69355; No Copyright; Avail: Department of Energy Information Bridge
In this talk, I discuss a universal form of matter, the Color Glass Condensate. It is this matter which composes the low x part of all hadronic wave-functions. The experimental programs at RHIC and HERA, and future programs at LHC and eRHIC may allow us to probe and study the properties of this matter.
NTIS
Glass; Condensates; Quantum Chromodynamics

20030034686 Air Force Research Lab., Edwards AFB, CA, USA
Near Tip Behavior in a Particulate Composite Material Under Constant Strain Rates Including Temperature and Thickness Effects
Liu, C. T.; Smith, C. W.; October 29, 2001; 17 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410504; AFRL-PR-ED-VG-2001-211; No Copyright; Avail: CASI; A03, Hardcopy
The objectives of this report were to investigate the effects of temperature and specimen thickness on local strain fields and crack growth behavior in a particulate composite material. Temperatures were -53.9 deg C, 22. 2 deg C and 73.9 deg C. Thickness is 2.54 mm and 12.7 mm. The conclusions were that the crack growth behavior at -53.9 deg C is significantly different from that at 22.2 deg C and 73.9 deg C. The increase in specimen thickness alters the local strain fields but the iso-strain contours are of the same general form. A power law relationship exists between the Model stress intensity factor and the crack growth rate.
DTIC
Composite Materials; Crack Propagation; Strain Rate; Mechanical Properties; Particulates

20030034735 Brookhaven National Lab., Upton, NY
New Form of High Energy Density Matter
McLerran, L.; 2000; 16 pp.
Report No.(s): DE2002-805487; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
NTIS
Density (Mass/Volume); Matter (Physics); Heavy Ions; High Energy Electrons; Energy Levels

20030037027 Brookhaven National Lab., Upton, NY
Measurement of the Muon Anomalous Magnetic Moment to 0. 7 ppm
Semertzidis, Y. K.; 2002; 16 pp.
Report No.(s): DE2002-805486; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
NTIS
Magnetic Anomalies; Magnetic Moments; Muons

20030037036 Lawrence Livermore National Lab., Livermore, CA
Optics Elements for Modeling Electrostatic Lenses and Accelerator Components: III. Electrostatic Deflectors
Brown, T. A.; Gillespie, G. H.; Sep. 21, 1999; 20 pp.
Report No.(s): DE2002-791696; No Copyright; Avail: Department of Energy Information Bridge

Ion-beam optics models for simulating electrostatic prisms (deflectors) of different geometries have been developed for the computer code TRACE 3-D. TRACE 3-D is an envelope (matrix) code, which includes a linear space charge model, that was originally developed to model bunched beams in magnetic transport systems and radiofrequency (RF) accelerators. Several new optical models for a number of electrostatic lenses and accelerator columns have been developed recently that allow the code to be used for modeling beamlines and accelerators with electrostatic components. The new models include a number of options for: (1) Einzel lenses, (2) accelerator columns, (3) electrostatic prisms, and (4) electrostatic quadrupoles. A prescription for setting up the initial beam appropriate to modeling 2-D (continuous) beams has also been developed. The models for electrostatic prisms are described in this paper.

NTIS
Optics; Accelerators; Models

20030037044 Fluor Hanford, Richland, WA
Pulse Rise Time Characterization of a High Pressure Xenon Gamma Detector for Use in Resolution Enhancement
2002; 24 pp.; In English
Report No.(s): DE2002-804476; No Copyright; Avail: Department of Energy Information Bridge

High pressure xenon ionization chamber detectors are possible alternatives to traditional thallium doped sodium iodide (NaI(T1)) and hyperpure germanium as gamma spectrometers in certain applications. Xenon detectors incorporating a Frisch grid exhibit energy resolutions comparable to cadmium/zinc/telluride (CZT), but with far greater sensitive volumes. The Frisch grid reduces the position dependence of the anode pulse risetimes, but it also increases the detector vibration sensitivity, anode capacitance, voltage requirements and mechanical complexity. We have been investigating the possibility of eliminating the grid electrode in high-pressure xenon detectors and preserving the high energy resolution using electronic risetime compensation methods. A two-electrode cylindrical high pressure xenon gamma detector coupled to time-to-amplitude conversion electronics was used to characterize the pulse rise time of deposited gamma photons. Time discrimination was used to characterize the pulse rise time versus photo peak position and resolution. These data were collected to investigate the effect of pulse rise time compensation on resolution and efficiency.

NTIS
Gamma Rays; High Pressure; Ionization Chambers; Xenon; Detectors; Pulse Time Modulation; Temporal Resolution

20030037057 Fermi National Accelerator Lab., Batavia, IL, Hawaii Univ. at Manoa, Honolulu
Synchro-Betatron Resonances in the 8 GeV Proton Driver
Ohnuma, S.; Nov. 2000; 16 pp.; In English
Report No.(s): DE2002-805246; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

NTIS
Betatrons; Protons; Synchrotrons

20030037063 Fermi National Accelerator Lab., Batavia, IL
Beam Simulation Tools for GEANT4 (BT-v1.0). User's Guide
Elvira, V. D.; Labrun, P.; Spentzouris, P.; Dec. 2002; In English
Report No.(s): DE2002-805249; No Copyright; Avail: National Technical Information Service (NTIS)

Geant4 is a tool kit developed by a collaboration of physicists and computer professionals in the high energy physics field for simulation of the passage of particles through matter. The motivation for the development of the Beam Tools is to extend the Geant4 applications to accelerator physics. The Beam Tools are a set of C++ classes designed to facilitate the simulation of accelerator elements: r.f. cavities, magnets, absorbers, etc. These elements are constructed from Geant4 solid volumes like boxes, tubes, trapezoids, or spheers. There are many computer programs for beam physics simulations, but Geant4 is ideal to model a beam through a material or to integrate a beam line with a complex detector. There are many such examples in the current international High Energy Physics programs.

NTIS
Computerized Simulation; User Manuals (Computer Programs); Beams (Radiation); Standard Model (Particle Physics)

20030037066 Argonne National Lab., IL, Stanford Linear Accelerator Center, CA
Theory and Simulation of CSR Microbunching in Bunch Compressors
Huang, Z.; Borland, M.; Emma, P.; Je Kim, K.; 2002; 8 pp.; In English
Report No.(s): DE2002-805258; No Copyright; Avail: Department of Energy Information Bridge

CSR microbunching instability in bunch compressors is studied both analytically and numerically. The iterative solutions of the integral equation for the instability provide approximate expressions of CSR microbunching due to initial density and energy modulation, and can be applied to a series of bending systems of multiple compressor chicanes and transport lines. Two similar but independent simulation methods are developed and are compared to each other as well as with theory. We determine the total gain in density modulation for all bend systems of the Linac Coherent Light Source and discuss initial conditions that start the unstable process.

NTIS
Beams (Radiation); Relativistic Electron Beams; Electron Bunching; Iterative Solution; Compressors; Computerized Simulation

20030037067 Brookhaven National Lab., Upton, NY
Muon EDM Experiment Using Stage II of the Neutrino Factory
Ferno, R. C.; Gallardo, J. C.; Morse, W. M.; Semertzidis, Y. K.; Oct. 2002; 10 pp.; In English
Report No.(s): DE2002-805488; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

NTIS
Muons; Neutrinos; Standard Model (Particle Physics); Dipole Moments; Particle Beams

20030037071 Jefferson Lab., Newport News, VA
Relativistic Theory of Few-Body Systems
Gross, F.; 2002; 18 pp.
Report No.(s): DE2002-805556; No Copyright; Avail: Department of Energy Information Bridge

Very significant advances have been made in the relativistic theory of few body systems since I visited Peter Sauer and his group in Hannover in 1983. This talk provides an opportunity to review the programs in this field since then. Different methods for the relativistic calculation of few nucleon systems are briefly described. As an example, seven relativistic calculations of the deuteron elastic structure functions, A, B, and T (sub 20), are compared. The covariant SPECTOR theory, among the more successful and complete of these methods, is described in more detail.

NTIS
Relativistic Theory; Deuterons

20030037072 Stanford Linear Accelerator Center, CA, Lawrence Berkeley National Lab., CA, Fermi National Accelerator Lab., Batavia, IL
Report of the Snowmass T7 Working Group on High Performance Computing
Ko, K.; Ryne, R.; Spentzouris, P.; Aug. 10, 2001; 28 pp.; In English
Report No.(s): DE2002-805413; No Copyright; Avail: Department of Energy Information Bridge

Computers have played a larger and larger role in the theory, design and development of accelerators and the associated technologies. Some examples are calculations of beam optics, simulation of instabilities, electromagnetic field calculations, simulation of space-charge dominated beams and halo formation, beam-beam simulations, start-to-end simulations of systems, real-time modeling of accelerators, and simulations of new accelerator ideas such as those involving lasers and plasmas. This group should explore the impact that advanced computational techniques using the most powerful computers would have on research and development in particle beams and accelerator technology. The group should document past success and look at the immediate and long term future of high performance computing (HPC) as applied to particle beams and accelerator technology.

NTIS
Particle Accelerators; Computerized Simulation; Computers; Beams (Radiation); Particle Theory

20030037093 Fermi National Accelerator Lab., Batavia, IL
Overview of Tevatron Collider Run II at Fermilab
Moore, R. S.; Dec. 2002; 10 pp.
Report No.(s): DE2002-805567; No Copyright; Avail: Department of Energy Information Bridge

The Run II era at Fermilab began in March 2001. Many changes to the accelerator complex were made to support the Tevatron proton-antiproton collider operation with peak luminosities of 2-4 times 10 the 32nd power square centimeters s to the minus 1 power while delivering greater than 5 fb to the minus 1 power of integrated luminosity before the LHC begins its physics program. This report describes the current status of Run II operations and the machine performances needed to achieve our goals.
NTIS
Beamforming; Beam Injection

20030037094 Jefferson Lab., Newport News, VA, Fermi National Accelerator Lab., Batavia, IL
Beam Dynamics Issues of Muon Acceleration in RLA
Bogacz, S. A.; Lebedev, V. A.; Dec. 2002; 8 pp.; In English
Report No.(s): DE2002-805573; No Copyright; Avail: Department of Energy Information Bridge
A conceptual design of a muon acceleration based on recirculating superconducting linacs is proposed. In the presented scenario, acceleration starts after ionization cooling at 210 MeV/c and proceeds to 20 GeV, where the beam is injected into a neutrino factory storage ring. The key technical issues are addressed: such as: the choice of acceleration technology (superconducting versus normal conducting) and the choice of RF frequency, and finally, implementation of the overall acceleration scheme: capture, acceleration, transport and preservation of large phase space of fast decaying species. Beam transport issues for large-momentum-spread beams are accommodated by appropriate lattice design choices. The proposed arc optics is further optimized with a sextupole correction to suppress chromatic effects contributing to emittance dilution. The presented proof-of-principle design of the arc optics with horizontal separation of multi-pass beams is extended for all passes.
NTIS
Linear Accelerators; Muons; Particle Acceleration; Particle Production; Particle Beams

20030037113 Helsinki Univ. of Technology, Espoo (Finland)
Diffusive Dynamics of Interacting Particles in Equilibrium and under Hydrodynamic Sedimentation
Lahtinen, J. M.; Aug. 2002; 130 pp.
Report No.(s): PB2003-101272; TKK-DISS-115(2002); Copyright; Avail: National Technical Information Service (NTIS)
Diffusive motion of particles plays an important role in phenomena in surface physics, for example in chemical reactions, surface growth, and spreading. Diffusive motion can be observed in many different systems. In this thesis the authors study diffusion and dynamics in two fundamentally different kinds of systems: (1) in Brownian surface system and (2) in a non-Brownian system of sedimenting particles with full hydrodynamic interactions. The quantities of central importance are the diffusion coefficients and the related correlation functions. In the sedimentation system the authors also discuss the behavior of the velocity fluctuations which has attracted a lot of attention recently. First the authors study the system of spherical Brownian particles on a smooth surface. Then the authors consider the influence of a periodic surface potential and the relation of the continuum model to the lattice gas model. Next we present the corresponding results in a system of rodlike molecules.
NTIS
Brownian Movements; Diffusion Coefficient; Hydrodynamics; Particle Diffusion; Equilibrium; Sediments; Continuum Modeling

20030037171 Lawrence Livermore National Lab., Livermore, CA
1-10 Mbar Laser-Driven Shocks Using the JANUS Laser
Dunn, J.; Price, D. F.; Moon, S. J.; Cauble, R. C.; Springer, P. T.; Aug. 10, 2001; In English
Report No.(s): DE2002-15002088; UCRL-JC-145171; No Copyright; Avail: National Technical Information Service (NTIS)
We report preliminary results using the Lawrence Livermore National Laboratory (LLNL) Janus laser facility to generate high pressure laser-driven shocks in the 1 - 10 Mbar regime. These experiments address various issues, including shock steadiness, planarity, uniformity and low target preheat, important for making precision equation of state (EOS) measurements on a small laser facility. A brief description of the experimental techniques, target design and measurements will be given.
NTIS
Lasers; Shock Waves

20030037180 Lawrence Livermore National Lab., Livermore, CA
Modeling Chamber Transport for Heavy-Ion Fusion
Sharp, W. M.; Callahan-Miller, D. A.; Tabak, M.; Yu, S. S.; Peterson, P. F.; Aug. 02, 2002; In English
Report No.(s): DE2002-15002125; UCRL-JC-149578; No Copyright; Avail: National Technical Information Service (NTIS)

In a typical thick-liquid-wall scenario for heavy-ion fusion (HIF), between seventy and two hundred high-current beams enter the target chamber through ports and propagate about three meters to the target. Since molten-salt jets are planned to protect the chamber wall, the beams move through vapor from the gas molecules. Radiation from the preheated target causes further beam stripping and gas ionization. Due to this stripping, beams for heavy-ion fusion are expected to require substantial neutralization in a target chamber. Much recent research has, therefore, focused on beam neutralization by electron sources that were neglected in earlier simulations, including emission from walls and the target, photoionization by the target radiation, and pre-neutralization by a plasma generated along the beam path. When these effects are included in simulations with practicable beam and chamber parameters, the resulting focal spot is approximately the size required by a distributed radiator target.
NTIS
Test Chambers; Beam Neutralization

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*.

20030032337 NASA Kennedy Space Center, Cocoa Beach, FL, USA
An Overview of Research Activity at the Launch Systems Testbed
Vu, Bruce; Kandula, Max; [2003]; 8 pp.; In English; Tenth International Congress on Sound and Vibration, 7-10 Jul. 2003, Stockholm, Sweden; Original contains black and white illustrations
Report No.(s): KSC-2003-045; Copyright; Avail: CASI; A02, Hardcopy

This paper summarizes the acoustic testing and analysis activities at the Launch System Testbed (LST) of Kennedy Space Center (KSC). A major goal is to develop passive methods of mitigation of sound from rocket exhaust jets with ducted systems devoid of traditional water injection. Current testing efforts are concerned with the launch-induced vibroacoustic behavior of scaled exhaust jets. Numerical simulations are also developed to study the sound propagation from supersonic jets in free air and through enclosed ducts. Scaling laws accounting for the effects of important parameters such as jet Mach number, jet velocity, and jet temperature on the far-field noise are investigated in order to deduce full-scale environment from small-scale tests.
Author
Launching; Acoustic Measurement; Signal Analyzers; Rocket Exhaust; Sound Propagation; Test Stands

20030032377 Naval Surface Warfare Center, Bethesda, MD
An Acoustic Procedure for Measuring Blade-Frequency Forces Generated by Model Ship Propellers
Strasberg, M.; Dec. 2002; ISBN0309084997; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410186; NSWCCD-70-TR-2002/135; No Copyright; Avail: CASI; A03, Hardcopy

An acoustic procedure is described for measuring the blade-frequency fluctuating forces developed by a powerful model propeller operating behind a model of a ship's hull or a wake generator in the anechoic test section of a wind tunnel. The sound pressure radiated by the propeller in a given direction is measured and its magnitude inserted into a simple theoretical relation to determine the alternating force developed by the propeller in that direction. Although the procedure was developed years ago, the details and limitations have not previously been described in the literature. Restrictions are discussed on the size of the propeller, location of the measurement point, measurement frequency, and the wind speed. Measurements determining the validity of the procedure are described, including comparisons of the magnitude of forces determined by this acoustic procedure with direct measurements made with a force dynamometer in a water tunnel.
DTIC
Underwater Acoustics; Propellers; Marine Propulsion; Wind Tunnel Tests

20030032411 NASA Langley Research Center, Hampton, VA, USA
An Aeroacoustic Study of a Leading Edge Slat Configuration
Mendoza, J. M.; Brooks, T. F.; Humphreys, W. M., Jr., Multi-; Aeroacoustics; 2002; Volume 1, No. 3, pp. 241-274; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Aeroacoustic evaluations of high-lift devices have been carried out in the Quiet Flow Facility of the NASA Langley Research Center. The present paper describes detailed flow and acoustic measurements that have been made in order to better

understand the noise generated from airflow over a wing leading edge slat configuration, and to possibly predict and reduce this noise source. The acoustic database is obtained by a moveable Small Aperture Directional Array of microphones designed to electronically steer to different portions of models under study. The slat is shown to be a uniform distributed noise source. The data was processed such that spectra and directivity were determined with respect to a one-foot span of slat. The spectra are normalized in various fashions to demonstrate slat noise character. In order to equate portions of the spectra to different slat noise components, trailing edge noise predictions using measured slat boundary layer parameters as inputs are compared to the measured slat noise spectra.
Author
Aeroacoustics; Leading Edge Slats; Aerodynamic Configurations; Scale Models; Flow Distribution

20030032519 NASA Langley Research Center, Hampton, VA, USA
Some Effects of Nose Bluntness and Fineness Ratio on the Static Longitudinal Aerodynamic Characteristics of Bodies of Revolution at Subsonic Speeds
Hayes, William C., Jr.; Henderson, William P.; February 1961; 68 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA-TN-D-650; No Copyright; Avail: CASI; A04, Hardcopy
. The effects of a systematic variation of nose shape and fineness ratio on the longitudinal aerodynamic characteristics of bodies of revolution have been qualitatively determined at subsonic speeds. Six nose shapes were investigated, representing five corner radii which varied from 0 to 50 percent of the body diameter and three face radii which varied from 50 percent of the model diameter to infinity. The complete models had fineness ratios of 0.50 to 2.00. In addition, effects of boattailing the afterbody and removing or varying the transitions trips which had been attached to initiate a turbulent boundary layer were noted. Results are presented for an angle-of-attack range from -4 deg to 24 deg for Mach numbers from 0.25 to 0.80, and indicate that small variations of the model nose can produce large variations in the static longitudinal aerodynamic characteristics of the body. These variations may in turn be moderated by an increase in the model fineness ratio .
Author
Bodies Of Revolution; Fineness Ratio; Static Aerodynamic Characteristics; Subsonic Speed; Turbulent Boundary Layer; Noise (Sound)

20030032530 Florida Atlantic Univ., Boca Raton, FL, USA
Noise Generation by Fans With Supersonic Tip Speeds
Glegg, Stewart; Envia, Edmane, Technical Monitor; March 2003; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG3-2702; WBS-22-708-87-23
Report No.(s): NASA/CR-2003-212098; NAS 1.15:212098; E-13751; No Copyright; Avail: CASI; A03, Hardcopy
Fan noise continues to be a significant issue for commercial aircraft engines and there still exists a requirement for improved understanding of the fundamental issues associated with fan noise source mechanisms. At the present time, most of the prediction methods identify the dominant acoustic sources to be associated with the stator vanes or blade trailing edges which are downstream of the fan face. However recent studies have shown that acoustic waves are significantly attenuated as they propagate upstream through a rotor, and if the appropriate corrections are applied, sound radiation from the engine inlet is significantly underpredicted. The prediction models can only be applied to fans with subsonic tip speeds. In contrast, most aircraft engines have fan tip speeds which are transonic and this implies an even higher attenuation for upstream propagating acoustic waves. Consequently understanding how sound propagates upstream through the fan is an important, and not well understood phenomena. The objective of this study is to provide improved insight into the upstream propagation effects through a rotor which are relevant to full scale engines. The focus of this study is on broadband fan noise generated by boundary layer turbulence interacting with the trailing edges of the fan blades. If this source mechanism is important upstream of the fan, the sound must propagate upstream through a transonic non uniform flow which includes large gradients and non linearities. Developing acoustic propagation models in this type of flow is challenging and currently limited to low frequency applications, where the frequency is of the same order as the blade passing frequency of the fan. For trailing edge noise, much higher frequencies are relevant and so a suitable approach needs to be developed, which is not limited by an unacceptably large computational effort. In this study we are in the process of developing a computational method which applies for the high frequencies of interest, and allows for any type of flow field associated with the fan. In this progress report the approach to be used and the basic equations will be presented. Some initial results will be given, but these are preliminary and need further verification.
Author
Noise Generators; Turbofans; Sound Waves; Stator Blades; Acoustic Propagation; Aerodynamic Noise

20030032920 Army Research Lab., Adelphi, MD

Detection and Localization with an Acoustic Array on a Small Robotic Platform in Urban Environments

Young, Stuart H.; Scanlon, Michael V.; Jan. 2003; 18 pp.; In English

Report No.(s): AD-A410432; ARL-TR-2575; No Copyright; Avail: CASI; A03, Hardcopy

Sophisticated robotic platforms with diverse sensor suites are quickly replacing the eyes and ears of soldiers on the complex battlefield. The U.S. Army Research Laboratory (ARL) in Adelphi, Maryland, has developed a robot-based acoustic detection system that will detect an impulsive noise event, such as a sniper's weapon firing or a door slamming, and will activate a pan tilt to orient a visible and infrared camera toward the detected sound. Once the cameras are cued to the target, on-board image processing can then track the target and/ or transmit the imagery to a remote operator for navigation, situational awareness, and target detection. Such a vehicle can provide reconnaissance, surveillance, and target acquisition for soldiers, law enforcement, and rescue personnel and can remove these people from hazardous environments. ARL's primary robotic platforms contain 16-inch diameter, eight-element acoustic arrays. Additionally, a 9-inch array is being developed in support of the Defense Advanced Research Project Agency tactical mobile robot program. The robots have been tested in both urban and open terrain. The current acoustic processing algorithm has been optimized to detect the muzzle blast from a sniper's weapon and to reject many interfering noise sources such as wind gusts, generators, and self-noise.

DTIC

Image Processing; Target Acquisition; Armed Forces (United States); Guns (Ordnance); Sound Detecting And Ranging

20030032961 Woods Hole Oceanographic Inst., MA

Horizontal Linear Array Sensor Localization and Preliminary Coherence Measurements from the 2001 ASIAEX South China Sea Experiment

Schroeder, Theodore H.; Sep. 2002; 106 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-95-1-005 1

Report No.(s): AD-A410435; No Copyright; Avail: CASI; A06, Hardcopy

This thesis examines data collected in the South China Sea (SCS) component of the 2001 Asian Seas International Acoustic Experiment (ASIAEX), where a fixed Horizontal Linear Array (HLA) was deployed to study transverse array coherence in a coastal environment. Arrays obtain their gain and directivity by coherently adding the energy that impinges on them. Therefore, to maximize the efficiency of an array, the size of the aperture over which the signal remains coherent needs to be determined. Scattering of sound by the ocean environment, especially in coastal areas, reduces the coherence of acoustic signals, and thereby limits the useful aperture of an acoustic array. During ASIAEX, a horizontal linear array was deployed on the continental shelf of the South China Sea in order to directly measure the acoustic coherence in a coastal environment. 224 Hz and 400 Hz sources were placed on the continental slope to provide an up slope propagation path and a 400 Hz source was placed on the shelf to provide an along shelf propagation path. This thesis analyzes one day of transmissions from these three sources and gives the first look at coherence lengths of the HLA determined by sensor-to-sensor correlations. To achieve this, the thesis analyzes continuous time series data from the Long Base Line (LBL) navigation system and two days of light bulb drops to provide array sensor localization. Accurate sensor positions are needed to determine the correlation versus sensor separation distance and ultimately the array coherence length.

DTIC

Oceanography; Sound Waves; Linear Arrays; Acoustic Frequencies

20030032984 Drexel Univ., Philadelphia, PA

Progress in Cancer Diagnosis With Ultrasound

Reid, J. M.; Goldberg, B. B.; Shankar, P. M.; Forsberg, F.; Bilgutay, N.; Oct 2001; 4 pp.; In English

Report No.(s): AD-A410486; No Copyright; Avail: CASI; A01, Hardcopy

Despite successes in using ultrasound to characterize tissues at many sites in the body, the diagnosis of cancer, especially in the female breast, has remained challenging. Besides devising methods to analyze the data, there are difficulties with collecting data from enough patients to validate a variety of new methods, and in coping with changes in the hardware. We have been conducting an integrated effort for nine years that has minimized these difficulties and is approaching success.

DTIC

Cancer; Mammary Glands; Ultrasonics; Diagnosis

20030032991 NASA Kennedy Space Center, Cocoa Beach, FL, USA

On the Propagation of Plane Acoustic Waves in a Duct With Flexible and Impedance Walls

Frendi, Abdelkader; Vu, Bruce; March 2003; 28 pp.; In English; Original contains color illustrations

Report No.(s): NASA/TM-2003-211185; NAS 1.15:211185; Copyright; Avail: CASI; A03, Hardcopy

This Technical Memorandum (TM) discusses the harmonic and random plane acoustic waves propagating from inside a duct to its surroundings. Various duct surfaces are considered, such as rigid, flexible, and impedance. In addition, the effects of a mean flow are studied when the duct alone is considered. Results show a significant reduction in overall sound pressure levels downstream of the impedance wall for both mean flow and no mean flow cases and for a narrow duct. When a wider duct is used, the overall sound pressure level (OSPL) reduction downstream of the impedance wall is much smaller. In the far field, the directivity is such that the overall sound pressure level is reduced by about 5 decibels (dB) on the side of the impedance wall. When a flexible surface is used, the far field directivity becomes asymmetric with an increase in the OSPL on the side of the flexible surface of about 7 dB.
Author
Ducts; Sound Propagation; Plane Waves; Sound Waves; Acoustic Properties; Boundary Conditions; Mathematical Models; Wall Flow; Surface Properties

20030033069 Defence Research and Development Canada, Ottawa, Ontario, Canada
Advanced Beamformers for 3D Ultrasound Systems Deploying Linear and Planar Phased Array Probes
Stergiopoulos, Stergios; Dhanantwari, Amar; May 2002; 116 pp.; In English
Report No.(s): AD-A410555; DRDC-TR-2002-058; No Copyright; Avail: CASI; A06, Hardcopy

The present report outlines the development of an advanced digital ultrasound imaging technology leading to a next-generation field-portable 4D diagnostic imaging system. The proposed technology consists of: Adaptive beamforming algorithms to provide high image-resolution for ultrasound diagnostic systems; 3D visualization imaging techniques to assist imaging during field-deployable minimally invasive operations; time-reversal pulse design for ultrasound signals to eliminate aberration effects, which cause fuzziness in reconstructed ultrasound images; and investigations on computing architectures and planar ultrasound sensor arrays allowing system integration of the proposed technologies as a compact- portable system for field-deployable operations.
DTIC
Ultrasonics; Beamforming; Adaptive Control

20030033868 Norwegian Univ. of Science and Technology, Trondheim, Norway
Proceedings of the 24th Scandinavian Symposium on Physical Acoustics
Kristiansen, Ulf R.; Jun. 2001; 125 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-0-1007
Report No.(s): AD-A410354; No Copyright; Avail: CASI; A06, Hardcopy

The 24th Scandinavian Symposium on Physical Acoustics was held at Ustaoset, Norway, 28-31 January 2001. The proceedings contains 18 of 27 presented papers. They cover a wide range of topics: underwater acoustics, new solutions to sound propagation problems, interaction of sound and porous media, non-linear acoustics, transducer technology and applications of ultrasound in industry.
DTIC
Acoustics; Conferences; Technology Utilization; Scandinavia

20030034598 Sanders Lockheed Martin Co., Nashua, NH, USA
Long Range Acoustic Classification
Thammakhoune, Ned B.; Lang, Stephen W.; Sep. 1999; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAL-01-96-2-0001
Report No.(s): AD-A410529; No Copyright; Avail: CASI; A02, Hardcopy

This paper introduces the use of dynamic features for robust target recognition of ground vehicles. Most current approaches rely on instantaneous spectral features such as those derived from harmonically related spectral lines. Significant drawback of these approaches are that the use of low amplitude (10-20dB below dominant line) spectral lines severely limit classification range. The strongest line is often detectable well before secondary lines. Dynamic features extracted directly from the strongest spectral line if successfully characterizing the target will extend the range of operation to several times. In this report a complete experimental evaluation of the effectiveness of dynamic features is conducted. The analysis is performed using a database consisting of approximately two hundred acoustic signatures collected from six unique vehicles. A number of features captured from the dynamic characteristic of the spectral line are evaluated. Classification performance is measured and presented in terms of confusion matrices. As an additional test of the classifier development tools developed for this task we selected added instantaneous spectral measurements to the dynamic feature and re-tested. We found that the performance

of the classifiers using the mixed spectral and dynamic features was excellent but 'blind' testing of the classifiers that were developed (testing against vehicle runs that were not used during classifier development) showed disappointing results.
DTIC

20030034608 ASRC Aerospace Corp., Greenbelt, MD, USA
On the Scaling Laws for Jet Noise in Subsonic and Supersonic Flow
Vu, Bruce; Kandula, Max; [2003]; 18 pp.; In English; 9th AIAA/CEAS Aeroacoustics Conference and Exhibit, 12-14 May 2003, Hilton Head, SC, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS10-03006
Report No.(s): KSC-2003-040; Copyright; Avail: CASI; A03, Hardcopy

The scaling laws for the simulation of noise from subsonic and ideally expanded supersonic jets are examined with regard to their applicability to deduce full scale conditions from small-scale model testing. Important parameters of scale model testing for the simulation of jet noise are identified, and the methods of estimating full-scale noise levels from simulated scale model data are addressed. The limitations of cold-jet data in estimating high-temperature supersonic jet noise levels are discussed. It is shown that the jet Mach number (jet exit velocity/sound speed at jet exit) is a more general and convenient parameter for noise scaling purposes than the ratio of jet exit velocity to ambient speed of sound. A similarity spectrum is also proposed, which accounts for jet Mach number, angle to the jet axis, and jet density ratio. The proposed spectrum reduces nearly to the well-known similarity spectra proposed by Tam for the large-scale and the fine-scale turbulence noise in the appropriate limit.
Author
Scaling Laws; Jet Aircraft Noise; Computerized Simulation; Supersonic Jet Flow; Subsonic Flow; Scale Models; Data Processing; Acoustic Velocity; Parameter Identification

20030034660 Bogazici Univ., Istanbul, Turkey
A Wavelet-Based Instrument for Detection of Crackles in Pulmonary Sounds
Kahya, Yasemin P.; Yerer, Serkan; Cerid, Omer; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410473; No Copyright; Avail: CASI; A01, Hardcopy

Crackles are discontinuous adventitious respiratory sounds, which are considered as signs of various pulmonary, disorders, therefore their detection is important in the analysis of lung sounds. In this work, an instrument for separating crackles from stationary, lung sounds and quantifying their characteristics is realized with DSP. The detection algorithm is based on increasing transient to background ratio by adaptive filtering and implementing nonlinear operators to wavelet based decomposed lung sounds.
DTIC
Lungs; Detection; Algorithms

20030034690 Naval Undersea Warfare Center, Newport, RI
Sonar Tracking Array
Griffin, Maurice J., Inventor; Aug 2002; 14 pp.; In English
Patent Info.: Filed: 6 Aug. 2002; US-Patent-Appl-SN-10214485
Report No.(s): AD-D020052; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC))

A sonar array comprising a support structure, an acoustic 7 projector attached to the support structure, and a plurality of 8 directional hydrophones attached to the support structure and 9 arranged so as to surround the acoustic projector. The 10 directional hydrophones are spaced about the acoustic projector. In one embodiment, the array includes means attached to the 12 support structure that allows the support structure to be 13 connected to a device that effects coarse steering of the sonar 14 array.
DTIC
Sonar; Sound Generators; Hydrophones; Directional Antennas

20030034828 Naval Undersea Warfare Center, Newport, RI
Speech to Touch Translator Assembly and Method
Dec 2002; 17 pp.; In English; US-Patent-Appl-SN-10/224230
Report No.(s): AD-D020049; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC))

A speech to touch translator assembly and method for converting spoken words directed to an operator into tactile

sensations caused by combinations of pressure point exertions on the body of the operator, each combination of pressure points exerted signifying a phoneme of one of the spoken words, permitting comprehension of spoken words by persons that are deaf and blind.
DTIC
Auditory Defects; Speech; Sound Detecting And Ranging; Translating

20030034857 Institute TNO of Applied Physics, Delft, Netherlands
Flow Noise Mechanisms: Literature Survey and Model Implementation
vanLier, L. J.; December 18, 2002; 64 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): A00/KM/110; TNO Proj. V050
Report No.(s): DGT-RPT-020142; TD-0205; Copyright; Avail: Other Sources

Three flow noise mechanisms, relevant for surface ships have been identified in the literature and have been implemented in prediction models. 1) excitation and radiated of the hull by flow 2) radiation of oscillating bubble clouds 3) direct radiation of bubbles excited by turbulence. The last mechanism also affects significantly the spectrum of wall pressure fluctuations, the excitation for the first mechanism. All mechanisms are very sensitive to input parameters, related to the flow (turbulence intensity, turbulent length scales, void fractions). Different sources of information on these input parameters available in the literature are not always consistent. However, the models can be used to obtain order of magnitude estimates of flow noise levels. Furthermore the models can be used to interpret results from future scale model experiments to construct scale rules for extrapolation to full-scale results.
Author
Flow Noise; Mathematical Models; Noise Intensity; Ships; Underwater Acoustics; Turbulent Boundary Layer

20030034905 Naval Undersea Warfare Center, Newport, RI
Track Quality Indicator with Hysteresis
Lane, Walter R., Inventor; January 08, 2003; 22 pp.; In English
Patent Info.: Filed: 24 Oct. 2002; US-Patent-Appl-SN-10241389
Report No.(s): AD-D020051; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC))

A first object of the present invention is providing a method for indicating the quality of tracks in a passive sonar system. Another object of the invention is providing such a method that is not overly sensitive to track status changes. Accordingly, the present invention is directed to a method and apparatus for calculating a track quality indicator from a plurality of tracker amplitude estimates. In one embodiment, the method utilizes the track quality indicator at the previous time increment. The track quality indicator is assigned as a lost track based on a first lost track threshold if the track quality indicator at the previous time increment indicated a lost track and based on a second lost track threshold if the track quality indicator at the previous time increment indicated a different status. The track quality indicator is assigned as an uncertain track based on a first uncertain track threshold if the track quality indicator at the previous time increment indicated a lost track or an uncertain track and based on a second uncertain track threshold if the track quality indicator at the previous time increment indicated a different status. The track quality indicator is assigned as a low signal to& noise ratio (SNR) track based on a first low SNR track threshold if the track quality indicator at the previous time increment indicated a strong track and based on a second low SNR track threshold if the track quality indicator at the previous time increment indicated a different status. The track quality indicator is assigned as a strong track if another track quality indicator is not assigned. The method continues to the next time increment after the track quality indicator is assigned.
DTIC
Patent Applications; Tracking (Position); Sonar; Target Recognition

20030038810 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft, Netherlands
Design Study of an Acoustic Array for Measuring Surface Ship Flow Noise in the MARIN Depressurized Towing Tank
Mast, A.; Thean, A.; deJong, C. A. F.; December 2002; 32 pp.; In English; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A02/KM/168; TNO Proj. 008.03459
Report No.(s): TD-0234; DGT-RPT-020145; Copyright; Avail: Other Sources

As a preparation for an US/NL collaborative research program into the contribution of flow noise to the underwater acoustic signature of surface ships, it is investigated whether acoustic scale model tests can be carried out in the MARIN Depressurized Towing Tank. Due to the many reflections at water surface, bottom and sidewalls, the environment is difficult for acoustic measurements. With the array techniques that are proposed in this report, it seems possible to identify noise

sources at the ship hull with a spatial resolution of 1 m at frequencies above 10 kHz (at model scale) against other sources that are at maximum 15 dB stronger. Due to the influence of reflections, the error in the source strength estimation varies between -6 and +6 dB.
Author
Underwater Acoustics; Acoustic Measurement; Ships; Flow Noise; Arrays

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*.

20030032290 NASA Goddard Space Flight Center, Greenbelt, MD, USA
D-wave Resonances in Positronium Hydride
DiRienzi, Joseph; Drackman, Richard J.; Rabin, Douglas, Technical Monitor; [2002]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

In a previous paper [Phys. Rev. A 65, 032721 (2002)] we re-examined a model describing the structure of the low-energy Ps-H resonances as being due to quasi-bound states of the positron in the perturbed Coulomb potential of the H-ion appearing in the closed, rearranged channel. In particular, we wished to understand why the lowest p-state resonance was so far away from the lowest quasi-bound (2p) state. We found that the lowest resonance actually corresponds to the first excited [3p] state, while the lowest state is not recognizable as a resonance. In the present work we repeat our analysis, but this time for the lowest d state. We find that the lowest [3d] state does correspond to a resonance shifted moderately.
Author
Coulomb Potential; Hydrides; Positronium; Resonance; Approximation; Wave Scattering

20030032443 NASA Ames Research Center, Moffett Field, CA, USA
Conductance of Dry DNA: Role of Environment
Anantram, M. P.; Adessi, Ch.; S. Walch; February 12, 2003; 3 pp.; In English; APS Meeting, 2-7 Mar. 2003, Austin, TX, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; Copyright; Avail: CASI; A01, Hardcopy

This paper presents viewgraphs on the conductance of dry DNA and its effect on the surrounding environment. The topics include: 1) Approach; 2) Influence of Counter Ions; 3) Conductance Versus DNA Length; 4) Intrinsic Resonant Tunneling in Engineered DNA Sequence; and 5) Transmission Versus Energy.
CASI
Deoxyribonucleic Acid; Resistance; Drying; Molecular Biology

20030032466 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mass Polarization Effect in He-like Ions: First and Second Order
Bhatia, A. K.; Drachman, Richard J.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

In a paper with a similar title Yamanaka has calculated the mass polarization effect (to first order in mu/M for several low-lying states of the two-electron atoms and ions with atomic number Z from 2 to 10. Here we improve the previous results by using Hylleraas variational wave functions with up to 560 terms and extend the calculation to include some additional states and the Z=1ground state. In addition, we compute the second-order effect using the method of pseudostate summation. In one appendix another method of computation is discussed and used as a check, while the energies of the Z=1 ions are presented and discussed in a second appendix.
Author
Ions; Polarization

20030033094 Cornell Univ., Ithaca, NY, USA
Studies of Atomic Free Radicals Stored in a Cryogenic Environment
Lee, David M.; Hubbard, Dorthy, Technical Monitor; Alexander, Glen, Technical Monitor; April 30, 2003; 32 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG8-1445; No Copyright; Avail: CASI; A03, Hardcopy

Impurity-Helium Solids are porous gel-like solids consisting of impurity atoms and molecules surrounded by thin layers

of solid helium. They provide an ideal medium for matrix isolation of free radicals to prevent recombination and store chemical energy. In this work electron spin resonance, nuclear magnetic resonance, X-ray diffraction, and ultrasound techniques have all been employed to study the properties of these substances. Detailed studies via electron spin resonance of exchange tunneling chemical reactions involving hydrogen and deuterium molecular and atomic impurities in these solids have been performed and compared with theory. Concentrations of hydrogen approaching the quantum solid criterion have been produced. Structured studies involving X ray diffraction, ultrasound, and electron spin resonance have shown that the impurities in impurity helium solids are predominantly contained in impurity clusters, with each cluster being surrounded by thin layers of solid helium.
Author
Free Radicals; Cryogenic Temperature; Helium; Impurities; Solid Cryogens

20030034627 Air Force Research Lab., Edwards AFB, CA, USA
DoD High Performance Computing Challenge Project
Gordon, Mark S.; Voth, Gregory; Pachter, Ruth; Boatz, Jerry; Jun. 1999; 20 pp.; In English
Contract(s)/Grant(s): AF Proj. 2302
Report No.(s): AD-A410258; AFRL-PR-ED-TP-FY99-0108; No Copyright; Avail: CASI; A03, Hardcopy

Project overview: atom-doped solid hydrogen and high energy density molecules as advanced rocket propellants; explosive annulenes as possible route to new nanostructural materials; theoretical methods, benchmarks which include centroid molecular dynamics and ab injitio electronic structure theory and results and future directions.
DTIC
Molecular Dynamics; Electronic Structure; Doped Crystals

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*.

20030032528 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Antiprotons in CR: What Do They Tell Us?
Moskalenko, I. V.; Strong, A. W.; Mashnik, S. G.; Ormes, J. F.; March 27, 2003; 1 pp.; In English; 28th ICRC, 31 Jul. - 7 Aug. 2003, Japan; Copyright; Avail: Other Sources; Abstract Only

Recent measurements of the CR antiproton flux have been shown to pose a problem for conventional propagation models (Moskalenko et al. 2002). In particular, models consistent with secondary/primary nuclei ratio in CR produce too few antiprotons, while matching the ratio and the antiproton flux requires some artificial assumptions. This may indicate an additional local CR component or new phenomena in particle propagation in the Galaxy. We discuss several possibilities which may cause this problem.
Author
Antiprotons; Particle Theory; Galaxies; Nuclei (Nuclear Physics)

20030032980 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Antiproton Production by CR on Air Nuclei
Maskalenko, I. V.; Mashnik, S. G.; March 27, 2003; 1 pp.; In English; 28th ICRC Meeting, 31 Jul. - 7 Aug. 2003, Japan; No Copyright; Avail: Other Sources; Abstract Only

Recent measurements of the cosmic ray (CR) antiproton flux have been shown to challenge existing CR propagation models. In particular, the conventional reacceleration model designed to match secondary/primary nuclei ratios produces too few antiprotons. Recently there appear some indications that the atmospheric contribution to antiproton production is considerably underestimated, which implies that antiproton CR flux might be lower. This may be the primary reason of the discrepancy discovered in CR propagation. We use the Los Alamos version of the Quark-Gluon String Model code LAQGSM together with available data on antiproton production on nuclei to analyse the accuracy of existing parameterizations of

antiproton production cross section. The LAQGSM model has been shown to reproduce well nuclear reactions and hadronic data in the range 0.01-800 GeV/nucleon.
Author
Nuclear Reactions; Cosmic Rays; Antiprotons; Particle Interactions; Mathematical Models; Astronomical Models

20030033899 Aristotle Univ. of Thessaloniki, Greece
Pulse Shaping for Localized Magnetic Resonance Tagging
Ikonomidou, V. N.; Sergiadis, G. D.; October 25, 2001; 5 pp.; In English
Report No.(s): AD-A410475; No Copyright; Avail: CASI; A01, Hardcopy

Magnetic resonance tagging is usually achieved by means of a train of non-selective radio-frequency pulses separated by gradient pulses. Thus, the modulation of the M(sub z) magnetization component expands all over the imaging plane. It has been proposed that the use of selective excitation pulses may limit the modulation only to regions of interest, thus preserving anatomical data in the rest of the image. In this paper, we intend to expand the tagging k-space concept in order to account for pulse selectivity, and offer a prediction and design tool for localized MR tagging sequences.
DTIC
Magnetic Resonance; Pulses

20030033936 Lawrence Livermore National Lab., Livermore, CA
Electron, Photon, and Ion Beams from the Relativistic Interaction of Petawatt Laser Pulses with Solid Targets
Hatchett, S. P.; Brown, C. G.; Cowan, T. E.; Henry, E. A.; Johnson, J.; Nov. 12, 1999; In English
Report No.(s): DE2002-790963; UCRL-JC-135029; No Copyright; Avail: National Technical Information Service (NTIS)

We have studied, in some detail, the x-ray emission from solid, thick (approximately 1 mm) Au targets illuminated by the Petawatt laser. We report here on the characteristics of the bremsstrahlung and what it reveals about the hot electron flow within the target. In the process of attempting to observe relativistic (hereafter hot) electron emission from solid, thin (50-125 micrometer) Au and plastic (CH) targets we discovered extraordinarily luminous beams of ions from the backs of these targets. We discuss below the characteristics of the ion beams and our ideas on the mechanism generating them.
NTIS
Bremsstrahlung; Ion Beams; Pulsed Lasers; Targets

20030034687 Duke Univ., Durham, NC, USA
Evaluation of a Recoil-Escape Fiber Target Using 94Mo(p,n)94mTc to Produce 94TcO4- Precursor for Radiolabeled Compounds Useful in Positron Emission Tomography
Illan, C. D.; Wieland, B. W.; Oct 2001; 5 pp.; In English
Report No.(s): AD-A410506; No Copyright; Avail: CASI; A01, Hardcopy

A variety of compounds radiolabeled with 99mTc(140 keV gamma T(sub 1/2)=6 hours) are widely used in nuclear medicine imaging. These compounds can also be radiolabeled using positron-emitting precursor 94mTcO4 (T(sub 1/2)=53 minutes) and used with Positron Emission Tomography (PET) to measure tissue concentrations in mu Ci/cm3, and produce kinetic data useful to understand the mechanism of drug action. This work-in-progress evaluates a novel accelerator target for producing 94mTc. Positron emitters have been produced with fiber targets, using the principle of recoil escape in which the target atoms are in a solid form, while recovering the product radionuclide ion by stopping it in a liquid or a gas. The recoil ion is transported out of the target, leaving the remaining target material to be used repeatedly in subsequent production runs. Our proposed target is based on this method.
DTIC
Technetium; Positrons; Tomography

20030036907 Lawrence Livermore National Lab., Livermore, CA
Target Design Activities for Inertial Fusion Energy at Lawrence Livermore Laboratory
Tabak, M.; Callahan-Miller, D.; Herrmann, M.; Hatchett, S.; Lindl, J. D.; Sep. 19, 2000; 16 pp.; In English
Report No.(s): DE2002-792755; UCRL-ID-137692; No Copyright; Avail: Department of Energy Information Bridge

We studied a variety of targets to be driven by ion beams or lasers in the past year. In order to relax target fabrication requirements, expand the allowed beam phase space volume and meet some radiological safety requirements, we continued to extend the set of the distributed radiator target designs for heavy ion beams. The hydrodynamic stability of a high gain directly driven laser target recently proposed at the Naval Research Laboratory has been studied. Because target chambers are

sensitive to the x-ray spectrum as well as the composition and energy of the capsule debris we also present these for this target. A novel implosion scheme for the Fast Igniter fusion scenario that minimizes the amount of coronal plasma that the igniting laser beam must penetrate is described. We describe recently derived scaling laws that relate the minimum value of the incoming fuel kinetic energy to the peak drive pressure, the fuel adiabat and the implosion velocity for capsules that use the kinetic energy of the implosion to heat the hot spot to ignition temperatures.
NTIS
Laboratories; Plasmas (Physics); Inertial Fusion (Reactor); Targets

20030037033 Lawrence Livermore National Lab., Livermore, CA
Spherical Harmonic Solutions to the 3D Kobayashi Benchmark Suite
Brown, P. N.; Chang, B.; Hanebutte, U. R.; Dec. 29, 1999; In English
Report No.(s): DE2002-791668; UCRL-JC-135163; No Copyright; Avail: National Technical Information Service (NTIS)

Spherical harmonic solutions of order 5, 9 and 21 on spatial grids containing up to 3.3 million cells are presented for the Kobayashi benchmark suite. This suite of three problems with simple geometry of pure absorber with large void region was proposed by Professor Kobayashi at an OECD/NEA meeting in 1996. Each of the three problems contains a source, a void and a shield region. Problem 1 can best be described as a box in a box problem, where a source region is surrounded by a square void region which itself is embedded in a square shield region. Problems 2 and 3 represent a shield with a void duct. Problem 2 having a straight and problem 3 a dog leg shaped duct. A pure absorber and a 50\% scattering case are considered for each of the three problems. The solutions have been obtained with Ardra, a scalable, parallel neutron transport code developed at Lawrence Livermore National Laboratory (LLNL). The Ardra code takes advantage of a two-level parallelization strategy, which combines message passing between processing nodes and thread based parallelism amongst processors on each node. All calculations were performed on the IBM ASCI Blue-Pacific computer at LLNL.
NTIS
Reactor Physics; Spherical Harmonics; Standards

20030037091 Lawrence Livermore National Lab., Livermore, CA
LLNL Accelerator Mass Spectrometry System for Biochemical (14)C-Measurements
Ognibene, T. J.; Bench, G.; Brown, T. A.; Vogel, J. S.; Oct. 31, 2002; 20 pp.
Report No.(s): DE2002-15001999; No Copyright; Avail: Department of Energy Information Bridge

We report on recent improvements made to our 1 MV accelerator mass spectrometry system that is dedicated to (14)C quantification of biochemical samples. Increased vacuum pumping capacity near the high voltage terminal has resulted in a 2-fold reduction of system backgrounds to 0.04 amol (14)C/mg carbon. Carbon ion transmission through the accelerator has also improved a few percent. We have also developed tritium measurement capability on this spectrometer.
NTIS
Particle Accelerators; Biochemistry; Mass Spectroscopy

20030037105 Lawrence Livermore National Lab., Livermore, CA
High Intensity Laser Interactions with Atomic Clusters
Ditmire, T.; Aug. 07, 2000; 10 pp.
Report No.(s): DE2002-15001992; No Copyright; Avail: Department of Energy Information Bridge

The development of ultrashort pulse table top lasers with peak pulse powers in excess of 1 TW has permitted an access to studies of matter subject to unprecedented light intensities. Such interactions have accessed exotic regimes of multiphoton atomic and high energy-density plasma physics. Very recently, the nature of the interactions between these very high intensity laser pulses and atomic clusters of a few hundred to a few thousand atoms has come under study. Such studies have found some rather unexpected results, including the striking finding that these interactions appear to be more energetic than interactions with either single atoms or solid density plasmas. Recent experiments have shown that the explosion of such clusters upon intense irradiation can expel ions from the cluster with energies from a few keV to nearly 1 MeV. This phenomenon has recently been exploited to produce DD fusion neutrons in a gas of exploding deuterium clusters. Under this project, we have undertaken a general study of the intense femtosecond laser cluster interaction. Our goal is to understand the macroscopic and microscopic coupling between the laser and the clusters with the aim of optimizing high flux fusion neutron production from the exploding deuterium clusters or the x-ray yield in the hot plasmas that are produced in this interaction. In particular, we are studying the physics governing the cluster explosions. The interplay between a traditional Coulomb explosion description of the cluster disassembly and a plasma-like hydrodynamic explosion is not entirely understood,

particularly for small to medium sized clusters (approx. 1000 atoms) and clusters composed of low-Z atoms. We are focusing on experimental studies of the ion and electron energies resulting from such explosions through various experimental techniques. We are also examining how an intense laser pulse propagates through a dense medium containing these clusters.
NTIS
High Power Lasers; Atomic Clusters; Pulsed Lasers

20030037127 Lawrence Livermore National Lab., Livermore, CA
National Ignition Facility: Status and Plans for the Experimental Program
Moses, E. I.; Nov. 12, 2002; 14 pp.
Report No.(s): DE2002-15002000; No Copyright; Avail: Department of Energy Information Bridge

The National Ignition Facility (NIF), currently under construction at the University of California's Lawrence Livermore National Laboratory, is a stadium-sized facility containing a 192-beam, 1.8-Megajoule, 500-Terawatt, 351-nm laser system and a 10-meter diameter target chamber with room for nearly 100 experimental diagnostics. NIF is being built by the National Nuclear Security Administration and when completed will be the world's largest laser experimental system, providing a national center to study inertial confinement fusion and the physics of matter at extreme energy densities and pressures. NIF's 192 energetic laser beams will compress fusion targets to conditions where they will ignite and burn, liberating more energy than required to initiate the fusion reactions. NIF experiments will allow the study of physical processes at temperatures approaching 100 million K and 100 billion times atmospheric pressure. These conditions exist naturally only in the interior of stars and in nuclear weapons explosions. In the course of designing the world's most energetic laser system, a number of significant technology breakthroughs have been achieved. NIF is now entering the first phases of its laser commissioning program. Low-energy preamplifier rod laser shots have been successfully propagated through the entire laser chain. Higher energy shots are planned through the end of 2002. NIF's target experimental systems are also being installed in preparation for laser performance and experimental capability commissioning starting in 2003.
NTIS
Ignition; Laser Beams; Research Facilities; Nuclear Research And Test Reactors

20030038811 Lawrence Livermore National Lab., Livermore, CA
Building a LLNL Capability in Radioactive Ion Beam Experiments
Bernstein, L. A.; Becker, J. A.; Garrett, P. E.; Younes, W.; Schiller, A.; Jan. 31, 2002; 22 pp.
Report No.(s): DE2002-15002231; UCRL-ID-147178; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this LDRD was to establish a program at LLNL in radioactive ion beam (RIB) experiments that would use these experiments to address a wide range physics issues in both stellar nucleosynthesis and stockpile stewardship radiochemistry. The LDRD was funded for a total of two years (fiscal years 2000 and 2001) and transferred to the Physical Data Research Program in fiscal year 2002. Reactions on unstable nuclei and isomeric states play a central role in the formation of elements in both stars and nuclear devices. However, the abilities of reaction models to predict cross sections on radioactive nuclei are uncertain at best. This can be attributed to the lack of experimental data to guide reaction-modeling efforts. Only the 10\% of all bound nuclei that can be formed with stable targets and beams have been accessed and studied. The proposed Rare Isotope Accelerator (RIA) and existing RIB facilities offer an unprecedented opportunity to address many of the outstanding questions in nuclear structure, reactions and astrophysics by enabling the observation of nuclear reactions with radioactive targets and/or beams.
NTIS
Ion Beams; Nuclear Structure; Radiochemistry; Particle Accelerators

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*.

20030032291 NASA Goddard Space Flight Center, Greenbelt, MD, USA
JASON-1 Precise Orbit Determination (POD)with SLR and DORIS Tracking
Zelensky, N. P.; Luthcke, S. B.; Rowlands, D. D.; Beckley, B. D.; Lemoine, Frank G.; Wang, Y. M.; Chinn, D. S.; Williams, T. A.; [2002]; 1 pp.; In English; Jason-1/TOPEX/Poseidon Science Working Team Meeting, 21-23 Oct. 2002, New Orleans, LA, USA; Copyright; Avail: Other Sources; Abstract Only

Jason-1, the TOPEX/POSEIDON (T/P) radar altimeter follow-on, is intended to continue measurement of the ocean surface with the same, if not better accuracy. T/P has demonstrated that, the time variation of ocean topography can be determined with an accuracy of a few centimeters, thanks to the availability of highly accurate orbits based on SLR and DORIS tracking. For verification and cross-calibration, Jason-1, was initially injected into the T/P orbit, flying just 72 seconds ahead of T/P. This configuration lasted over 21 Jason cycles. In mid-August T/P was maneuvered into its final tandem configuration, a parallel groundtrack, in order to improve the combined coverage. Preliminary investigations using cycles 1-9, shown at the June 2002 SWT, indicated that nominal Jason orbits can achieve the 2-3 cm accuracy objective, however several puzzling aspects of SLR and DORIS measurement modeling were also observed. This paper presents recent analysis of Jason SLR+DORIS POD spanning more than 20 cycles, and revisits several of the more puzzling issues, including estimation of the Laser Retroreflector Array (LRA) offset. The accuracy of the orbits and of the measurement modeling are evaluated using several tests, including SLR, DORIS, and altimeter crossover residual analysis, altimeter collinear analysis, and direct comparison with GPS and other orbits. T/P POD results over the same period are used as a reference.
Author
Topography; Oceans; Ocean Surface; Radio Altimeters

20030032385 Army Research Lab., White Sands Missile Range, NM, USA
Models for Saturable and Reverse Saturable Absorption in Materials for Optical Limiting
Pritchett, Timothy; Oct. 2002; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410148; ARL-TR-2567; No Copyright; Avail: CASI; A03, Hardcopy

The systems used to protect eyes and sensors from frequency-agile laser weapons must be capable, over a relatively broad range of frequencies, of absorbing, refracting, deflecting, or scattering laser radiation of high intensity, even while affording high transmission to light of low to moderate intensity. The design of such devices begins with an accurate characterization of the nonlinear optical response of the candidate active materials. In this work, the relevant material parameters can be extracted from experimentally obtained data only by indirect means: that is, the actual experimental results are compared to the results obtained from a theoretical model employing hypothetical values of the desired parameters, and the parameters of the model are varied until the model results match the experimental data. If this procedure is to work, the model must capture all the essential features of the interaction of the material to be characterized with the laser beam propagating through it. We review the assumptions and approximations underlying the commonly used models for nonlinear absorption, paying particular to the limits of applicability that these impose.
DTIC
Nonlinear Systems; Laser Weapons; Radiation Protection; Optical Properties; Laser Beams

20030032985 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Removing Fringes from STIS Slitless Spectra and WFC3 CCD Images
Malumuth, E. M.; Hill, R. S.; Gull, T.; Woodgate, B. E.; Bowers, C. W.; Kimble, R. A.; Lindler, D.; Hill, R. J.; Cheng, E. S.; Cottingham, D. A.; [2002]; 4 pp.; In English; Hubble Space Telescope Workshop, 17-18 Oct. 2002, Baltimore, MD, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

We have developed a model that allows us to defringe slitless 2-dimensional spectra taken with the Space Telescope Imaging Spectrograph (STIS). An IDL tool has been developed which allows the user to defringe any spectrum obtained with the G750L grating on STIS. This technique has been employed to model the fringing on Wide Field Camera 3 (WFC3) flight candidate CCDs.
Author
Imaging Techniques; Ccd Cameras; Spaceborne Telescopes; Interference; Diffraction Patterns; Spectrographs

20030033124 Vavilov State Optical Inst., Saint Petersburg, USSR
Development of Liquid Crystal Spatial Light Modulators for mid-IR radiation, Addressed by Visible Radiation
Venediktov, Vladimir Y.; Oct. 2002; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410722; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Research Institute for Laser Physics as follows: Recent years has shown fast progress in the development of the technique of compensation for distortions in laser and imaging optical systems working in the visible spectral range through the use of dynamic holographic recording in optically-addressed liquid crystal spatial light modulators. However, this has not been extended to the mid-IR due to the lack of photoconductors that are sensitive to radiation in this wavelength range. The goal of this project is to solve this problem with an approach that will result in the

photoconductive layer being transparent to the mid-IR radiation, and with the internal mirror that reflects the mid-IR radiation being sufficiently transparent to the visible light that the hologram can be recorded. Several elements of this type will be fabricated, tested and delivered. The spatial light modulator is to provide high diffraction efficiency for the recording of the dynamic grating, and to possibly record the phase gratings with the amplitude of the phase retardation of as much as 2 pi radians in the mid-IR spectral range.
DTIC
Liquid Crystals; Infrared Radiation; Light Modulators

20030033950 Naval Undersea Warfare Center, Newport, RI
Method for Coupling Fiber Optic Elements
Antonelli, Lynn T., Inventor; Dec 2002; 15 pp.; In English
Report No.(s): AD-D020050; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC))

A method for coupling fiber optic elements includes providing a hollow wax housing. A first fiber optic element is inserted in a first direction into the housing to position a free end thereof in the housing. A second fiber optic element is inserted into the housing from an opposite direction to position a free end of the second fiber optic element in the housing confronting the first fiber optic element free end. The housing is filled with optical grade epoxy resin which is permitted to cure, thereby to effect physical and optical connection between the first and second fiber optic elements. The free ends are in close proximity, or in the case of coupling from one strand to many, in enough of a spaced relation to cause needed light diffusion.
DTIC
Coupling; Optical Fibers

20030034718 INTELLITE ALBUQUERQUE NM
Micromachined Deformable Mirrors for Beam Control and Imaging Applications
Mansell,; Feb. 2002; 6 pp.; In English
Contract(s)/Grant(s): F49620-01-C-0060; AF Proj. STTR
Report No.(s): AD-A410687; AFRL-SR-AR-TR-03-0015; No Copyright; Avail: CASI; A02, Hardcopy

We have built and are testing Mini-Cassegrain deformable mirrors to produce prototype bench level system in the next few weeks. These mirrors were fabricated in our clean-room facility here in Albuquerque and differ from normal DMs by having a transparent faceplate membranes and perforations in the back plate to allow light to transmit through the membrane. These mirrors are being tested in the clean area of our office facility. Electronics for a driver/ controller are in final preparation. Parts to assemble a filly operational Mini-Cassegrain are now on-hand.
DTIC
Cassegrain Optics; Deformable Mirrors

20030034906 Lawrence Livermore National Lab., Livermore, CA
Monte Carlo Simulations of Arterial Imaging with Optical Coherence Tomography
Amendt, P.; Estabrook, K.; Everett, M.; London, R. A.; Maitland, D.; Feb. 01, 2000; 18 pp.; In English
Report No.(s): DE2002-790961; No Copyright; Avail: Department of Energy Information Bridge

The laser-tissue interaction code LATIS is used to analyze photon scattering histories representative of optical coherence tomography (OCT) experiments performed at Lawrence Livermore National Laboratory. Monte Carlo photonics with Henyey-Greenstein anisotropic scattering is implemented and used to simulate signal discrimination of intravascular structure. An analytic model is developed and nsed to obtain a scaling law relation for optimization of the OCT signal and to validate Monte Carlo photonics. The appropriateness of the Henyey-Greenstein phase function is studied by direct comparison with more detailed Mie scattering theory using an ensemble of spherical dielectric scatterers. Modest differences are found between the two prescriptions for describing photon angular scattering in tissue. In particular, the Mie scattering phase functions provide less overall reflectance signal but more signal contrast compared to the Henyey-Greenstein formulation.
NTIS
Coherence; Monte Carlo Method; Computer Aided Tomography; Optical Properties

20030036948 Helsinki Univ. of Technology, Espoo
Flow and Conductivity Properties of Comb-Shaped Self-Organized Supramolecules
Maeki-Ontto, R.; Nov. 23, 2001; 46 pp.
Report No.(s): PB2003-102632; Copyright; Avail: National Technical Information Service (NTIS)

Self-organization of polymers to achieve nanoscale structures has been widely studied. Examples of such systems are liquid crystalline polymers (1), block copolymers (2) and polymer-amphiphile complexes. They form nanostructures due to repulsive and attractive forces within the system. Probably the most common self-organized polymers are diblock copolymers, which consist of two polymer blocks A and B, which are covalently bonded to each other. Due to repulsive forces between them, the material microphase separates to form nanostructures such as spherical, cylindrical and lamellar structures .
NTIS
Flow Characteristics; Nanostructure Growth; Nanostructure (Characteristics); Block Copolymers

20030037005 Lawrence Livermore National Lab., Livermore, CA
Advanced Techniques for Fourier Transform Wavefront Reconstruction
Poyneer, L. A.; Aug. 05, 2002; 18 pp.; In English
Report No.(s): DE2002-15002381; UCRL-JC-149568; No Copyright; Avail: Department of Energy Information Bridge
The performance of Fourier transform (FT) reconstructors in large adaptive optics systems with Shack-Hartmann sensors and a deformable mirror is analyzed. FT methods, which are derived for point-based geometries, are adapted for use on the continuous systems. Analysis and simulation show how to compensate for effects such as misalignment of the deformable mirror and wavefront sensor gain. Further filtering methods to reduce noise and improve performance are presented. All these modifications can be implemented at the filtering stage, preserving the speed of FT reconstruction. Simulation of a large system shows how compensated FT methods can have equivalent or better performance to slower vector-matrix-multiply reconstructions.
NTIS
Adaptive Optics; Fourier Transformation; Wave Front Reconstruction; Noise Reduction

20030037032 Lawrence Livermore National Lab., Livermore, CA
Filamentation and Forward Brillouin Scatter of Entire Smoothed and Aberrated Laser Beams
Still, C. H.; Berger, R. L.; Langdon, A. B.; Hinkel, D. E.; Suter, L. J.; Oct. 29, 1999; 42 pp.
Report No.(s): DE2002-790942; No Copyright; Avail: Department of Energy Information Bridge
Laser-plasma interactions are sensitive to both the fine-scale speckle and the larger scale envelope intensity of the beam. For some time, simulations have been done on volumes taken from part of the laser beam cross-section, and the results from multiple simulations extrapolated to predict the behavior of the entire beam. However, extrapolation could very well miss effects of the larger scale structure on the fine-scale. The only definitive method is to simulate the entire beam. These very large calculations have been infeasible until recently, but they are now possible on massively parallel computers. Whole beam simulations show the dramatic difference in the propagation and break up of smoothed and aberrated beams.
NTIS
Laser Beams; Laser Plasma Interactions

20030037068 Argonne National Lab., IL
Spontaneous and Amplified Radiation at the Initial of a SASE FEL
Huang, Z.; Kim, K. J.; 2002; 8 pp.
Report No.(s): DE2002-805259; No Copyright; Avail: Department of Energy Information Bridge
At the initial stage of a self-amplified spontaneous emission (SASE) free-electron laser (FEL), spontaneous undulator radiation in certain experimental configurations can dominate the amplified signal over an extended undulator distance. In this paper we study both the spontaneous and the amplified radiation in the framework of the paraxial wave equation and determine the transition from the dominance of spontaneous emission to exponential amplification. We compare theoretical expectations with SASE simulation codes GINGER and GENESIS.
NTIS
Free Electron Lasers; Spontaneous Emission

20030037116 Lawrence Livermore National Lab., Livermore, CA
Reflectance, Optical Properties, and Stability of Molybdenum/Strontium and Molybenum/Yttrium Multilayer Mirrors
Kjornrattananwanich, B.; Sep. 01, 2002; In English
Report No.(s): DE2002-15002102; UCRL-LR-150541; No Copyright; Avail: National Technical Information Service (NTIS)
The motivation of this work is to develop high reflectance normal-incidence multilayer mirrors in the 8-12 nm wavelength region for applications in astronomy and extreme ultraviolet lithography. To achieve this goal, Mo/Sr and Mo/Y multilayers

were studied. These multilayers were deposited with a UHV magnetron sputtering system and their reflectances were measured with synchrotron radiation. High normal-incidence reflectances of 23\% at 8.8 nm, 40.8\% at 9.4 nm, and 48. 3\% at 10.5 nm were achieved. However, the reflectance of Mo/Sr multilayers decreased rapidly after exposure to air. Attempts to use thin layers of carbon to passivate the surface of Mo/Sr multilayers were unsuccessful.
NTIS
Mirrors; Lithography; Thin Films; Molybdenum; Yttrium; Strontium

20030037177 Lawrence Livermore National Lab., Livermore, CA
Woelter Instrument Optical Design
Nederbragt, W. W.; Oct. 11, 2002; In English
Report No.(s): DE2002-15002122; UCRL-ID-150702; No Copyright; Avail: National Technical Information Service (NTIS)

Hundreds of target assemblies will be constructed annually for use on NIF or OMEGA in the near future. Currently, we do not have the capability to tomographically characterize the target assemblies at the desired resolution. Hence, we cannot verify if an assembly has been assembled correctly. The Engineering Directorate, through the LDRD program, is currently funding an x-ray instruments that could solve this problem. This instrument is based on a Woelter Type-I design. We will refer to this design as the Woelter instrument in the remainder of the report.
NTIS
Optical Equipment; Design Analysis; Microscopes

20030037182 Lawrence Livermore National Lab., Livermore, CA
National NIF Diagnostic Program Fiscal Year 2002 Third Quarter Report
MacGowan, B.; Jul. 01, 2002; In English
Report No.(s): DE2002-15002131; UCRL-ID-148561-02-3; No Copyright; Avail: National Technical Information Service (NTIS)

Table of Contents: Overview and Summary; Schedule report; Budget; Report; Change Control Board Actions; Streaked X-Ray Detector; (SXD) Static X-Ray Imager (SXI); Full Aperture Backscatter Diagnostics (FABS); Diagnostic Instrument Manipulator (DIM); Gated X-Ray Detector (GXD); X-Ray Survey Spectrometer (HENEX); Visar; Neutron Yield Diagnostic (NYD); Target Diagnostic Alignment (TDA); Diagnostic Timing Fiducial; Target Diagnostic Integration; and Controls Integration.
NTIS
X Ray Detectors; Diagnosis

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20030034639 Princeton Univ., NJ
Heatpulse Propagation Studies on DIII-D and TFTR
Fredrickson, E.; Austin, M. E.; Groebner, R.; Manickam, J.; Rice, B.; Apr. 2000; 48 pp.
Report No.(s): DE2002-753927; No Copyright; Avail: Department of Energy Information Bridge

Sawtooth phenomena have been studied on DIII-D and TFTR. In the experiments, with high power neutral beam injection the sawtooth characteristics were studied with fast electron temperature (ECE) and soft x-ray diagnostics. A strong ballistic electron heat pulse is found on DIII-D, stronger than was previously reported on TFTR. Evidence is presented in this paper that the ballistic effect is related to the sawtooth precursor. Fast, 2 msec interval, measurements on DIII-D were made of the ion temperature evolution following the sawtooth to document the ion heat pulse characteristics. It is found that the ion heat pulse does not exhibit the very fast, 'ballistic' behavior seen for the electrons. Further, both the electron and ion heat pulses from partial sawtooth crashes and similar events are seen to propagate at speeds close to those expected from the power balance calculations of the thermal diffusivities. These results suggest that the fast sawtooth induced heat pulse propagation is not a feature of non-linear transport models, but that MHD events can have a strong effect on thermal transport.
NTIS
Electron Energy; Neutral Beams; X Rays; Sawtooth Waveforms; Oscillations; Ion Temperature

20030037018 Lawrence Livermore National Lab., Livermore, CA

National Ignition Facility: Status and Plans for Laser Fusion and High-Energy-Density Experimental Studies

Moses, E.; Wuest, C. R.; Oct. 16, 2002; 34 pp.; In English

Report No.(s): DE2002-15002264; UCRL-JC-142223-REV-3; No Copyright; Avail: Department of Energy Information Bridge

The National Ignition Facility (NIF), currently under construction at the University of Californias Lawrence Livermore National Laboratory, is a stadium-sized facility containing a 192-beam, 1.8-Megajoule, 500-Terawatt, 351-nm laser system and a 10-meter diameter target chamber with room for nearly 100 experimental diagnostics. NIF is being built by the National Nuclear Security Administration and when completed will be the world's largest laser experimental system, providing a national center to study inertial confinement fusion and the physics of matter at extreme energy densities and pressures. NIF will provide 192 energetic laser beams that will compress small fusion targets to conditions where they will ignite and bum, liberating more energy than is required to initiate the fusion reactions. NIF experiments will allow the study of physical processes at temperatures approaching 100 million K and 100 billion times atmospheric pressure. These conditions exist naturally only in the interior of stars and in nuclear weapons explosions. In the course of designing the world's most energetic laser system, a number of significant technology breakthroughs have been achieved. Research is also underway to develop a shorter pulse capability on NIF for very high power and extreme electromagnetic field research and applications. We discuss here the technology challenges and solutions that have made NIF possible, along with enhancements to NIF's design that could lead to near-exawatt power levels.

NTIS

Laser Fusion; Fusion Reactors; Inertial Confinement Fusion

20030037172 Lawrence Livermore National Lab., Livermore, CA

Inertial Fusion Technology Spin-Offs History Provides a Glimpse of the Future

Powell, H.; Mar. 07, 2000; In English

Report No.(s): DE2002-15002097; UCRL-MI-137869; No Copyright; Avail: National Technical Information Service (NTIS)

The development and demonstration of inertial fusion is incredibly challenging because it requires simultaneously controlling and precisely measuring parameters at extreme values in energy, space, and time. The challenges range from building megajoule drivers that perform with percent-level precision to fabricating targets with submicron specifications to measuring target performance at micron scale with picosecond time resolution. Over the past 30 years in attempting to meet this challenge, the inertial fusion community around the world has invented new technologies in lasers, particle beams, pulse power drivers, diagnostics, target fabrication, and other areas. These technologies have found applications in diverse fields of industry and science. Moreover, simply assembling the teams with the background, experience, and personal drive to meet the challenging requirements of inertial fusion has led to spin-offs in unexpected directions, for example, in laser isotope separation, extreme ultraviolet (EUV) lithography for microelectronics, compact and inexpensive radars, advanced laser materials processing, and medical technology.

NTIS

Inertial Confinement Fusion; Lasers

20030038801 Lawrence Livermore National Lab., Livermore, CA

Laser Plasma Interactions with Intensities from 10(12) W/cm(2) to 10(21) W/cm(2)

Kruer, W. L.; Nov. 05, 2002; 26 pp.

Report No.(s): DE2002-15002157; UCRL-JC-149143; No Copyright; Avail: Department of Energy Information Bridge

A tutorial introduction is given to some important physics and current challenges in laser plasma interactions. The topics are chosen to illustrate a few of John Dawsons many pioneering contributions to the physics and modeling of plasmas. In each case, a current frontier is also briefly discussed, including the .53pm option for laser fusion, kinetic inflation of instability levels, and new regimes accessed with ultra-high power lasers.

NTIS

Plasmas (Physics); Laser Beams

20030038815 Lawrence Livermore National Lab., Livermore, CA

National Ignition Facility Applications for Inertial Fusion Energy and High Energy Density Science

Campbell, E. M.; Hogan, W. J.; Aug. 12, 1999; In English

Report No.(s): DE2002-791695; UCRL-JC-135355; No Copyright; Avail: National Technical Information Service (NTIS)

Over the past several decades, significant and steady progress has been made in the development of fusion energy and its associated technology and in the understanding of the physics of high-temperature plasmas. While the demonstration of net fusion energy (fusion energy production exceeding that required to heat and confine the plasma) remains a task for the next millennia and while challenges remain, this progress has significantly increased confidence that the ultimate goal of societally acceptable (e.g. cost, safety, environmental considerations including waste disposal) central power production can be achieved. This progress has been shared by the two principal approaches to controlled thermonuclear fusion magnetic confinement (MFE) and inertial confinement (ICF). ICF, the focus of this article, is complementary and symbiotic to MFE. ICF invokes spherical implosion of the fuel to achieve high density, pressures, and temperatures, inertially confining the plasma for times sufficiently long (t approx. 10(sup -10) sec) that approx. 30\% of the fuel undergoes thermonuclear fusion. NTIS

Controlled Fusion; High Temperature Plasmas; Thermonuclear Power Generation

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*.

20030032263 NASA Glenn Research Center, Cleveland, OH, USA

Defect Clustering and Nano-Phase Structure Characterization of Multi-Component Rare Earth Oxide Doped Zirconia-Yttria Thermal Barrier Coatings

Zhu, Dongming; Chen, Yuan L.; Miller, Robert A.; [2003]; 13 pp.; In English; 27th Annual International Conference on Advanced Ceramics and Composites, 26-31 Jan. 2003, Cocoa Beach, FL, USA; Original contains black and white illustrations Contract(s)/Grant(s): WBS 22-714-04-05; Copyright; Avail: CASI; A03, Hardcopy

Advanced oxide thermal barrier coatings have been developed by incorporating multi-component rare earth oxide dopants into zirconia-yttria to effectively promote the creation of the thermodynamically stable, immobile oxide defect clusters and/or nano-scale phases within the coating systems. The presence of these nano-sized defect clusters has found to significantly reduce the coating intrinsic thermal conductivity, improve sintering resistance, and maintain long-term high temperature stability. In this paper, the defect clusters and nano-structured phases, which were created by the addition of multi-component rare earth dopants to the plasma-sprayed and electron-beam physical vapor deposited thermal barrier coatings, were characterized by high-resolution transmission electron microscopy (TEM). The defect cluster size, distribution, crystallographic and compositional information were investigated using high-resolution TEM lattice imaging, selected area diffraction (SAD), electron energy-loss spectroscopy (EELS) and energy dispersive spectroscopy (EDS) analysis techniques. The results showed that substantial defect clusters were formed in the advanced multi-component rare earth oxide doped zirconia- yttria systems. The size of the oxide defect clusters and the cluster dopant segregation was typically ranging from 5 to 50 nm. These multi-component dopant induced defect clusters are an important factor for the coating long-term high temperature stability and excellent performance.

Author

Clusters; Doped Crystals; Thermal Control Coatings; Yttrium Oxides; Zirconium Oxides; Crystal Defects; Nanostructure (Characteristics)

20030032300 QSS Group, Inc., Greenbelt, MD, USA

Total Ionizing Dose Effects in MOS Oxides and Devices

Oldham, Timothy R.; McLean, F. B.; [2003]; 22 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The development of military and space electronics technology has traditionally been heavily influenced by the commercial semiconductor industry. The development of MOS technology, and particularly CMOS technology, as dominant commercial technologies has occurred entirely within the lifetime of the NSREC. For this reason, it is not surprising that the study of radiation interactions with MOS materials, devices and circuits has been a major theme of this conference for most of its history. The basic radiation problem in a MOS transistor is illustrated. The application of an appropriate gate voltage causes a conducting channel to form between the source and drain, so that current flows when the device is turned on. In Fig. lb, the effect of ionizing radiation is illustrated. Radiation-induced trapped charge has built up in the gate oxide, which causes a shift in the threshold voltage (that is, a change in the voltage which must be applied to turn the device on). If this shift is

large enough, the device cannot be turned off, even at zero volts applied, and the device is said to have failed by going depletion mode.
Author
Ionizing Radiation; Dosage; Transistors; Radiation Effects; Depletion; Cmos

20030032341 NASA Glenn Research Center, Cleveland, OH, USA, Ohio Aerospace Inst., Cleveland, OH, USA
Atomistic Modeling Of Co Growth On Cu(111]
Khalil, Joseph; Bozzolo, Guillermo; Farias, Daniel; deParga, Vazquez; deMiguel, J. J.; Miranda, R.; [2002]; 6 pp.; In English; Materials Research Society Symposium, 2002; On original document some information was cut off on left side of two pages and right side of two. There are also black and white illustrations.
Contract(s)/Grant(s): NCC3-594; Copyright; Avail: CASI; A02, Hardcopy

The BFS method for alloys is applied to the study of Co growth on Cu(111). The parameterization of the Co-Cu system is obtained from first-principles calculations, and tested against known experimental features for low coverage Co deposition on Cu(100) and Cu(111). Atomistic simulations are performed to investigate the behavior of Co on Cu(111) as a function of coverage.
Author
Cobalt; Copper; Mathematical Models; Crystal Growth; Atomic Theory

20030033894 Helsinki Univ. of Technology, Espoo
Investigations of Solid-Liquid Interfaces in Helium at Ultralow Temperatures
Tsepelin, V.; 2001; 44 pp.
Report No.(s): PB2003-102631; Copyright; Avail: National Technical Information Service (NTIS)

This thesis describes ultralow temperature studies of helium quantum crystals. Owing to the surrounding super fluid, small latent heat of crystallization and correspondingly short relaxation times, which are unreachable in ordinary crystals, helium crystals offer a unique and clean modeling system to study surface phenomena in a solid. The measurements of the crystal shape and growth rates are essential in providing the microscopic understanding of crystal growth.
NTIS
Helium; Crystal Growth; Cryogenic Temperature

20030036915 Iowa State Univ., Ames. Dept. of Materials Science and Engineering
Analysis of Gd(Sub 5)(Si(Sub 2)Ge(Sub 2)) Microstructure and Phase Transition
Meyers, J. S.; 2002; 64 pp.
Report No.(s): DE2002-803738; No Copyright; Avail: Department of Energy Information Bridge

With the recent discovery of the giant magnetocaloric effect and the beginning of extensive research on the properties of Gd(Sub 5)(Si(Sub X)Ge(Sub 1-X)(Sub 4)), a necessity has developed for a better understanding of the microstructure and crystal structure of this family of rare earth compounds with startling phenomenological properties. The aim of this research is to characterize the microstructure of the Gd(Sub 5)(Si(Sub X)Ge(Sub 1-X)(Sub 4)) with X = 2 and its phase change by using both transmission and electron microscopes.
NTIS
Crystal Structure; Microstructure; Rare Earth Compounds

20030036940 National Inst. of Standards and Technology, Gaithersburg, MD
Determination of the Single Crystal Elastic Constants by Diffraction from a Cubic Polycrystal
DeWit, R.; 2003; 24 pp.
Report No.(s): PB2003-102250; NISTIR-6944; No Copyright; Avail: CASI; A03, Hardcopy

Using the theory of statistical continuum mechanics, closed expressions are derived for the diffraction elastic constants of a cubic polycrystal that is statistically homogeneous, isotropic, and disordered. By measuring these constants for several diffracting planes of a single polycrystal, the single crystal elastic constants are determined.
NTIS
Elastic Properties; Polycrystals; Single Crystals; Diffraction

20030036967 Netherlands Energy Research Foundation, Petten, Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)

Solar Grade Silicon By a Direct Route Based on Carbothermic Reduction of Silica: Requirements and Production Technology

Geerligs, L. J.; Wyers, G. P.; Jensen, R.; Raaness, O.; Waernes, A. N.; 2002; 8 pp.; In English

Report No.(s): PB2003-102652; Copyright; Avail: National Technical Information Service (NTIS)

In the European projects SOLSILC and SPURT, a process is developed for the production of solar grade silicon (SOG-Si) by carbothermic reduction of silica, based on very pure raw materials. The purity of the raw materials greatly reduces the requirements on purification of the silicon, from dopants and other impurities. This paper reports the technology used for the Si production, which is suitable for the available high purity silica and carbon materials. It also reports results from the carbon removal process, which brings the carbon content of the silicon from several hundred ppmw to below 5 ppmw. Finally, it discusses experiments on the allowable impurity concentrations in SOGSi feedstock for directional solidification. Segregation observed during directional solidification is better than previously published, and allowable concentrations of Fe and Ti are similar to what was previously published for monocrystalline material by Westinghouse Corp.

NTIS

Silicon; Technologies

20030037002 National Renewable Energy Lab., Golden, CO, Colorado School of Mines, Golden. Dept. of Physics

Investigation of the Microstructure of Cu(In,Ga)Se(2) Thin Films Used in High-Efficiency Devices

Noufi, R.; Yan, Y.; Jones, K.; Al-Jassim, M.; Keyes, B.; May 2002; In English

Report No.(s): DE2002-15000987; No Copyright; Avail: National Technical Information Service (NTIS)

This conference paper describes the microstructure of Cu(In,Ga)Se2 (CIGS) films, as it transitioned from Cu-rich to In-rich composition, by transmission electron microscopy, and energy-dispersive X-ray spectroscopy. We find that the Cu-rich samples have larger grains than the In-rich samples, and they contain two structurally different forms of the Cu(sub x)Se secondary phase. These samples also show sub-interfaces about 0.2 micrometers below the surface. The In-rich samples were almost void of these sub-interfaces.

NTIS

Microstructure; Thin Films; Copper Alloys; Photovoltaic Conversion; X Ray Spectroscopy

20030037013 National Renewable Energy Lab., Golden, CO, Colorado School of Mines, Golden, CO

Deep Level Transient Spectroscopy and Capacitance-Voltage Measurements of Cu(In,Ga)Se(2)

Abushama, J.; Johnston, S.; Ahrenkiel, R.; Noufi, R.; May 2002; 12 pp.; In English

Report No.(s): DE2002-15000995; No Copyright; Avail: Department of Energy Information Bridge

This conference paper describes the electronic properties of ZnO/CdS/Cu(In,Ga)Se2 (CIGS)/Mo/SLG polycrystalline thin-film solar cells with compositions ranging from Cu-rich to In-rich were investigated by deep level transient spectroscopy and capacitance-voltage (C-V) measurements. This compositional change represents the evolution of the film during growth by the three-stage process. Four thin-film CIGS samples with different Cu content were obtained. The Cu/(In+Ga) ratio ranges from 1.24 (Cu-rich)to 0.88 (In-rich), whereas the Ga/(In+Ga) ratio ranges from 0.19 (Cu-rich)to 0.28 (In-rich).The Cu-rich sample exhibits a shallow majority-carrier trap with an activation energy of 0.12 eV and another deeper trap with an activation energy of 0.28 eV, whereas the In-rich sample has a shallow minority-carrier trap with an activation energy of 0.12 eV. The two samples show evidence of a deeper trap at higher temperature. C-V measurements showed that the average carrier concentration (N values) around the junction of the cell changed as the film transitions from Cu-rich to In-rich. DLTS shows that acceptor-like traps are dominant in samples where CIGS grains did not go through the Cu-rich to In(Ga)-rich transition. While donor-like traps are dominant in the In(Ga)-rich samples.

NTIS

Solar Cells; Thin Films; Spectroscopy; Electronics

20030037099 Fermi National Accelerator Lab., Batavia, IL, National High Magnetic Field Lab., Tallahassee, FL

Effect of Thermo-Mechanical Stress during Quench on Nb(3)Sn Cable Performance

Imbasciati, L.; Bauer, P.; Ambrosio, G.; Lamm, M. J.; Miller, J. R.; Dec. 2002; 8 pp.; In English

Report No.(s): DE2002-805584; No Copyright; Avail: Department of Energy Information Bridge

Several high field magnets using Nb(3)Sn superconductor are under development for future particle accelerators. The high levels of stored energy in these magnets can cause high peak temperatures during a quench. The thermo-mechanical stress

generated in the winding during the fast temperature rise can result in a permanent damage of the brittle Nb(3)Sn. Although there are several studies of the critical current degradation of Nb(3)Sn strands due to strain, little is known about how to apply the strain limitations to define a maximum acceptable temperature in the coils during a quench. Therefore, an experimental program was launched, aimed at improving the understanding of the effect of thermo-mechanical stress in coils made from brittle Nb(3)Sn. A first experiment, reported here, was performed on cables. The experimental results were compared to analytical and finite element models. The next step in our experimental program will be to repeat similar measurements in small racetrack coils and later in full size magnets.
NTIS
High Field Magnets; Mathematical Models; Particle Accelerators; Thermodynamics; Superconductors (Materials); Niobium; Tin; Stress Distribution

20030037125 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD
Determination of Texture from Individual Grain Orientation Measurements
Blendell, J. E.; Vaudin, M. D.; Fuller, E. R.; 2002; 14 pp.
Report No.(s): PB2003-102700; No Copyright; Avail: CASI; A03, Hardcopy

We present a technique for determining the texture of a polycrystalline material based on the measurement of the orientation of a number of individual grains. We assumed that the sample has fiber (i.e. axisymmetric) texture and that the texture can be characterized by a function (the March-Dollase function) with a single parameter. We simulated a large number, N, of orientation data sets, using the March-Dollase function for a total of five different texture parameters, r(init) Using the maximum likelihood method we solved for the texture parameter, r(prime) that best fits each simulated data set in order to determine the distribution of r(prime) evaluate the precision and accuracy with which r(prime) can be determined. The 90\% confidence limits of the ratio r(prime)/rinit varied as N-1/2 but were independent of r(init). Using the texture of slightly textured alumina as determined by x-ray diffraction we calculated the 90\% confidence limits for measurements of 131 grains. The orientations of 131 grains in textured alumina were measured by electron backscatter diffraction and the texture determined from those measurements lay within these 90\% confidence limits.
NTIS
X Ray Diffraction; Maximum Likelihood Estimates; Aluminum Oxides; Electron Diffraction; Polycrystals

20030037134 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, American Superconductor Corp., Westborough, MA, Los Alamos National Lab., NM
Method for Crystallographic Texture Investigations Using Standard X-Ray Equipment
Vaudin, M. D.; Rupich, M. W.; Jowett, M.; Riley, G. N.; Bingert, J. F.; 2002; In English
Report No.(s): PB2003-102698; No Copyright; Avail: National Technical Information Service (NTIS)

A fast and accurate method has been developed for measuring crystalline texture in homogeneous materials. The method uses a conventional powder x-ray diffractometer capable of q scans. Two scans are recorded from the sample: first, a high resolution q-2q scan is obtained of a Bragg peak whose diffracting planes are normal to the preferred orientation direction; second, a q scan is obtained using this peak. The q scan contains the required texture information but the intensities must be corrected for defocussing and absorption to obtain the texture profile. The q-2q scan of the Bragg peak is used to make the defocussing correction, and first principles calculations are used to correct for absorption. The theory behind these corrections is presented here. The validity of the technique has been verified by making measurements on untextured alumina. Data obtained from Bi2Sr2Ca2Cu3O10 superconducting tape specimens with this technique are compared with texture data obtained with a four-circle diffractometer.
NTIS
Crystallography; Textures; X Ray Diffraction; Superconductivity; Homogeneity

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*.

20030033033 Air Force Research Lab., Edwards AFB, CA, USA
Heat Transfer and Deposition Behavior of Hydrocarbon Rocket Fuels
Bates, Ron; June 18, 2002; 3 pp.; In English
Contract(s)/Grant(s): AF Proj. 4847
Report No.(s): AD-A410534; AFRL/PRS-ED-AB-2002-148; No Copyright; Avail: CASI; A01, Hardcopy

As the desire to increase the performance of hydrocarbon/liquid oxygen rocket engines naturally leads to increased combustion chamber pressures and higher energy hydrocarbon fuels, the combustion chamber and nozzle heat fluxes also increase. For engines regeneratively cooled with hydrocarbon fuel, this additional thermal stress must be effectively carried by the fuel without degradation of the cooling channel surfaces. A methodology for evaluation of the thermal performance (thermal stability and heat transfer characteristics) of hydrocarbon rocket fuels is suggested. As part of that methodology, an experimental research program to investigate the thermal performance of several new candidate hydrocarbon rocket fuels has been started. The experimental program uses a series of test rigs of increasing complexity and fidelity to successively screen identified fuels without the cost and complexity of a full engine system level test. Results of small-scale thermal decomposition experiments utilizing a System for Thermal Decomposition Studies (STDS) test rig provide an initial evaluation of the thermal stability performance of fuels from very small fuel samples. Measurements of heat transfer coefficient and the effect of wall temperature, flow velocity, and wetted-material on deposit formation in heated test channels are obtained from larger rigs, such as the NASA/GRC Heated Tube Facility and the AFRL/PRS High Heat Flux Facility. Representative results from early testing will be presented to illustrate the effectiveness of the overall approach.
DTIC
Deposition; Heat Transfer; Hydrocarbon Fuels; Thermal Decomposition; Liquid Propellant Rocket Engines

20030036909 Brookhaven National Lab., Upton, NY, Universidade Estadual Paulista, Sao Paulo (Brazil)
Possible Origin of RHIC R(out)/R(sid) HBT Results
Padula, S. S.; 2002; 8 pp.; In English
Report No.(s): DE2002-801702; BNL-69354; No Copyright; Avail: Department of Energy Information Bridge
The effects of opacity of the nuclei together with a blackbody type of emission along the system history are considered as a means to explain the ratio R(sub out)/R(sub sid) observed by STAR and PHENIX collaborations at RHIC. Within our model, no flow is required to explain the data trend of this ratio for large surface emissivities.
NTIS
Particle Accelerators; Opacity; Quarks

20030037062 Fermi National Accelerator Lab., Batavia, IL
BTeV Pixel Detector and Trigger System
Kwan, S.; Dec. 2002; 10 pp.
Report No.(s): DE2002-805271; No Copyright; Avail: Department of Energy Information Bridge
BTeV is an approved forward collider experiment at the Fermilab Tevatron dedicated to the precision studies of CP violation, mixing, and rare decays of beauty and charm hadrons. The BTeV detector has been designed to achieve these goals. One of the unique features of BTeV is a state-of-the-art pixel detector system, designed to provide accurate measurements of the decay vertices of heavy flavor hadrons that can be used in the first trigger level. The pixel vertex detector and the trigger design are described. Recent results on some of the achievements in our research and development effort are presented.
NTIS
Pixels; Radiation Detectors

20030037065 Jefferson Lab., Newport News, VA
Nucleon Form Factors
de Jager, K.; 2002; 14 pp.
Report No.(s): DE2002-805273; No Copyright; Avail: Department of Energy Information Bridge
A review of data on the nucleon electro-weak form factors in the space-like region is presented. Recent results from experiments using polarized beams and either polarized targets or nucleon recoil polarimeters have yielded a significant improvement on the precision of the electromagnetic data obtained with the traditional Rosenbluth separation. An outlook is presented of planned experiments.
NTIS
Nucleons; Form Factors

20030037073 Fermi National Accelerator Lab., Batavia, IL
Accelerator Physics and Technology Limitations to Ultimate Energy and Luminosity in Very Large Hadron Colliders
Bauer, P.; Limon, P.; Peggs, S.; Syphers, M.; Solyak, N.; Dec. 2002; 8 pp.
Report No.(s): DE2002-805414; FERMILAB-CONF-01/421; No Copyright; Avail: Department of Energy Information Bridge

The following presents a study of the accelerator physics and technology limitations to ultimate energy and luminosity in very large hadron colliders (VLHCs). The main accelerator physics limitations to ultimate energy and luminosity in future energy frontier hadron colliders are synchrotron radiation (SR) power, proton-collision debris power in the interaction regions (IR), number of events-per-crossing, stored energy per beam and beam-stability. Quantitative estimates of these limits were made and translated into scaling laws that could be inscribed into the particle energy versus machine size plane to delimit the boundaries for possible VLHCs. Eventually, accelerator simulations were performed to obtain the maximum achievable luminosities within these boundaries.
NTIS
Hadrons; Particle Collisions; Particle Accelerators; High Energy Interactions

20030038768 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, Sussex Univ., Brighton (England), Oxford Univ. (England)
Conformal Orbifold Partition Functions from Topologically Massive Gauge Theory
Ferreira, P. C.; Kogan, I. I.; Szabo, R. J.; Dec. 2001; 52 pp.; In English
Report No.(s): PB2003-102092; IHES/P/01/53; SUSX-TH-01-040,OUTP-01-57P; No Copyright; Avail: CASI; A04, Hardcopy

The authors continue the development of the topological membrane approach to open and unoriented string theories. The authors study orbifolds of topologically massive gauge theory defined on the geometry of a generic compact Riemann surface. The orbifold operations are constructed by gauging the discrete symmetries of the bulk three-dimensional field theory. Multi-loop bosonic string vacuum amplitudes are thereby computed as bulk correlation functions of the gauge theory. It is shown that the three-dimensional correlators naturally reproduce twisted and untwisted sectors in the case of closed worldsheet orbifolds, and Neumann and Dirichlet boundary conditions in the case of open ones. The bulk wavefunctions are used to explicitly construct the characters of the underlying extended Kac-Moody group for arbitrary genus. The correlators for both the original theory and its orbifolds give the expected modular invariant statistical sums over the characters.
NTIS
String Theory; Field Theory (Physics)

20030038796 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette
Einstein Billiards and Overextensions of Finite-Dimensional Simple Lie Algebras
Damour, T.; De Buyl, S.; Henneaux, M.; Schomblond, C.; Jun. 2002; 42 pp.
Report No.(s): PB2003-102079; IHES/P/02/43; No Copyright; Avail: CASI; A03, Hardcopy

In recent papers, it has been shown that (1) dynamics of theories involving gravity can be described, in the vicinity of a space-like singularity, as a billiard motion in a region of hyperbolic space bounded by hyperplanes; and (2) that the relevant billiard has remarkable symmetry properties in the case of pure gravity in d+1 spacetime dimensions, or supergravity theories in 10 or 11 spacetime dimensions, for which it turns out to be the fundamental Weyl chamber of the Kac-Moody algebras AE(sub d), E(sub 10), BE(sub 10) or DE(sub 10) (depending on the model). The authors analyze in this paper the billiards associated to other theories containing gravity, whole toroidal reduction to three dimensions involves coset models G/H (with G maximally non compact). We show that in each case, the billiard is the fundamental Weyl chamber of the (indefinite) Kac-Moody 'overextension' (or 'canonical Lorentzian extension') of the finite-dimensional Lie algebra that appears in the toroidal compactification to 3 spacetime dimensions.
NTIS
Lie Groups; Algebra; Gravitation

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20030032281 Defence Science and Technology Organisation, Edinburgh, Australia
Constrained Planning and Wargame Performance in Military and Civilian Teams
Kardos, Monique; Chapman, Taryn; February 2003; 55 pp.; In English; Original contains color illustrations
Report No.(s): DSTO-GD-0352; DODA-AR-012-560; Copyright; Avail: Other Sources

The TLCAC study, conducted during January 2001, involved two military and three civilian teams conducting planning

activities under time constraint and fighting a battle with a designated enemy using the Janus wargame. This report outlines the planning behaviours observed in military and civilian participants, and briefly discusses their possible relation(s) with the wargame outcomes. It is concluded that the current behavioural results show a stronger association with the Recognitional Planning Model than the military appreciation process, indicating a need for further work in the area and a consideration of the foundation model of planning used.
Author
War Games; Planning; Teams

20030032304 NASA, Washington, DC, USA
Academy Sharing Knowledge (ASK). The NASA Source for Project Management Magazine, Volume 11, March 2003
March 2003; 44 pp.; In English; Original contains color illustrations
Report No.(s): NASA/NP-2003-03-300-HQ; NAS 1.83:2003-03-300-HQ; No Copyright; Avail: CASI; A03, Hardcopy

APPL is a research-based organization that serves NASA program and project managers, as well as project teams, at every level of development. In 1997, APPL was created from an earlier program to underscore the importance that NASA places on project management and project teams through a wide variety of products and services, including knowledge sharing, classroom and online courses, career development guidance, performance support, university partnerships, and advanced technology tools. ASK Magazine grew out of APPL's Knowledge Sharing Initiative. The stories that appear in ASK are written by the 'best of the best' project managers, primarily from NASA, but also from other government agencies and industry. Contributors to this issue include: Teresa Bailey, a librarian at the Jet Propulsion Laboratory, Roy Malone, Deputy Director in the Safety and Mission Assurance (S&MA) Office at the NASA Marshall Space Flight Center (MSFC), W. Scott Cameron, Capital Systems Manager for the Food and Beverage Global Business Unit of Procter and Gamble, Ray Morgan, recent retiree as Vice President of AeroVironment, Inc., Marty Davis, Program Manager of the Geostationary Operational Environmental Satellite (GOES) at the NASA Goddard Space Flight Center (GSFC) in Greenbelt, Maryland, Todd Post, editor of ASK Magazine, and works for EduTech Ltd. in Silver Spring, Maryland, Dr. Owen Gadeken, professor of Engineering Management at the Defense Acquisition University, Ken Schwer, currently the Project Manager of Solar Dynamics Observatory, Dr. Edward Hoffmwan, Director of the NASA Academy of Program and Project Leadership, Frank Snow, a member of the NASA Explorer Program at Goddard Space Flight Center since 1992, Dr. Alexander Laufer, Editor-in-Chief of ASK Magazine and a member of the Advisory Board of the NASA Academy of Program and Project Leadership, Judy Stokley, presently Air Force Program Executive Officer for Weapons in Washington, D.C. and Terry Little, Director of the Kinetic Energy Boost Office of the Missile Defense Agency.
Derived from text
Project Management; NASA Programs; Leadership; Organizations

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20030033833 Naval Surface Warfare Center, Dahlgren, VA
Cooperative Research and Development Agreement (CRADA) Guidebook
Linsenmeyer, Edward C.; Johnson, Ramsey D.; May 2002; 21 pp.; In English
Report No.(s): AD-A410623; NSWCDD/MP-02/26; No Copyright; Avail: CASI; A03, Hardcopy

Authorization for Government-operated Federal laboratories to enter into Cooperative Research and Development Agreements (CRADAs) was initially provided by the Stevenson-Wydler Technology Innovation Act of 1980, which was amended by the Federal Technology Transfer Act of 1986. The Department of Defense (DoD) and the Department of the Navy (DoN) have each issued specific guidelines governing technology transfer. This guidebook was prepared for the Naval Surface Warfare Center, Dahlgren Division (NSWCDD), Dahlgren, Virginia, and provides guidelines concerning responsibilities, requirements, options, types, format, and contents of CRADAs.
DTIC
Technology Transfer; Research Facilities

20030033963 Lawrence Livermore National Lab., Livermore, CA
Virtual Manual: Moving from Paper-to Web-Based Documentation
Cannon, G.; Butler, J.; Corey, C. W.; Hedman, I.; Aug. 12, 1999; 14 pp.; In English
Report No.(s): DE2002-791691; No Copyright; Avail: Department of Energy Information Bridge

Lawrence Livermore National Laboratory is implementing an Integrated Safety Management System (ISMS) to assure that all environment, safety, and health (ES&H) requirements and practices are integrated into work planning, execution, and feedback. A major component to ISMS is the rewriting of the Laboratory's ES&H documentation to meet federal, state, and local requirements and standards. Previously, the Laboratory's operations documentation was paper-based and decentralized; updates were time consuming and expensive to produce and distribute. The immediate goal for the ISMS project team was the development of a virtual, Web-based manual that provides current, consistent information easily accessible to users. Future updates to this virtual manual will be faster, less expensive, and immediately available.
NTIS
Documentation; Manuals; Safety Management; Websites; Information Dissemination

20030036939 Swedish Environmental Research Inst., Goeteborg
Work Environment Work in Coordinated Management Systems
Birgersdotter, L.; Karlsson, A.; Antonsson, A. B.; Dec. 2002; 42 pp.; In Swedish
Report No.(s): PB2003-102621; Copyright; Avail: National Technical Information Service (NTIS)

Lately a large amount of various management systems (MS) has been introduced within companies and organizations with the objective to structure and systematize the work. MS are different according to level of demands and details, where for example ISO-standards are extensive and detailed while for example municipal guidelines for environmental certificate are more oversearching. The MS's are also aiming at different issues such as environment, quality and occupational health and safety (OHS).
NTIS
Work; Management Planning; Management Systems

20030037045 CH2M Hill Hanford Group, Inc., Richland, WA
CDM on a Shoestring Indentifying and Utilizing an Existing Configuration and Data Management Infrastructure
Vann, J. M.; Aug. 24, 2000; 22 pp.; In English
Report No.(s): DE2002-804490; No Copyright; Avail: Department of Energy Information Bridge

The spreading need for and use of configuration and data management (CDM) standards has highlighted a number of challenges to the companies that need to Implement those standards. For companies and organizations that are new to CDM or have limited CDM capabilities, one of the major dilemmas faced is identifying how and where to start. In many cases there is a need to contend with a legacy of poody identified items and information and an immature or non-existent CDM infrastructure (processes, procedures, people, information systems). To the company management and CDM professional this poses a seemingly insurmountable task of putting in place a CDM infrastructure that provides the needed benefits while keeping within an acceptable cost and schedule. This paper deals with initially establishing the CDM infrastructure using the tools that a company already has available. The paper identifies features of common software applications that can be used to implement CDM principles.
NTIS
Configuration Management; Data Management; Applications Programs (Computers); Information Systems

20030037046 CH2M Hill Hanford Group, Inc., Richland, WA
Integration of Multiple Contractors with Performance Type of Contracts
2000; 14 pp.; In English
Report No.(s): DE2002-804742; No Copyright; Avail: Department of Energy Information Bridge

The management practices, procedures, and processes that are suited to managing Management and Operation (M&O) type of contracts at Department of Energy (DOE) sites, which were cost reimbursement with award fee, are not well suited to managing contracts where fee is determined by performance metrics. Thus a different style of management, requiring substantial revamping of the management process, is needed. This shift in philosophy also requires a dramatic shift in culture. This paper will describe how these changes are being managed at the River Protection Project (RPP), located at the DOE's

Hanford Site in Washington State, one of DOE's largest and highest risk environmental clean-up project.
NTIS
Radioactive Wastes; Environment Management; Environmental Cleanup; Energy Technology; Waste Management

20030037048 CH2M Hill Hanford Group, Inc., Richland, WA
Office of River Protection: Simplifying Project Management Tools
2000; 14 pp.; In English
Report No.(s): DE2002-804743; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
NTIS
Project Management; Rivers

20030037051 Fluor Hanford, Richland, WA, Fluor Federal Services, Richland, WA
Fuel Supply Shutdown Facility Interim Operational Safety Requirements
Benecke, M. W.; Besser, R. L.; Brehm, J. R.; Remaize, J. A.; Sep. 06, 2000; 30 pp.; In English
Report No.(s): DE2002-804808; No Copyright; Avail: Department of Energy Information Bridge
The Interim Operational Safety Requirements for the Fuel Supply Shutdown (FSS) Facility define acceptable conditions, safe boundaries, bases thereof, and management of administrative controls to ensure safe operation of the facility.
NTIS
Fuel Systems; Safety Management

20030037090 Science Applications International Corp., Oak Ridge, TN
Report of Official Foreign Travel to Canada 2-10 August 2002
Mason, J. D.; Aug. 26, 2002; 20 pp.; In English
Report No.(s): DE2002-805442; No Copyright; Avail: Department of Energy Information Bridge
In support of DOEs use of SGML, XML, HTML, and related standards, I have served since 1985 as Chairman of the international committee responsible for SGML and related standards, ISO/IEC JTC1/SC34 (SC34) and its predecessor organizations. During my August 2002 trip, I attended the summer 2002 meeting of SC34/WG3 in Montreal, Canada. I also read a paper at Extreme Markup Languages 2002, a major conference on the use of SGML and XML sponsored by IDE Alliance.
NTIS
Energy Technology; Conferences; Canada; Transportation

20030037146 General Accounting Office, Washington, DC
Federal Student Aid: Timely Performance Plans and Reports Would Help Guide and Assess Achievement of Default Management Goals
Feb. 2003; 46 pp.
Report No.(s): PB2003-102741; GAO-03-348; No Copyright; Avail: CASI; A03, Hardcopy
The Department of Education's Office of Federal Student Aid (FSA) is responsible for managing and administering the nation's student financial assistance programs authorized under title IV of the Higher Education Act (HEA) of 1965, as amended. In 1998, the Congress amended HEA to establish FSA as a performance-based organization (PBO) in order to address longstanding management weaknesses. Among other requirements, HEA called for FSA to annually develop 5-year plans that establish measurable goals and to issue annual reports on the extent to which the goals were met. The intent of this law was to provide among other things, a greater level of accountability for FSA's administration of programs. Additionally, HEA requires FSA to seek the opinions and suggestions of postsecondary institutions and other stakeholders, such as lenders and borrowers, regarding their delivery system.
NTIS
Education; Students; Management Planning

20030037148 General Accounting Office, Washington, DC
Transportation Security Administration: Actions and Plans to Build a Results-Oriented Culture
Jan. 2003; 52 pp.
Report No.(s): PB2003-102747; GAO-03-190; No Copyright; Avail: CASI; A04, Hardcopy

The objective of our review was to describe the Transportation Security Administration's (TSA) actions and plans for implementing the results-oriented practices required in the Aviation and Transportation Security Act (ATSA) and recommend next steps for TSA to build a results-oriented organizational culture and to establish a positive control environment. To identify results-oriented practices and recommend next steps, we reviewed our models, guides, reports, and other products on strategic planning and performance measurement, strategic human capital management, transformation efforts, and other related areas. We next analyzed ATSA in relation to our products to identify any results-oriented practices that were statutorily required in the legislation. In addition, we reviewed TSA and Department of Transportation missions, performance goals and measures, performance agreements, policies and procedures, and organizational charts and other relevant documentation. To describe TSA's status in implementing these results-oriented practices, we interviewed 25 officials from various TSA offices including strategic planning, human capital, training, budget, public affairs, and policy, among others. We also visited Baltimore-Washington International airport after it was transitioned to federal control to talk to front-line managers about their responsibilities and specifically their role in providing performance data to headquarters. We developed the recommended next steps by referring to our models, guides, reports, and other products on results-oriented practices and identifying additional practices that were associated with and would further complement or support current TSA efforts. We performed our work from May through September 2002 in accordance with generally accepted government auditing standards.
NTIS
Transportation; Security; Management Planning

20030037151 California Univ., Berkeley. Dept. of Economics, North Carolina Univ. at Greensboro. Dept. of Economics, Dartmouth Coll., Hanover, NH
Universities as Research Partners
Hall, B. H.; Link, A. N.; Scott, J. T.; Jun. 2002; 80 pp.; In English
Report No.(s): PB2003-102755; No Copyright; Avail: CASI; A05, Hardcopy

Universities are a key institution in the U.S. innovation system, and an important aspect of university involvement is the role universities play in private-public partnering activities. This study seeks to gain a better understanding of the performance of university-industry research partnerships by using a survey of a sample of pre-commercial research projects funded by the U.S. Advanced Technology Program (ATP). Although results must be interpreted cautiously because of the small sample size, the study finds that projects with university involvement tend to be in areas involving new science and therefore the projects may experience more difficulty and delay but also are more likely to end successfully. This finding implies that universities are contributing to basic research awareness and insight among the partners in ATP-funded projects.
NTIS
Universities; Research Management; Surveys

20030037161 Patent and Trademark Office, Washington, DC
USA Patent and Trademark Office 21st Century Strategic Plan
Jun. 03, 2002; 20 pp.
Report No.(s): PB2003-102786; No Copyright; Avail: CASI; A03, Hardcopy

Today, the USA Patent and Trademark Office (USPTO) is under siege. Patent application filings have increased dramatically throughout the world. There are an estimated seven million pending applications in the world's examination pipeline, and the annual workload growth rate is in the range of 20-30 percent. Technology has become increasingly complex, and demands from customers for higher quality products and services have escalated. Our applicants are concerned that the fees they pay to have their patent and trademark applications examined are being diverted for other purposes, thereby jeopardizing the benefits intellectual property rights bring to our national economy. In the USA, these demands have created substantial workload challenges in the processing of patents. The Congress, the owners of intellectual property, the patent bar, and the public-at-large have all told us that we must address these challenges aggressively and promptly.
NTIS
Management Planning; Information Systems

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*.

20030032266 NASA Langley Research Center, Hampton, VA, USA
NASA Video Catalog, Supplement 13
April 2003; 290 pp.; In English; Original contains color illustrations
Report No.(s): NASA/SP-2003-7109/SUPPL13; NAS 1.21:7109/SUPPL13; No Copyright; Avail: CASI; A13, Hardcopy

This issue of the NASA Video Catalog cites video productions listed in the NASA STI Database. The videos listed have been developed by the NASA centers, covering Shuttle mission press conferences; fly-bys of planets; aircraft design, testing and performance; environmental pollution; lunar and planetary exploration; and many other categories related to manned and unmanned space exploration. Each entry in the publication consists of a standard bibliographic citation accompanied by an abstract. The Table of Contents shows how the entries are arranged by divisions and categories according to the NASA Scope and Coverage Category Guide. For users with specific information, a Title Index is available. A Subject Term Index, based on the NASA Thesaurus, is also included. Guidelines for usage of NASA audio/visual material, ordering information, and order forms are also available.
Author
Video Tapes; Bibliographies; Catalogs (Publications)

20030032369 Japan Science and Technology Corp., Tokyo, Japan
Cooperative Search Engine: A Distributed Search Engine for Fresh Information
Uehara, Minoru; Mori, Hideki; Sakai, Yoshifumi; Sato, Nobuyoshi; Yomamoto, Takashi; Nishida, Yoshihiro; January 2001; 7 pp.; In English; Copyright; Avail: Other Sources

In information retrieval of Web pages, we usually use search engines. A conventional search engine has the problem that the update interval is very long because it is based on centralized architecture, which collects documents by using robots. So, we have developed a distributed search engine, Cooperative Search Engine (CSE) in order to reduce the update interval. In CSE, a global search engine is constructed with multiple Meta search engines, which hide each local search engine in each Web site. CSE can make the update interval very short by indexing on each Web site. In this paper, we describe the framework of CSE and its efficiency.
Author
Information Retrieval; Websites; Indexing (Information Science)

20030032469 NASA Goddard Space Flight Center, Greenbelt, MD, USA
MODIS/Terra and MODIS/Aqua Ocean Data Products Goddard Earth Sciences (GES) DAAC
[2003]; 4 pp.; In English; Fall 2002 AGU Meeting; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy

This information sheet provides an overview of MODIS/Terra and MODIS/Aqua Ocean Data products produced by NASA Goddard Earth Sciences (GES) DAAC.
CASI
Information Dissemination; Catalogs (Publications)

20030032477 NASA Langley Research Center, Hampton, VA, USA
NASA Patent Abstracts Bibliography: A Continuing Bibliography, Supplement 62
January 2003; 44 pp.; In English; Original contains color illustrations
Report No.(s): NASA/SP-2003-7039/SUPPL62; NAS 1.21:7039/SUPPL62; No Copyright; Avail: CASI; A03, Hardcopy

Several thousand inventions result each year from research supported by the National Aeronautics and Space Administration. NASA seeks patent protection on inventions to which it has title if the invention has important use in government programs or significant commercial potential. These inventions cover a broad range of technologies and include many that have useful and valuable commercial application. NASA inventions best serve the interests of the USA when their benefits are available to the public. In many instances, the granting of nonexclusive or exclusive licenses for the practice of these inventions may assist in the accomplishment of this objective. This bibliography is published as a service to companies, firms, and individuals seeking new, licensable products for the commercial market. The NASA Patent Abstracts Bibliography

is a semiannual NASA publication containing comprehensive abstracts of NASA owned inventions covered by U.S. patents. The citations included in the bibliography arrangement of citations were originally published in NASA's Scientific and Technical Aerospace Reports (STAR) and cover STAR announcements made since May 1969. The citations published in this issue cover the period July 2002 through. December 2002. This issue includes 10 major subject divisions separated into 76 specific categories and one general category/division. (See Table of Contents for the scope note of each category, under which are grouped appropriate NASA inventions.) This scheme was devised in 1975 and revised in 1987 in lieu of the 34 category divisions which were utilized in supplements (01) through (06) covering STAR abstracts from May 1969 through January 1974. Each entry consists of a STAR citation accompanied by an abstract and, when appropriate, a key illustration taken from the patent or application for patent. Entries are arranged by subject category in ascending order. A typical citation and abstract presents the various data elements included in most records cited. This appears after the table of contents.
Derived from text
Abstracts; Bibliographies; NASA Programs; Technology Utilization; Patents

20030033006 Naval Facilities Engineering Service Center, Port Hueneme, CA
Freedom Banner - Cobra Gold 2002, Total Asset Visibility Experiment
McCambridge, Daniel J.; Dec. 2002; 146 pp.; In English; Original contains color illustrations
Report No.(s): AD-A410683; TM-2357-AMP; No Copyright; Avail: CASI; A07, Hardcopy

This document describes an experimentation of technology that can bring the Marine Corps closer to the goal of achieving Total Asset Visibility. The venue used for this effort was the Freedom Banner/Cobra Gold 2002 exercise. This exercise was conducted in Thailand during April and May 2002. Several organizations were involved in the effort. The experiment had three objectives: (1) Provide the Third Force Service Support Group with technology that can enhance the TAV of equipment. (2) Identify and measure bandwidth parameters of the technology used to provide the TAV. This data will be used to compare this technology with the bar code scanning systems currently fielded in the Marine Corps. This data can also be used to evaluate sensor technologies that will be deployed in the battlefield. (3) Evaluate the capability to provide near real time visibility of deployed assets through existing or joint operational internet based systems. The three objectives were satisfied. Several conclusions and recommendations resulted from the effort. Total Asset Visibility technology has a significant impact on the Marine Corps process for off loading a Maritime Propositioning Ship. The impact is both a reduction in personnel required for the operation and in time required capturing data and providing information. The additional bandwidth burden resulting from the network traffic related to the technology was minimal. A residual was provided to the Third Force Service Support Group for the purposes of enhancing the visibility of their equipment.
DTIC
Information Systems; Data Processing Equipment; Technology Assessment; Military Operations; Military Technology

20030034634 National Inst. of Standards and Technology, Gaithersburg, MD
Acquiring and Deploying Intrusion Detection Systems
Mell, P.; Nov. 05, 1999; 14 pp.
Report No.(s): PB2000-100641; No Copyright; Avail: CASI; A03, Hardcopy

Intrusion detection is a topic extensively discussed in the popular press, IT trade articles, scholarly journals, and security newsletters. Intrusion detection systems (IDSs) hold great promise for deterring or mitigating the damage caused by 'hacking' or breaking into sensitive IT systems. Thus, IDSs are at the forefront of many organizations' attention and now their checkbooks. Careful planning, phased deployments, and specialized training are among the steps that can be taken to minimize the potential for costly deployments, poor returns on investment, or high maintenance costs while maximizing the security benefit to an organization. This ITL Bulletin provides basic information about IDSs to help organizations avoid common pitfalls in acquiring, deploying, and maintaining IDSs. The topics covered are: A definition of intrusion detection, Reasons to acquire IDSs, Types of IDSs, IDS monitoring approaches, IDS event analysis approaches, IDSs that automatically respond to attacks, Tools that complement IDSs, Limitations of IDSs, Deployment of IDSs, and The future of IDSs.
NTIS
Intrusion; Warning Systems; Planning; Education

20030034663 Raytheon Electronic Systems, El Segundo, CA, USA
Information Assurance Reliability Model (IARM)
Gotfried, Roberta L.; Moore, Robert J.; Kuckelman, Mark J.; Sep. 2002; 7 pp.; In English
Contract(s)/Grant(s): F33615-00-C-1628; AF Proj. ARPI
Report No.(s): AD-A410474; AFRL-IF-WP-TP-2002-501; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this effort is to design, develop, document, demonstrate, evaluate, and deliver science-based methods for information assurance (IA) design and assessment. The ultimate goal of the proposed research is to improve the IA reliability and robustness of systems overall and their ability to withstand asymmetric attacks. This can be achieved by means of scientific methods and modeling techniques that assist in specifying requisite IA protection of a system, and in measuring the ability of a design or implementation of a system to meet that specification. The results of IARM research during its two phases demonstrate that a reliability approach to IA of systems shows a lot of promise, and can contribute to more rapid maturation of the field and increased reliability of systems against IA attacks. The current predominance of IA research into defense against specific attacks, and the lack of useful metrics collection are ignoring this promising direction for research and systems engineering. IARM researchers have observed that too little thought is being given to useful metrics to collect during system operation, and in the course of other IA research. For example, currently, it is common to measure the amount of time it takes a Red Team to attack a given system. However, metrics and observations related to the effect of various Red Team or hacker actions on a system would contribute significantly to the growth of IA reliability and the ability to integrate IA approaches within the system engineering process. The article reviews phase 1 of the project, which included mathematical modeling using continuous time Markov chains and computing state transition diagram transition probabilities and transition rates, and phase 2 of the project, which included real time reliability monitoring, top level architecture, and human behavioral modeling of attackers and security system administrators using variations of game theory. (13 refs.)
DTIC
Mathematical Models; Systems Engineering; Reliability Analysis; Information Systems

20030037015 Pacific Northwest National Lab., Richland, WA
PNNL Information Technology Benchmarking
Hostetler, D. D.; Goolsbey, J. E.; Niesen, D. A.; Phillips, A. C.; Aug. 1999; 14 pp.
Report No.(s): DE2002-15001473; No Copyright; Avail: Department of Energy Information Bridge

Benchmarking is a methodology for searching out industry best practices that lead to superior performance. It is exchanging information, not just with any organization, but with organizations known to be the best within PNNL, in industry, or in dissimilar industries with equivalent functions. It is used as a continuous improvement tool for business and technical processes, products, and services. Information technology comprising all computer and electronic communication products and services underpins the development and/or delivery of many PNNL products and services. The purpose is to engage other organizations in the collaborative process of benchmarking in order to improve the value of IT services provided to customers. TM documents intended audience consists of other U. S. Department of Energy (DOE) national laboratories and their IT staff. Although the individual participants must define the scope of collaborative benchmarking, an outline of IT service areas for possible benchmarking is described.
NTIS
Laboratories; Information Dissemination; Information Systems

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

20030036983 Bureau of International Labor Affairs, Washington, DC
Advancing the Campaign Against Child Labor. Volume 2: Addressing the Worst Forms of Child Labor
2002; 54 pp.; In English
Report No.(s): PB2003-102671; No Copyright; Avail: CASI; A04, Hardcopy

This report examines some action strategies related to efforts to eliminate the worst forms of child labor, some issues in developing these strategies, and some examples of how strategies have been implemented in actual projects. The report suggests that there is no one strategy or mix of strategies that can be isolated as appropriate or most cost-effective for addressing all cases of the worst forms of child labor. Actions taken need to be designed according to the context in which child labor is found.
NTIS
Cost Effectiveness; Labor; Children

20030038797 Lawrence Livermore National Lab., Livermore, CA

Whither Deterrence. A Brief Synopsis

Poppe, C.; Vergino, E.; Barker, B.; Brown, P.; Gilmartin, T. J.; May 29, 2002; 20 pp.

Report No.(s): DE2002-15002153; UCRL-ID-148557; No Copyright; Avail: Department of Energy Information Bridge

To most audiences, deterrence has been interconnected with nuclear weapons whose purpose had been to deter a Soviet attack. But, the Soviet Union has been gone for almost a decade. President George W. Bush has stated that Russia is not an enemy of the USA and the numbers of nuclear weapons can be dramatically reduced. It is important to note that deterrence has always transcended nuclear weapons. The USA first line of deterrence has been its formidable conventional warfare capability, designed to prevent conflict and win wars if necessary. The role of nuclear weapons has been to deter the use of nuclear weapons and other weapons of mass destruction against U.S. interests during the conduct of conventional warfare and to ensure our ability to inflict massive destruction on any who would use nuclear weapons, or other weapons of mass destruction, against us. With regard to the Soviet Union, the threat of the use of nuclear weapons was a critical component of our deterrent to prevent massive Soviet conventional attack against our allies in Europe.

NTIS

Nuclear Weapons; Military Operations; Strategy

20030038803 Lawrence Livermore National Lab., Livermore, CA

WSSX-A Joint U.S.-Russian Nuclear Counter-Terrorism Exchange

Crites, T. R.; Sep. 25, 2002; 12 pp.

Report No.(s): DE2002-15002158; UCRL-JC-149057; No Copyright; Avail: Department of Energy Information Bridge

In 1994, the U. S. and Russian Federation governments formally agreed to exchange information on the safety and security of nuclear weapons. This agreement included three major elements, called Technical Working Groups (TWGs). TWG C deals with counter-terrorism. Its four assigned actions and U.S./Russian experience are reviewed in this paper. Although active exchange programs were created under TWGs A and B, involving workshops and laboratory-to-laboratory development projects, little work was initiated in TWG C, due to the sensitive nature of this information. After 9/11, however, it became clear that much could be gained by having each country share information to help solve the problem of nuclear proliferation among terrorist groups. Government-to-government meetings have reaffirmed the initial agreement to exchange information on this topic, and a number of joint project proposals are now under discussion. The Joint Steering Committee that oversees this exchange has approved approximately 20 projects. They include such topics as terrorist threat scenario development, detection of nuclear material and explosives in transportation containers, analysis of material mass and configuration, and consequence mitigation. It is expected that the joint development of these capabilities will enhance our ability to respond to a nuclear threat and to facilitate mutual assistance, should either party experience a nuclear terrorist event.

NTIS

United States; Russian Federation; International Cooperation; Terrorism; Nuclear Weapons

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.

20030034667 Tokai Univ., Kanagawa, Japan

Development of The Navigation System for The Visually Impaired by Using Optical Beacons

Magatani, Kazushige; Sawa, Koji; Yanashima, Kenji; Oct 2001; 4 pp.; In English

Report No.(s): AD-A410481; No Copyright; Avail: CASI; A01, Hardcopy

Our objective of this study is the development of the navigation system which is used in the indoor space(eg. underground shopping mall, hospital, etc.) and supports activities of the visually impaired without help of others. This system is composed of optical beacons which are set on the ceiling and emit the position code as infrared signal, an optical receiver which receives signal from beacons, and a navigator which guides a user by artificial voice. Three subjects with low vision were tested in the hospital with our navigation system. 49 optical beacons were set on the ceiling, and the subject equipped with an optical receiver and a navigator. Each subject walked from the start point to the destination following the guidance voice. From these experiment, the following characteristics became clear. 1) On a pathway where a subject can fell the wall, every subjects could follow the navigation voice. 2) Some subjects couldn't go across the wide pathway straight, and then the system lost their

position. Therefore, if the problem of crossing the pathway is improved, our navigation system will be a very valuable one to support activities of the visually impaired.
DTIC

20030036978 Lawrence Livermore National Lab., Livermore, CA
Science & Tecnology Review: Modeling Fires to Fight Them
2002; In English
Report No.(s): DE2002-15002347; No Copyright; Avail: National Technical Information Service (NTIS)
Contents include the following: High-Tech Help for Fighting Wildfires; This Model Can Take the Heat; The Best and the Brightest Come to Livermore; A View to a Kill, and Biological Research Evolves at Livermore.
NTIS
Fires; Fire Fighting; Research

20030037097 Department of Energy, Washington, DC
Environmental Management Performance Report November 2000
Nov. 09, 2000; 254 pp.; In English
Report No.(s): DE2002-805449; No Copyright; Avail: Department of Energy Information Bridge
The purpose of the Environmental Management Performance Report (EMPR) is to provide the Department of Energy Richland Operations Office's (DOE-RL's) report of Hanford's Environmental Management (EM). This report is a monthly publication that summarizes EM Site performance under RL Operations Office.
NTIS
Waste Management; Spent Fuels; Radioactive Wastes

20030037120 Foersvarets Forskningsanstalt, Stockholm (Sweden)
Air Power - Future Capability in Russia
Loefstedt, H.; Mar. 2002; 112 pp.
Report No.(s): PB2003-101261; FOI-R-0439-SE; No Copyright; Avail: CASI; A06, Hardcopy
There is a rapid evolution in guided weapons. Russia has capability and knowledge to follow and implement that development. There might well be a considerable shift in Russian present capacity to conduct air-to-ground operations if Russia will acquire such weapons. That shift is possible even if Russia must restrict itself to the use of existing aircraft. A condition is that the Russian Air Force will develop normal status in maintenance of equipment and personnel training. Russian air capability will develop into a threat only after a political upheaval. To guard against that, it is necessary to give political and material support for continued democratic evolution. However an armed air defense will be needed as a last resort. The data and considerations behind the conclusions are presented in the second part of the report. The way is described how a great number of performance data are combined to aggregated capability figures. Data from Kosovo and Kuwait-war are used for air to ground weapons. A new method has been developed for air-to-air equipment. A number of sensitivity analyses are carried through because of the uncertainty in data and methods.
NTIS
Military Technology; Precision Guided Projectiles; Air To Surface Missiles; Armed Forces (Foreign); Russian Federation

20030037183 Westinghouse Savannah River Co., Aiken, SC
SME Acceptability Determination For DWPF Process Control (U)
Aug. 30, 2002; 74 pp.; In English
Report No.(s): DE2002-805889; WSRC-TR-95-000364-REV-4; No Copyright; Avail: Department of Energy Information Bridge
This document has supported the technical basis for the Defense Waste Processing Facility (DWPF) of the Savannah River Site (SRS) since the DWPF began radioactive operation in 1996. The facility blends High Level Waste (HLW) with glass frit and vitrifies the resulting mix into a stable, borosilicate wasteform. While doing so, it must satisfy, with appropriate confidence, several product and process constraints. These include constraints on: the process melt (i.e., melt viscosity and liquidus temperature) to assure that the material is processable and the quality of the resulting wasteform (i.e., durability of the glass product).
NTIS
Statistics; Process Control (Industry); Waste Treatment; Borosilicate Glass

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*.

20030032527 NASA Glenn Research Center, Cleveland, OH, USA

Radiative Heat Loss Measurements During Microgravity Droplet Combustion in a Slow Convective Flow

Hicks, Michael C.; Kaib, Nathan; Easton, John; Nayagam, Vedha; Williams, Forman A.; March 2003; 11 pp.; In English; Third Joint Meeting of the U.S. Sections of the Combustion Institute, 16-19 Mar. 2003, Chicago, IL, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS-22-101-32-09

Report No.(s): NASA/TM-2003-212216; NAS 1.15:212216; E-13837; Copyright; Avail: CASI; A03, Hardcopy

Radiative heat loss from burning droplets in a slow convective flow under microgravity conditions is measured using a broad-band (0.6 to 40 microns) radiometer. In addition, backlit images of the droplet as well as color images of the flame were obtained using CCD cameras to estimate the burning rates and the flame dimensions, respectively. Tests were carried out in air at atmospheric pressure using n-heptane and methanol fuels with imposed forced flow velocities varied from 0 to 10 centimeters per second and initial droplet diameters varied from 1 to 3 millimeters. Slow convective flows were generated using three different experimental configurations in three different facilities in preparation for the proposed International Space Station droplet experiments. In the 2.2 Second Drop-Tower Facility a droplet supported on the leading edge of a quartz fiber is placed within a flow tunnel supplied by compressed air. In the Zero-Gravity Facility (five-second drop tower) a tethered droplet is translated in a quiescent ambient atmosphere to establish a uniform flow field around the droplet. In the KC 135 aircraft an electric fan was used to draw a uniform flow past a tethered droplet. Experimental results show that the burn rate increases and the overall flame size decreases with increases in forced-flow velocities over the range of flow velocities and droplet sizes tested. The total radiative heat loss rate, Q(sub r), decreases as the imposed flow velocity increases with the spherically symmetric combustion having the highest values. These observations are in contrast to the trends observed for gas-jet flames in microgravity, but consistent with the observations during flame spread over solid fuels where the burning rate is coupled to the forced flow as here.

Author

Microgravity; Burning Rate; Radiative Heat Transfer; Thermal Radiation; Drop Towers; Fuel Combustion; Convective Flow

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030032269 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Discovery of a New Nearby Star

Teegarden, B. J.; Pravdo, S. H.; Covey, K.; Frazier, O.; Hawley, S. L.; Hicks, M.; Lawrence, K.; McGlynn, T.; Reid, I. N.; Shaklan, S. B.; [2003]; 11 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

We report the discovery of a nearby star with a very large proper motion of 5.06 +/- 0.03 arcsec/yr. The star is called SO025300.5+165258 and referred to herein as HPMS (high proper motion star). The discovery came as a result of a search of the SkyMorph database, a sensitive and persistent survey that is well suited for finding stars with high proper motions. There are currently only 7 known stars with proper motions greater than 5 arcsec/yr. We have determined a preliminary value for the parallax of pi = 0.43 +/- 0.13 arcsec. If this value holds our new star ranks behind only the Alpha Centauri system (including Proxima Centauri) and Barnard's star in the list of our nearest stellar neighbours. The spectrum and measured tangential velocity indicate that HPMS is a main-sequence star with spectral type M6.5. However, if our distance measurement is correct, the HPMS is underluminous by 1.2 +/- 0.7 mag.

Author

M Stars; Stellar Motions; Data Bases; Sky Surveys (Astronomy); Main Sequence Stars

20030032274 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Building A New Kind of Graded-Z Shield for Swift's Burst Alert Telescope

Robinson, David W.; July 15, 2002; 8 pp.; In English; SPIE Astronomical Telescopes and Instrumentation, 22-28 Aug. 2002, Waikola, HI, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The Burst Alert Telescope (BAT) on Swift has a graded-Z Shield that closes out the volume between the coded aperture mask and the Cadmium-Zinc-Telluride (CZT) detector array. The purpose of the 37 kilogram shield is to attenuate gamma rays that have not penetrated the coded aperture mask of the BAT instrument and are therefore a major source of noise on the detector array. Unlike previous shields made from plates and panels, this shield consists of multiple layers of thin metal foils (lead, tantalum, tin, and copper) that are stitched together much like standard multi-layer insulation blankets. The shield sections are fastened around BAT, forming a curtain around the instrument aperture. Strength tests were performed to validate and improve the design, and the shield will be vibration tested along with BAT in late 2002. Practical aspects such as the layup design, methods of manufacture, and testing of this new kind of graded-Z Shield are presented.

Author

Electromagnetic Shielding; Spaceborne Telescopes; Gamma Ray Bursts; Gamma Ray Astronomy; Gamma Ray Telescopes

20030032301 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Imaging X-ray Detector for Lobster-ISS

Black, J. K.; Brunton, A. N.; Bannister, N. P.; Deines-Jones, P.; Jahoda, K.; [2003]; 5 pp.; In English; Nuclear Instruments and Methods A. 6th International Conference on Position Sensitive Detectors, 9-13 Sep. 2002, Leicester, UK; Original contains black and white illustrations; Copyright; Avail: Other Sources

Lobster-ISS is a revolutionary astrophysical X-ray all-sky monitor scheduled for deployment as an attached payload on the International Space Station (ISS) in 2009. Using a new wide field-of-view focusing optic, Lobster-ISS provides an order-of-magnitude improvement in the sensitivity of all-sky monitors in the soft X-ray band (0.1 - 3.0 keV). This lobster-eye optic presents unique challenges to the imaging X-ray detector at its focus. Micro-patterned imaging proportional counters, with their mechanical simplicity and high performance are the most practical means of meeting the requirements. We describe our design for the Lobster-ISS X-ray imaging detector based on direct-imaging micro-well proportional counters and the expected performance.

Author

X Ray Astronomy; X Ray Telescopes; X Ray Imagery; X Ray Detectors

20030032409 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Using Multiwavelength Observations to Determine the Black Hole Mass and Accretion Rate in the Type 1 Seyfert Galaxy NGC 5548

Chiang, James; Blaes, Omer; [2002]; 20 pp.; In English

Contract(s)/Grant(s): NGC-5548; NAG5-7723; NAG7-075; No Copyright; Avail: CASI; A03, Hardcopy

We model the spectral energy distribution of the type 1 Seyfert galaxy NGC 5548, fitting data from simultaneous optical, UV, and X-ray monitoring observations. We assume a geometry consisting of a hot central Comptonizing region surrounded by a thin accretion disk. The properties of the disk and the hot central region are determined by the feedback occurring between the hot Comptonizing region and thermal reprocessing in the disk that, along with viscous dissipation, provides the seed photons for the Comptonization process. The constraints imposed upon this model by the multiwavelength data allow us to derive limits on the central black hole mass, Mu is approximately or less than 2x10(exp 7) solar mass, the accretion rate, Mu is approximately or less than 2.5x10(exp 5) sq solar mass per year/Mu, and the radius of the transition region between the thin outer disk and the geometrically thick, hot inner region, is approximately 2-5x10(exp 14) cm.

Author

Spectral Energy Distribution; Line Spectra; Seyfert Galaxies; Active Galactic Nuclei; Black Holes (Astronomy); X Ray Spectroscopy

20030032414 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Servicing and Deployment of National Resources in Sun-Earth Libration Point Orbits

Folta, David C.; Beckman, Mark; Mar, Greg C.; Mesarch, Michael; Cooley, Steven; Leete, Steven J.; [2002]; 12 pp.; In English; 53th International Astronautical Congress: The World Space Congress - 2002, 10-19 Oct. 2002, Houston, TX, USA Report No.(s): IAC-02-Q.6.08; No Copyright; Avail: CASI; A03, Hardcopy

Spacecraft travel between the Sun-Earth system, the Earth-Moon system, and beyond has received extensive attention

recently. The existence of a connection between unstable regions enables mission designers to envision scenarios of multiple spacecraft traveling cheaply from system to system, rendezvousing, servicing, and refueling along the way. This paper presents examples of transfers between the Sun-Earth and Earth-Moon systems using a true ephemeris and perturbation model. It shows the (Delta)V costs associated with these transfers, including the costs to reach the staging region from the Earth. It explores both impulsive and low thrust transfer trajectories. Additionally, analysis that looks specifically at the use of nuclear power in libration point orbits and the issues associated with them such as inadvertent Earth return is addressed. Statistical analysis of Earth returns and the design of biased orbits to prevent any possible return are discussed. Lastly, the idea of rendezvous between spacecraft in libration point orbits using impulsive maneuvers is addressed.
Author
Costs; Deployment; Earth-Moon System; Refueling; Rendezvous Spacecraft; Spacecraft Orbits; Sun; Trajectories

20030032416 Hawaii Univ., Honolulu, HI, USA
A Study of Planetary System Formation and Evolution Using a Dual Channel Adaptive Optics Imaging Polarimeter
Potter, Daniel E.; [2003]; 4 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NGT5-50357; No Copyright; Avail: CASI; A01, Hardcopy

The award I received from the Graduate Student Research Program in 2001, and the renewal award in 2002, supported the gathering and processing of my thesis data, and the presentation of my scientific results at astronomy conferences. Ultimately, this led to a successful defense of my PhD thesis. In the thesis work, I built, calibrated, and observed with the first dual imaging polarimeter ever used in series with a high order adaptive optics system and on an 8 meter class telescope. The instrument was arguably the most sensitive instrument for the high-contrast detection of the scattered light from circumstellar disks. The success of the instrument has provided the impetus for the construction of several similar simultaneous adaptive optics imaging polarimeters. In the course of the observations, a number of circumstellar disks were resolved for the first time in their scattered light, such as the disk around the classical T-tauri stars, LkCa 15 and LkHa 262. A sample of 24 young, nearby, solar-analog stars were observed with the instrument in search of the scattered light signature from debris disks around these stars. Although none of the stars revealed any obvious scattered light signatures, a meaningful limit was placed on the dust population around these stars. Also, a brown dwarf binary system was found to be a companion to one of the solar-analog stars observed, HD130948. A careful monitoring of the orbit of the binary brown dwarf will result in a dynamical mass determination of the objects, providing a valuable calibration of the physical models explaining brown dwarf evolution.
Author
Planetary Evolution; Polarimeters; Astronomical Polarimetry; Stellar Envelopes

20030032428 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Where was the Iron Synthesized in Cassiopeia A?
Hwang, Una; Laming, J. Martin; [2003]; 22 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

We investigate the properties of Fe-rich knots on the east limb of the Cassiopeia A supernova remnant observed with Chandra/AXAF CCD Imaging Spectrometer (ACIS). Using analysis methods developed in a companion paper, we constrain the ejecta density profile and the Lagrangian mass coordinates of the knots from their fitted ionization age and electron temperature. Fe-rich knots which also have strong emission from Si, S, Ar, and Ca are clustered around mass coordinates q approx. equal to 0.35 - 0.4 in the shocked ejecta of 2 solar masses; this places them 0.7 - 0.8 solar masses out from the center (or 2 - 2.1 solar masses, allowing for the mass of a compact object). We also find an Fe clump that is evidently devoid of line emission from lower mass elements, as would be expected for a region that had undergone alpha-rich freeze out. This clump has a similar mass coordinate to the other Fe knots.
Author
Cassiopeia A; Supernova Remnants; Iron; Ejecta; Lagrange Coordinates; Ionization; Electron Energy

20030032430 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evaluation of Models for Diffuse Continuum Gamma Rays in EGRET Range
Strong, A.; Moskalenko, I. V.; Reimer, O.; March 07, 2003; 1 pp.; In English; 28th ICRC, 31 Jul. - 7 Aug. 2003, Japan; Copyright; Avail: Other Sources; Abstract Only

The GALPROP model for cosmic-ray propagation produces explicit predictions for the angular distribution of gamma-rays. We compare our current models with EGRET spectra for various regions of the sky. This allows a critical test of alternative hypotheses for the observed GeV excess. We show that a population of hard-spectrum sources cannot be solely

responsible for the excess since it also appears at high latitudes; on the other hand the 'hard electron' spectrum model cannot explain the gamma-ray excess in the inner Galaxy. Hence some combination of these explanations is required.
Author
Gamma Ray Telescopes; Gamma Rays; Cosmic Rays; Diffuse Radiation; Continuums

20030032929 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On the Prospects of Measuring the Cosmic History of Element Synthesis with Future Far-IR/Submillimeter Observatories
Leisawitz, David; [2003]; 1 pp.; In English; American Astronomical Society Meeting, 5-9 Jan. 2003, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

To understand the cosmic history of element synthesis it will be important to obtain extinction-free measures of the heavy element contents of high-redshift objects and to chart two monumental events: the collapse of the first metal-free clouds to form stars, and the initial seeding of the universe with dust. The information needed to achieve these objectives is uniquely available in the far-infrared/submillimeter (FIR/SMM) spectral region. Following the Decadal Report and anticipating the development of the Single Aperature Far-IR (SAFIR) telescope capabilities of a large-aperature, background-limited FIR/SMM observatory and an interferometer on a boom, and discuss how such instruments could be used to measure the element synthesis history of the universe.
Author
Heavy Elements; Red Shift; Cosmology; Synthesis (Chemistry); Galactic Evolution

20030032938 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Hot HB Stars in Globular Clusters - Physical Parameters and Consequences for Theory. VI. The Second Parameter Pair M3 and M13
Moehler, S.; Landsman, W. B.; Sweigart, A. V.; Grundahl, F.; [2002]; 13 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): DLR-50 OR-96029-ZA; Copyright; Avail: CASI; A03, Hardcopy

We present the results of spectroscopic analyses of hot horizontal branch (HB) stars in M13 and M3, which form a famous second parameter pair. From the spectra we derived - for the first time in M13 - atmospheric parameters (effective temperature and surface gravity) as well as abundances of helium, magnesium, and iron. Consistent with analyses of hot HB stars in other globular clusters we find evidence for helium depletion and iron enrichment in stars hotter than about 12,000 K in both M3 and M13. Accounting for the iron enrichment substantially improves the agreement with canonical evolutionary models, although the derived gravities and masses are still somewhat too low. This remaining discrepancy may be an indication that scaled-solar metal-rich model atmospheres do not adequately represent the highly non-solar abundance ratios found in blue HB stars with radiative levitation. We discuss the effects of an enhancement in the envelope helium abundance on the atmospheric parameters of the blue HB stars, as might be caused by deep mixing on the red giant branch or primordial pollution from an earlier generation of intermediate mass asymptotic giant branch stars.
Author
Globular Clusters; Horizontal Branch Stars; Stellar Spectra; Spectroscopic Analysis; Hot Stars

20030032992 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Gas Production Rate and Coma Structure of Comet C/1995 01 (Hale-Bopp)
Morgenthaler, Jeffrey P.; Harris, Walter M.; Roesler, Frederick L.; Scherb, Frank; Anderson, Christopher M.; Doane, Nathaniel E.; Oliversen, Ronald J., Kluwer; Earth, Moon, and Planets; 2002; Volume 90, pp. 1-11; In English; Copyright; Avail: Other Sources; Abstract Only

The University of Wisconsin-Madison and NASA-Goddard conducted a comprehensive multi-wavelength observing campaign of coma emissions from comet Hale-Bopp, including OH 3080 A, [O I] 6300 A, H2O(+) 6158 A, H Balmer-alpha 6563 A, NH2 6330 A, [C I] 9850 A CN 3879 A, C2 5141 A, C3 4062 A, C I 1657 A, and the UV and optical continua. In this work, we concentrate on the results of the H2O daughter studies. Our wide-field OH 3080 A measured flux agrees with other, similar observations and the expected value calculated from published water production rates using standard H2O and OH photochemistry. However, the total [O I] 6300 A flux determined spectroscopically over a similar field-of-view was a factor of 3 - 4 higher than expected. Narrow-band [O I] images show this excess came from beyond the H2O scale length, suggesting either a previously unknown source of [O I] or an error in the standard OH + upsilon to O((sup I)D) + H branching ratio. The Hale-Bopp OH and [O I] distributions, both of which were imaged to cometocentric distances greater than 1 x

10(exp 6) km, were more spatially extended than those of comet Halley (after correcting for brightness differences), suggesting a higher bulk outflow velocity. Evidence of the driving mechanism for this outflow is found in the H(alpha) line profile, which was narrower than in comet Halley (though likely because of opacity effects, not as narrow as predicted by Monte-Carlo models). This is consistent with greater collisional coupling between the suprathermal H photodissociation products and Hale-Bopp's dense coma. Presumably because of mass loading of the solar wind by ions and ions by the neutrals, the measured acceleration of H2O(+) down the ion tail was much smaller than in comet Halley. Tailward extensions in the azimuthal distributions of OH 3080 A, [O I], and [C I], as well as a Doppler asymmetry in the [O I] line profile, suggest ion-neutral coupling. While the tailward extension in the OH can be explained by increased neutral acceleration, the [O I] 6300 A and [C I] 9850 A emissions show 13\% and less than 200\% excesses in this direction (respectively), suggesting a non-negligible contribution from dissociative recombination of CO(+) and/or electron collisional excitation. Thus, models including the effects of photo-and collisional chemistry are necessary for the full interpretation of these data.
Author
Gas Streams; Wavelengths; Balmer Series; Brightness; Excitation; Halley's Comet; Photochemical Reactions

20030032993 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Latitude-Dependent Effects in the Stellar Wind of Eta Carinae
Smith, Nathan; Davidson, Kris; Gull, Theodore R.; Ishibashi, Kazunori; Hillier, D. John; [2002]; 21 pp.; In English
Contract(s)/Grant(s): NAS5-26555; GO-8327; Copyright; Avail: CASI; A03, Hardcopy

The Homunculus reflection nebula around eta Carinae provides the rare opportunity to observe the spectrum of a star from more than one direction. In the case of eta Car, the nebula's geometry is known well enough to infer how wind profiles vary with latitude. We present STIS spectra of several positions in the Homunculus, showing directly that eta Car has an aspherical and axisymmetric stellar wind. P Cygni absorption in Balmer lines depends on latitude, with relatively high velocities and strong absorption near the polar axis. Stronger absorption at high latitudes is surprising, and it suggests higher mass flux toward the poles, perhaps resulting from equatorial gravity darkening on a rotating star. Reflected profiles of He I lines are more puzzling, and offer clues to eta Car's wind geometry and ionization structure. During eta Car's high-excitation state in March 2000, the wind had a fast, dense polar wind, with higher ionization at low latitudes. Older STIS data obtained since 1998 reveal that this global stellar-wind geometry changes during eta Car's 5.5 year cycle, and may suggest that this star s spectroscopic events are shell ejections. Whether or not a companion star triggers these outbursts remains ambiguous. The most dramatic changes in the wind occur at low latitudes, while the dense polar wind remains relatively undisturbed during an event. The apparent stability of the polar wind also supports the inferred bipolar geometry. The wind geometry and its variability have critical implications for understanding the 5.5 year cycle and long-term variability, but do not provide a clear alternative to the binary hypothesis for generating eta Car s X-rays.
Author
Latitude; Stellar Winds; Nebulae; A Stars; Asphericity; Companion Stars; Line Spectra; Liquid Helium

20030033021 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Recent X-ray Variability of Eta Car Approaching The X-ray Eclipse
Corcoran, M.; Swank, J. H.; Ishibashi, K.; Gull, T.; Humphreys, R.; Damineli, A.; Walborn, N.; Hillier, D. J.; Davidson, K.; White, S. M., Americ; Bulletin of the American Astronomical Society; [2002]; Volume 34, No. 4; 1 pp.; In English; AAS 201st Meeting, 5-9 Jan. 2003, Seattle, WA, USA; Copyright; Avail: Other Sources; Abstract Only

We discuss recent X-ray spectral variability of the supermassive star Eta Car in the interval since the last X-ray eclipse in 1998. We concentrate on the interval just prior to the next X-ray eclipse which is expected to occur in June 2003. We compare the X-ray behavior during the 2001-2003 cycle with the previous cycle (1996-1998) and note similarities and differences in the temporal X-ray behavior. We also compare a recent X-ray observation of Eta Car obtained with the Chandra high energy transmission grating in October 2002 with an earlier observation from Nov 2002, and interpret these results in terms of the proposed colliding wind binary model for the star. In addition we discuss planned observations for the upcoming X-ray eclipse.
Author
X Ray Binaries; Supermassive Stars; X Ray Astronomy; X Ray Spectra; Eclipsing Binary Stars; Variable Stars

20030033091 NASA Ames Research Center, Moffett Field, CA, USA
Luminescence from Vacuum-Ultraviolet-Irradiated Cosmic Ice Analogs and Residues
Gudipati, Murthy S.; Dworkin, Jason P.; Chillier, Xavier D. F.; Allamandola, Louis J., Americ; The Astrophysical Journal; 20 Jan. 2003; Volume 583, No. 1, pp. 1-10; In English
Contract(s)/Grant(s): NCC2-1303; RTOP 344-38-12-04; RTOP 344-50-92-02; Copyright; Avail: CASI; A02, Hardcopy

Here we report a study of the optical luminescent properties for a variety of vacuum-ultraviolet (VUV)- irradiated cosmic ice analogs and the complex organic residues produced. Detailed results are presented for the irradiated, mixed molecular ice: H2O:CH3OH:NH3:CO (100:50:1:1), a realistic representation for an interstellar/precometary ice that reproduces all the salient infrared spectral features associated with interstellar ices. The irradiated ices and the room-temperature residues resulting from this energetic processing have remarkable photoluminescent properties in the visible (520-570 nm). The luminescence dependence on temperature, thermal cycling, and VUV exposure is described. It is suggested that this type of luminescent behavior might be applicable to solar system and interstellar observations and processes for various astronomical objects with an ice heritage. Some examples include grain temperature determination and vaporization rates, nebula radiation balance, albedo values, color analysis, and biomarker identification.
Author
Luminescence; Far Ultraviolet Radiation; Ice; Irradiation; Residues; Organic Compounds

20030033859 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Chandra Observations of a Young Embedded Magnetic B Star in the p Ophiuchus Cloud
Hamaguchi, Kenji; Imanishi, Kensuke; January 2002; 28 pp.; In English; Document missing every even page number.; Copyright; Avail: CASI; A03, Hardcopy

This paper reports the analysis of two Chandra X-ray observations of the young magnetic B star rho Ophiuchus S1. X-ray emission from the star was detected in both observations. The average flux is almost the same in both, but during each observation the flux shows significant time variations by a factor of two on timescales of 20-40 ksec. Each spectrum can be fit by either an absorbed power law model with a photon index of approx. -3 or a thin-thermal plasma model with a temperature of approx. 2 keV and an extremely low metal abundance (approx. less than 0.1 solar). The spectrum of the first observation has an apparent line feature at about 6.8 keV, which likely corresponds to highly ionized iron K alpha. In contrast, the spectrum of the second observation shows an anomalous edge absorption component at E approx. 1 keV. The continuum emission and log (L(sub X)/L(sub bol)) approx. -6 are similar to those of young intermediate-mass stars (Herbig Ae/Be stars) although the presence of the magnetic field inferred from the detection of non-thermal radio emission has drawn an analogy between rho Ophiuchus S1 and magnetic chemically peculiar (MCP) stars. If the X-ray emission is thermal, the highest plasma temperature observed is too high to be explained by the conventional theories of magnetic stars, and favors some kind of magnetic dynamo activity, while if the emission is nonthermal, it might be related to mass infall. The 6.8 keV line and 4 keV edge features are marginal but they give important information near the stellar body if they are real. Their physical interpretation is discussed.
Author
B Stars; Magnetic Stars; Molecular Clouds; X Ray Astronomy; Peculiar Stars

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030032296 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Imaging Large Scale Structure in the X-ray Sky
Yang, Y.; Mushotzky, R. F.; Barger, A. J.; Cowie, L. L.; Sanders, D. B.; Steefen, A. T.; January 2003; 4 pp.; In English; CD-ROM contains full text document in PDF format
Contract(s)/Grant(s): NSF AST-0084847; NSF AST-0084816; Copyright; Avail: CASI; A01, Hardcopy

We present the first results of a wide solid angle, moderately deep Chandra survey of the Lockman Hole North West Region. Our 9 ACIS-I fields cover an effective solid angle of 0.33 sq deg and reach a depth of 3 x 10(exp -16) erg/sq cm/s in the 0.4-2 keV band, and 3 x 10(exp -15) erg/sq cm/s in the 2-8 keV band. The best fit logN-logS for the entire field, the largest contiguous Chandra field yet observed, matches well onto that of the Chandra Deep Field North. This indicates that over 90\% of the 2-8 keV X-ray background is resolved into point sources. We show that the full range of the 'cosmic variance' previously seen in different Chandra fields can be reproduced in a small region of the sky. The count-in-cells analysis shows that the 2-10 keV band sources have much larger angular correlation scale than that of the 0.4-2 keV band. We found the large difference is likely to be caused by a stronger spatial correlation in the hard band sources rather than the redshift effect.
Author
Large-Scale Structure Of The Universe; X Ray Astronomy; Active Galaxies; Galactic Nuclei; X Ray Imagery

20030032465 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Role of Rotation in the Evolution of Massive Stars

Heap, Sara R.; Lanz, Thierry M.; [2003]; 1 pp.; In English; AAS Meeting, 5-10 Jan. 2003, Seattle, WA, USA

Contract(s)/Grant(s): GO-7437; FUSE-B134; No Copyright; Avail: Other Sources; Abstract Only

Recent evolutionary models of massive stars predict important effects of rotation including: increasing the rate of mass loss; lowering the effective gravity; altering the evolutionary track on the Hertzsprung-Russel Diagram (HRD); extending the main-sequence phase (both on the HR diagram and in time); and mixing of CNO-processed elements up to the stellar surface. Observations suggest that rotation is a more important factor at lower metallicities because of higher initial rotational velocities and weaker winds. This makes the Small Magellanic Cloud (SMC), a low-metallicity galaxy (Z=0.2 solar Z), an excellent environment for discerning the role of rotation in massive stars. We report on a FUSE+STIS+optical spectral analysis of 17 O-type stars in the SMC, where we found an enormous range in N abundances. Three stars in the sample have the same (low) CN abundances as the nebular material out of which they formed, namely C=0.085 solar C and N=0.034 solar N. However, more than half show N approx. solar N, an enrichment factor of 30X! Such unexpectedly high levels of N have ramifications for the evolution of massive stars including precursors to supernovae. They also raise questions about the sources of nitrogen in the early universe. This study was supported in part by grants from NASA's ADP, HST GO-7437, and FUSE B134.

Author

Stellar Evolution; O Stars; Spectrum Analysis; Stellar Spectra; Stellar Composition; Stellar Rotation; Massive Stars

20030032471 NASA Goddard Space Flight Center, Greenbelt, MD, USA

On the Determination of Ejecta Structure and Explosion Asymmetry from the X-ray Knots of Cassiopeia A

Laming, J. Martin; Hwang, Una; [2003]; 31 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

We present a detailed analysis of Chandra X-ray spectra from individual ejecta knots in the supernova remnant Cassiopeia A. The spectra are fitted to give the electron temperature T(sub e), and (single) ionization age n(sub e)t. These quantities are compared with the predictions of self similar hydrodynamic models incorporating time dependent ionization and radiation losses, and Coulomb electron-ion equilibration behind the reverse shock, for a variety of different ejecta density profiles described by a uniform density core and a power law envelope. We find that the ejecta close to the 'jet' region in the NE, but not actually in the jet itself, have a systematically shallower outer envelope than ejecta elsewhere in the remnant, and we interpret this as being due to more energy of the initial explosion being directed in this polar direction as opposed to equatorially. The degree of asymmetry we infer is at the low end of that generally modelled in asymmetric core-collapse simulations, and may be used to rule out highly asymmetric explosion models.

Author

X Ray Spectra; X Ray Spectroscopy; Spectrum Analysis; Cassiopeia A; Astronomical Models; Mathematical Models; Asymmetry; Ejecta; Computerized Simulation; Applications Programs (Computers)

20030032928 NASA Marshall Space Flight Center, Huntsville, AL, USA

Statistical Properties of Maximum Likelihood Estimators of Power Law Spectra Information

Howell, L. W.; December 2002; 61 pp.; In English; Original contains black and white illustrations

Report No.(s): NASA/TP-2002-212020/REV1; M-1056; NAS 1.60:212020/REV1; No Copyright; Avail: CASI; A04, Hardcopy

A simple power law model consisting of a single spectral index, alpha(sub 1), is believed to be an adequate description of the galactic cosmic-ray (GCR) proton flux at energies below 10(exp 13) eV, with a transition at the knee energy, Epsilon(sub k), to a steeper spectral index alpha(sub 2) is greater than alpha(sub 1) above Epsilon(sub k). The maximum likelihood (ML) procedure was developed for estimating the single parameter alpha(sub 1) of a simple power law energy spectrum and generalized to estimate the three spectral parameters of the broken power law energy spectrum from simulated detector responses and real cosmic-ray data. The statistical properties of the ML estimator were investigated and shown to have the three desirable properties: (P1) consistency (asymptotically unbiased), (P2) efficiency (asymptotically attains the Cramer-Rao minimum variance bound), and (P3) asymptotically normally distributed, under a wide range of potential detector response functions. Attainment of these properties necessarily implies that the ML estimation procedure provides the best unbiased estimator possible. While simulation studies can easily determine if a given estimation procedure provides an unbiased estimate of the spectra information, and whether or not the estimator is approximately normally distributed, attainment of the Cramer-Rao bound (CRB) can only be ascertained by calculating the CRB for an assumed energy spectrum-detector response function combination, which can be quite formidable in practice. However, the effort in calculating the CRB is very

worthwhile because it provides the necessary means to compare the efficiency of competing estimation techniques and, furthermore, provides a stopping rule in the search for the best unbiased estimator. Consequently, the CRB for both the simple and broken power law energy spectra are derived herein and the conditions under which they are attained in practice are investigated. The ML technique is then extended to estimate spectra information from an arbitrary number of astrophysics data sets produced by vastly different science instruments. This theory and its successful implementation will facilitate the interpretation of spectral information from multiple astrophysics missions and thereby permit the derivation of superior spectral parameter estimates based on the combination of data sets.
Author
Maximum Likelihood Estimates; Cramer-Rao Bounds; Spectrum Analysis; Cosmic Rays; Statistical Distributions; Parameter Identification; Mathematical Models; Spectra

20030032951 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
The Nearest Black Holes
Oliversen, Ronald J., Technical Monitor; Garcia, M.; April 2003; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10889; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this program is to study black holes, both in our Galaxy and in nearby galaxies. We aim to study both 'stellar mass' x-ray binaries containing black holes (both in our Galaxy and in nearby galaxies), and super-massive black holes in nearby galaxies. This program facilitates this study by funding related travel, computer equipment, and partial salary for a post-doc.
Derived from text
Black Holes (Astronomy); Galaxies; X Ray Binaries; X Ray Astronomy

20030032982 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Coronagraphic Imaging with HST and STIS
Grady, C. A.; Proffitt, C.; Malumuth, E.; Woodgate, B. E.; Gull, T. R.; Bowers, C. W.; Heap, S. R.; Kimble, R. A.; Lindler, D.; Plait, P.; [2002]; 11 pp.; In English; 2002 Hubble Space Telescope Calibration Workshop, 17-18 Oct. 2002, Baltimore, MD, USA
Contract(s)/Grant(s): NAS5-26555; GO-7088; GO-8037; GO-8491; GO-8896; GO-9241; Copyright; Avail: CASI; A03, Hardcopy

Revealing faint circumstellar nebulosity and faint stellar or substellar companions to bright stars typically requires use of techniques for rejecting the direct, scattered, and diffracted light of the star. One such technique is Lyot coronagraphy. We summarize the performance of the white-light coronagraphic capability of the Space Telescope Imaging spectrograph, on board the Hubble Space Telescope.
Author
Coronagraphs; Hubble Space Telescope; Imaging Techniques; Astrophysics

20030032994 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Studying X-Ray Binaries with High Energy Frequency Quasi-Periodic Oscillations
Oliversen, Ronald J., Technical Monitor; Kaaret, P.; April 2003; 3 pp.; In English
Contract(s)/Grant(s): NAG5-7405; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this investigation is to further our understanding of the dynamics of accreting neutron stars and black holes in the hope of using these systems as probes of the physics of strong gravitational fields. The main focus of this work has been a multi-year program of simultaneous millisecond x-ray timing and spectral observations carried out with the Rossi X-Ray Timing Explorer (RXTE) to perform the x-ray timing and one of the satellites Asca, BeppoSAX, or Chandra to perform x-ray spectral measurements. With the advent of Chandra, we have extended our work to include imaging of X-ray jets from binaries and the study of extragalactic X-ray binaries. Significant progress was made over the past year.
Author
X Ray Binaries; Black Holes (Astronomy); Gravitation Theory; X Ray Astronomy; Energetic Particles; Plasmas (Physics); Neutron Stars; Stellar Oscillations

20030033077 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Exotic Molecules in Space: A Coordinated Astronomical Laboratory and Theoretical Study
Stringfellow, Guy, Technical Monitor; Thaddeus, Patrick; April 2003; 6 pp.; In English
Contract(s)/Grant(s): NAG5-9379; Copyright; Avail: CASI; A02, Hardcopy

The present report covers the third year of a grant which represents a direct continuation of NASA NAG5-4050, with the same title as before. It is dedicated as before to the discovery and characterization of new astrophysical molecules. This year, like the two before, has been extremely productive, yielding many new discoveries of astronomical interest at both radio and optical wavelengths, and the publication or submission of the 15 papers listed below. Nearly all of these articles have or will soon appear in the leading refereed journals of astrophysics, chemical physics, physics, or molecular spectroscopy. One is a major invited review for Molecular Physics. One of our other invited reviews published in Spectrochimica Acta in 2001 was recently awarded the Sir Harold Thompson Memorial Award, annually given to the best paper in that journal. During the past year significant advances have been made by our group in the laboratory study of exotic silicon and carbon molecules of astronomical interest. The most exciting discoveries include the pure silicon cluster Si3, several novel silicon hydrides, and the detection of phenyl radical, CsH5, a fundamental reactive organic ring. In addition, the rotational spectra of many carbon chains terminated with Si, N, O, and other heteroatoms have also been detected for the first time. The laboratory astrophysics of the whole set is complete in the sense that the entire radio spectrum of each species has now been measured or can be calculated to very high accuracy. Nearly all of these newly found molecules are plausible candidates for the detection by radio astronomers in the interstellar gas or in circumstellar sources because they are similar in structure and composition to known astronomical species, and because most are calculated to possess large permanent dipole moments.
Author
Molecular Spectroscopy; Interstellar Gas; Molecular Clouds; Radio Astronomy; Radio Spectra; Visible Spectrum; Rotational Spectra

20030033078 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
RXTE Observations of the Outburst of the Dwarf Nova SS Cyg and VW Hyi and XTE Observations of the Precessing Disk CV TV Col
Oliversen, Ronald J., Technical Monitor; April 2003; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9107; No Copyright; Avail: CASI; A01, Hardcopy
A final report on the Rossi X Ray Timing Explorer (RXTE) Observations of outbursts SS Cyg and VW Hyi dwarf novae are presented, along with observations of the Precessing Disk CV TV Col using the XTE.
CASI
Cygnus Constellation; X Ray Timing Explorer; Dwarf Novae; Astrophysics; Observation; Cataclysmic Variables

20030033920 Space Telescope Science Inst., Baltimore, MD, USA
Small-Scale Interstellar Structure Toward the Open Cluster CHI Persei-Fuse II
Sonneborn, George, Technical Monitor; Friedman, Scott; April 29, 2003; 4 pp.; In English
Contract(s)/Grant(s): NAG5-12639; STScI Proj. J01025; No Copyright; Avail: CASI; A01, Hardcopy
The purpose of this study was to measure the physical conditions of gas along sight lines toward 6 stars in the core Chi Persei open cluster. These sight lines traverse gas in both the Orion and Perseus spiral arms of the Galaxy, at distances of 500 and 2000 pc, respectively. The stars have angular separations ranging from 45 to 280 arcsec; 60 arcsec corresponds to linear distances of 0.15 and 0.6 pc in the two arms. Thus, abundance variations in these observations would constitute evidence for small-scale variations in the properties of the interstellar medium. Ground-based Na I observations at high resolution (approx. 15 km/sec) toward 172 stars (including the 6 in this study) in the double open cluster h and Chi Persei have revealed complex spatial variation. These variations are especially evident in the gas at velocities of -40 and -55 km/sec, corresponding to the Perseus spiral arm. 21 cm observations of HI emission using the Low Resolution DRAO Survey, with a 12-arcmin beam, also show variations. Averaging the Na I apparent optical depth profiles of neighboring sight lines in order to mimic such a beam size reduces the variation, as compared to the individual Na I measurements, but still show variations larger than seen in the 21 cm profiles. Na I is not the dominant ionization state of Na in the interstellar medium. Thus, it is possible that the variations seen really trace physical structures in the interstellar medium, or they may simply result from variations in the radiation field seen by the gas, or be due to some other environmental circumstance. To distinguish among these possibilities in the present study we obtained FUSE spectra toward the 6 targets in order to measure the molecular hydrogen absorption profiles along these sight lines. The higher J states of H2 are populated by the ambient W radiation field, and thus can provide insight into the environment affecting the gas. If both the high and low J states reveal absorption line profiles with variations similar to that observed in Na I, this would indicate that the variations are due to real structures in the interstellar medium. On the other hand, if the only the high J profiles mimicked the Na I profiles, then the variations may be attributable to environmental effects. We found that the H2 profiles showed considerable variation over the 6 sight lines, and that the profiles, despite having somewhat lower velocity resolution, resemble the Na I profiles. Thus, it appears that the gas really does exhibit variations in physical structures along these sight lines. Useful follow-up work would be to obtain higher signal-to-noise FUSE

observations of H2, since the present data are of only moderate quality, and to obtain data on additional targets in this double cluster, in order to map out in more detail the extent and magnitude of the small-scale variations.
Author
Physical Properties; Molecular Gases; Stars; Stellar Cores; Cluster Analysis; Spiral Galaxies

20030033925 Colorado Univ., CO, USA
FUV Spectra of Evolved Late-K and M Stars: Mass Loss Revisited and Stellar Activity
Harper, Graham M.; August 28, 2002; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9010
Report No.(s): CU-1532022; No Copyright; Avail: CASI; A01, Hardcopy

This is the final report for the FUSE Cycle 1 program A100: FUV Spectra of Evolved Late-K and M Stars: Mass Loss revisited and Stellar Activity. Targets alpha TrA (K3 II) and gamma Cru (M3 III) were originally assigned 25 ksec each, to be observed in the medium aperture. Once the in-flight performance and telescope alignment problems were known, the observations were reprogrammed to optimized the scientific return of the program. Alpha TrA was scheduled for 25 ksec observations in both the medium and large apertures. The principle aim of this program was to measure the stellar FUV line and continuum emission, in order to estimate the photoionization radiation field and to determine the level of stellar activity through the fluxes in the collisionally excited high temperature diagnostics: C III 977Angstroms and O VI 1032,1038Angstrom doublet. The medium aperture observations were obtained successfully while the large aperture observations were thought by Johns Hopkins University (JHU)to be lost to satellite problems. There was insufficient signal-to-noise in the medium aperture short wavelength Sic channels to do quantitative science.
Derived from text
Stellar Activity; K Stars; M Stars; Far Ultraviolet Radiation; Stellar Mass; Ultraviolet Spectra

20030034659 George Washington Univ., Washington, DC, USA
Unveiling the Nature of Soft Gamma Repeaters and Magnetars: Scientists Measure the Most Powerful Magnet Known
Swank, Jean, Technical Monitor; Parke, William; November 04, 2002; 2 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-11951; Copyright; Avail: CASI; A01, Hardcopy

This newsletter from NASA Goddard Space Flight Center (GSFC) announces measurements of the magnetic field of a magnetar. The magnetic field was approx. 10(exp 15) gauss, up to 10 times more powerful than previous estimates. The newsletter also describes how the star's magnetic field slows its rotation, and how starquakes emit protons, which are trapped in this neutron star's magnetic field, and make it a soft gamma repeater (SGR).
CASI
Magnetars; Soft Gamma Repeaters; Stellar Magnetic Fields; Magnetic Flux

20030034670 George Washington Univ., Washington, DC, USA
Discovery of Cyclotron Resonance Features in the Soft Gamma Repeater SGR 1806-20
Ibrahim, Alaa I.; Safi-Harb, Samar; Swank, Jean H.; Parke, William; Zane, Silvia; Turolla, Roberto; [2002]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-11951; Copyright; Avail: CASI; A01, Hardcopy

We report evidence of cyclotron resonance features from the Soft Gamma Repeater SGR 1806-20 in outburst, detected with the Rossi X-ray Timing Explorer in the spectrum of a long, complex precursor that preceded a strong burst. The features consist of a narrow 5.0 keV absorption line with modulation near its second and third harmonics (at 11.2 keV and 17.5 keV respectively). The line features are transient and are detected in the harder part of the precursor. The 5.0 keV feature is strong, with an equivalent width of approx. 500 eV and a narrow width of less than 0.4 keV. Interpreting the features as electron cyclotron lines in the context of accretion models leads to a large mass-radius ratio (M/R greater than 0.3 solar mass/km) that is inconsistent with neutron stars or that requires a low (5-7) x 10(exp 11) G magnetic field that is unlikely for SGRs. The line widths are also narrow compared with those of electron cyclotron resonances observed so far in X-ray pulsars. In the magnetar picture, the features are plausibly explained as ion cyclotron resonances in an ultra-strong magnetic field that have recently been predicted from magnetar candidates. In this view, the 5.0 keV feature is consistent with a proton cyclotron fundamental whose energy and width are close to model predictions. The line energy would correspond to a surface magnetic field of 1.0 x 10(exp 15) G for SGR 1806-20, in good agreement with that inferred from the spin-down measure in the source.
Author
Cyclotron Resonance; Soft Gamma Repeaters; Gamma Ray Bursts; X Ray Astronomy

20030034741 National Renewable Energy Lab., Golden, CO

Current Issues in Terrestrial Solar Radiation Instrumentation for Energy, Climate and Space Applications

Stoffel, T. L.; Reda, I.; Myers, D. R.; Renne, D.; Wilcox, S. W.; 1999; 12 pp.

Report No.(s): DE2002-751051; No Copyright; Avail: Department of Energy Information Bridge

Reductions of uncertainty in terrestrial solar radiation measurements are needed to validate the Earth's radiation balance derived from satellite data. Characterization of solar energy resources for renewable technologies requires greater time and spatial resolution for economical technology deployment. Solar radiation measurement research at the National Renewable Energy Laboratory addresses calibrations, operational characteristics, and corrections for terrestrial solar radiation measurements. We describe progress in measurements of broadband diffuse-sky radiation, and characterization of field instrument thermal offsets and spectral irradiance. The need and prospects for absolute references for diffuse and long wave terrestrial solar radiation measurements are discussed. Reductions in uncertainty of broadband irradiance measurements from tens of watts per square meter to a few (one to two) watts per square meter are reported, which reduce time and labor to quantify and identify trends in artificial optical radiation sources, terrestrial solar radiation, and the Earth's radiation budget. NTIS

Climatology; Solar Radiation; Terrestrial Radiation; Solar Energy; Radiation Measuring Instruments; Aerospace Industry

20030034787 George Washington Univ., Washington, DC, USA

Unveiling the Nature of Soft Gamma Repeaters and Magnetars

Parke, William; Swank, Jean, Technical Monitor; [2003]; 5 pp.; In English

Contract(s)/Grant(s): NAG5-11951; No Copyright; Avail: CASI; A01, Hardcopy

We briefly describe some results of our ongoing study of Soft Gamma Repeater (SGR) bursts with Rossi X-ray Timing Explorer (RXTE) satellite. We have detected evidence of cyclotron resonance absorption features from the SGR 1806-20 in the spectrum of a long, complex precursor that preceded a strong burst. The observation is made by the analysis of data from the RXTE. The features consist of a narrow 5.0 keV absorption line together with modulation near its second and third harmonics (at 11.2 keV and 17.5 keV respectively). The line features are transient and are detected in the harder radiation part of the precursor. The 5.0 keV feature is strong, with an equivalent width of approximately 500 eV and a narrow width of less than 0.4 keV. Interpreting the features as electron cyclotron lines in the context of accretion models leads to a large mass radius ratio (M/R greater than 0.3 M sun/km) that is inconsistent with neutron stars or that requires a low (5-7) x l0(exp 11)G magnetic field that is unlikely for SGRs. The line widths are also narrow compared with those of electron cyclotron resonances observed so far in X-ray pulsars. In the magnetar picture, the features are plausibly explained as ion cyclotron resonances in an ultra-strong magnetic field that have recently been predicted from magnetar candidates. In this view, the 5.0 keV feature is consistent with a proton cyclotron fundamental whose energy and width are close to model predictions. The line energy would correspond to a surface magnetic field of 1.0 x 10(exp 15)G for SGR 1806-20, in good agreement with that inferred from the spin-down measure in the source. Following the first evidence of proton cyclotron features from SGR 1806-20, we performed a comprehensive search of a large number of bursts from the source. We detected the 5 keV absorption feature in a variety of bursts, confirming our initial discovery and establishing the presence of the feature in the source s burst spectra. The line feature is well explained as proton cyclotron resonance in an ultra-strong magnetic field, offering a direct measurement of SGR 1806-20 s magnetic field (B approx. 10(exp l5)G) and a clear evidence of a magnetar. Together with the source's spin-down rate, the feature also provided the first measurement of the gravitational redshift, mass and radius of a magnetar.

Derived from text

Cyclotron Radiation; Magnetic Fields; Soft Gamma Repeaters; Magnetars; Gamma Ray Bursts; X Ray Astronomy; Cyclotron Resonance

20030037176 Lawrence Livermore National Lab., Livermore, CA

BRIGHT Lights, BIG City: Massive Galaxies, Giant Ly-A Nebulae, and Proto-Clusters

van Breugel, W.; Reuland, M.; de Vries, W.; Stanford, A.; Dey, A.; Sep. 30, 2002; In English

Report No.(s): DE2002-15002113; UCRL-JC-149640; No Copyright; Avail: National Technical Information Service (NTIS)

High redshift radio galaxies are great cosmological tools for pinpointing the most massive objects in the early Universe: massive forming galaxies, active super-massive black holes and proto-clusters. We report on deep narrow-band imaging and spectroscopic observations of several radio galaxy fields to investigate the nature of giant Ly-a nebulae centered on the galaxies and to search for over-dense regions around them. We discuss the possible implications for our understanding of the formation and evolution of massive galaxies and galaxy clusters.

NTIS

Galaxies; Nebulae; Star Clusters

20030038794 Lawrence Livermore National Lab., Livermore, CA
Portent of Heine's Reciprocal Square Root Identity
Cohl, H. S.; Oct. 12, 2002; 12 pp.
Report No.(s): DE2002-15002149; UCRL-JC-150467; No Copyright; Avail: Department of Energy Information Bridge

Precise efforts in theoretical astrophysics are needed to fully understand the mechanisms that govern the structure, stability, dynamics, formation, and evolution of differentially rotating stars. Direct computation of the physical attributes of a star can be facilitated by the use of highly compact azimuthal and separation angle Fourier formulations of the Green's functions for the linear partial differential equations of mathematical physics.
NTIS
Star Formation; Boundary Value Problems

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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*.

20030032439 NASA Ames Research Center, Moffett Field, CA, USA
Evaluation of Human vs. Teleoperated Robotic Performance in Field Geology Tasks at a Mars Analog Site
Glass, B.; Briggs, G.; [2003]; 8 pp.; In English; 7th International Symposium on Artificial Intelligence, Robotics and Automation in Space (i-SAIRAS 2003), 1-23 May 2003, Nara, Japan; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Exploration mission designers and planners have costing models used to assess the affordability of given missions - but very little data exists on the relative science return produced by different ways of exploring a given region. Doing cost-benefit analyses for future missions requires a way to compare the relative field science productivity of spacesuited humans vs. virtual presence/teleoperation from a nearby habitat or orbital station, vs. traditional terrestrial-controlled rover operations. The goal of this study was to define science-return metrics for comparing human and robotic fieldwork, and then obtain quantifiable science-return performance comparisons between teleoperated rovers and spacesuited humans. Test runs with a simulated 2015-class rover and with spacesuited geologists were conducted at Haughton Crater in the Canadian Arctic in July 2002. Early results imply that humans will be 1-2 orders of magnitude more productive per unit time in exploration than future terrestrially-controlled robots.
Author
Mars Exploration; Planetary Geology; Robotics; Mars Surface; Manned Space Flight

20030032942 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Production, Outflow Velocity, and Radial Distribution of H2O and OH in the Coma of Comet C/1995 O1 [Hale-Bopp] from Wide Field Imaging of OH
Harris, Walter M.; Scherb, Frank; Mierkiewicz, Edwin; Oliverson, Ronald; Morgenthaler, Jeffrey; [2003]; 2 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Observations of OH are a useful proxy of the water production rate (Q(sub H2O)) and outflow velocity (V(sub out)) in comets. From wide field images taken on 03/28/1997 and 04/08/1997 that capture the entire scale length of the OH coma of comet C/1995 O1 (Hale-Bopp), we obtain Q(sub H2O) from the model-independent method of aperture summation. With an adaptive ring summation algorithm, we extract the radial brightness distribution of OH 0-0 band emission out to cometocentric distances of up to 10(exp 6) km, both as azimuthal averages and in quadrants covering different position angles relative to the comet-Sun line. These profiles are fit using both fixed and variable velocity 2-component spherical expansion models to estimate V(sub OH) with increasing distance from the nucleus. The OH coma of Hale-Bopp was more spatially extended than previous comets, and this extension is best matched by a variable acceleration of H2O and OH that acted across the entire coma, but was strongest within 1-2 x 10(exp 4) km from the nucleus. Our models indicate that V(sub OH) at the edge of our detectable field of view (10(exp 6) km) was approx. 2-3 times greater in Hale-Bopp than for a 1P/Halley-class comet at 1 AU, which is consistent with the results of more sophisticated gas-kinetic models, extrapolation from previous observations of OH in comets with Q(sub H2O) greater than 10(exp 29)/s , and direct radio measurements of the outer coma Hale-Bopp OH velocity. The most probable source of this acceleration is thermalization of the excess energy of dissociation of H2O and OH over an extended collisional coma. When the coma is broken down by quadrants in position angle, we find an azimuthal asymmetry in the radial distribution that is characterized by an increase in the spatial extent of OH in the region between the

orbit-trailing and anti-sunward directions. Model fits specific to this area and comparison with radio OH measurements suggest greater acceleration here, with V(sub OH) approx. 1.5 times greater at a 10(exp 6) km cometocentric distance than elsewhere in the coma. We discuss several mechanisms that may have acted within the coma to produce the observed effect.
Author
Hale-Bopp Comet; Radial Distribution; Flow Velocity; Water; Hydroxyl Radicals; Outgassing

20030032948 Arizona State Univ., Tempe, AZ, USA
Microbeam Investigations of Presolar and Early Solar System Materials
Huss, Gary R.; [2003]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-8158; ASU-PVA6552
Report No.(s): ASU-PVA-6552/TE; No Copyright; Avail: CASI; A01, Hardcopy

This grant provided three years of funding to initiate an independent research program in Cosmochemistry at Arizona State University. Because the new equipment that was installed at ASU took longer than expected to get running, the project was extended for a fourth year with no additional funding. By the time the funds were expended, we had set up an entirely new ion microprobe laboratory at ASU, and we have been fully operational for over two years. This laboratory was funded in almost equal parts by NASA, NSF, and ASU. Papers describing the first results from this new laboratory are being published now, and the results have been making an impact on the Cosmochemistry community. While this laboratory was being built, I continued my research program in collaboration with G. J. Wasserburg at Caltech. As equipment became available, I gradually shifted my research to ASU. Over the lifetime of this grant, my research program resulted in 12 papers and 13 abstracts on topics ranging from presolar grains (2 papers, 3 abstracts), short-lived radionuclides (6 papers, 6 abstracts), chemical compositions of chondritic materials (3 papers, 3 abstracts), silicon isotopic fractionation (1 abstract), and the oxygen composition of the Sun (1 paper). The most important results of this period were the discovery of presolar hibonite in a meteorite residue, the measurement of 26A1 in CAIs from enstatite chondrites, and the measurements of 10Be in type A CAIs from CV chondrites. All of these results have had a significant impact on research in Cosmochemstry.
Author
Meteoritic Composition; Cosmochemistry; Microbeams; Bibliographies

20030032989 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Measurements of [C I] 9850 A Emission from Comet Hale-Bopp
Oliversen, R. J.; Doane, N.; Scherb, F.; Harris, W. M.; Morgenthaler, J. P.; [2002]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We present quantitative measurements of cometary [C I] 9850 A, emission obtained during observations of comet Hale-Bopp (C/1995 O1) in 1997 March and April. The observations were carried out using a high-resolution (lambda/Delta lambda approx. 40,000) Fabry-Perot/CCD spectrometer at the McMath-Pierce solar telescope on Kitt Peak. This forbidden line, the carbon analog of [O I] 6300 A, is emitted in the radiative decay of C(1D) atoms. In the absence of other sources and sinks, [C I] 9850 A emission may be used as a direct tracer of CO photodissociation in comets. However, in Hale-Bopp's large, dense coma, other processes, such as collisional excitation of ground-state C(3P), dissociative recombination of CO+, and collisional dissociation of CO and CO2 may produce significant amounts of C(1D). The long C(1D) radiative lifetime (approx. 4000 s) makes collisional de-excitation (quenching) the primary loss mechanism in the inner coma. Thus, a detailed, self-consistent global model of collisional and photochemical interactions is necessary to fully account for [C I] 9850 A emission in comet Hale-Bopp.
Author
Hale-Bopp Comet; Gas Dissociation; Photodissociation; Comet Heads; Carbon Monoxide; Carbon Dioxide; Line Spectra

20030033029 Arizona Univ., Tucson, AZ, USA
Preservation and Enhancement of the Spacewatch Data Archives
Larsen, Jeffrey A.; April 24, 2003; 4 pp.; In English
Contract(s)/Grant(s): NAG5-8095; No Copyright; Avail: CASI; A01, Hardcopy

In March of 1998, the asteroid 1997 XF11 was announced to be potentially hazardous after being tracked over 90 days. A potential two year wait for confirming observations was shortened to under 24 hours because of the existence of archived photographic prediscovery images. Spacewatch was a pioneer in using CCD scanning and possesses a valuable digital archive of its scans. Unfortunately these data are aging on magnetic tape and will soon be lost. Since 1990, the Spacewatch project gathered some 1.5 Terabytes of scan data covering roughly 75,000 degrees of sky to a limiting magnitude of V = 21.5. The

data have not yet been mined for all of their asteroids for scientific studies and orbit determination. Spacewatch's real-time motion detection program MODP was constrained by the computers of the era to use simplified image processing algorithms at a reduced efficiency. Jedicke and Herron estimated MODP's efficiency at finding asteroids to be approximately 60 percent to V=18 and improving somewhat thereafter. This lead to a substantial bias correction in their analyses. Larsen has developed a MODP replacement capable in excess of 90 percent efficiency in the same range and able to push a magnitude fainter in completeness. We propose a program of post-processing and re-archiving Spacewatch data. Our scans would be transferred from tape to CD-ROMs and converted to FITS images -- establishing a consistent data format and media for both past and future Spacewatch observations. Larsen's MODP replacement would mine these data for previously undetected motions, which would be made available to the Minor Planet Center and our ongoing asteroid population studies. A searchable observation record would be made generally available for prediscovery work. We estimate the net asteroid yield of this proposal is equivalent to three full years of Spacewatch operations.
Author
Asteroid Detection; Magnetic Tapes; Data Mining; Orbit Determination

20030033939 Space Physics Research Inst., Sunnyvale, CA, USA
Vertical Structure in Outer Planet Atmospheres
Rages, Kathy A.; [1999]; 7 pp.; In English
Contract(s)/Grant(s): NCC 2-1115; No Copyright; Avail: CASI; A02, Hardcopy

The period covered by this cooperative agreement included: 1) the analysis of data acquired by both Voyager spacecraft during their encounters with Saturn in 1979 and 1980; 2) work on Uranus' seasonal variability and transient albedo features on both Uranus and Neptune using observations made by the Hubble Space Telescope beginning in 2000; 3) a search for lightning on Jupiter using HST; and 4) the analysis of Pathfinder images of Martian surface features.
Derived from text
Neptune (Planet); Planetary Atmospheres; Saturn (Planet); Planetary Structure; Grand Tours; Photometry

20030037019 Arizona State Univ., Tempe, AZ, USA
Jupiter System Data Analysis Program: Mechanisms, Manifestation, and Implications of Cryomagmatism on Europa
Fagents, Sarah A.; [2003]; 10 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-8898; No Copyright; Avail: CASI; A02, Hardcopy

The objectives of the work completed under NASA Grant NAG5-8898 were (i) to document and characterize the low-albedo diffuse surfaces associated with triple bands and lenticulae, (ii) to determine their mechanisms of formation, and (iii) to assess the implications of these features for the resurfacing (in space and time) of the Europa and the nature of the Europan interior. The approach involved a combination of processing and analysis of Solid State Imaging data returned by the Galileo spacecraft during the primary and extended mission phases, together with numerical modeling of the physical processes interpreted to the observed features. We have modeled the formation of Europan triple explosive venting of cryoclastic material from bands and lenticulae halos by two processes: (i) a liquid layer in the Europan interior, and (ii) lag deposit formation by the thermal influence of subsurface cryomagmatic intrusions. We favor the latter hypothesis for explaining these features, and further suggest that a liquid water or brine intrusion is required to provide sufficient lateral heating of surface ice to explain the 25 km size of the largest features. (Solid ice diapirs, even under the most favorable conditions, become thermally exhausted before they heat significant lateral distances). We argue that water circulating in open fractures, or repeated cryomagmatic 'diking' events would provide sufficient thermal input to produce the observed features. Thus our work argues for the existence of a liquid beneath Europa's surface. Our results might most easily be explained by the presence of a continuous liquid layer (the putative Europan ocean); this would concur with the findings of the Galileo magnetometer team. However, we cannot rule out the possibility that discrete liquid pockets provide injections of fluid closer to the surface.
Derived from text
Planetary Geology; Europa; Ice; Water; Magma; Cryogenic Temperature

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20030032419 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Three-Dimensional MHD Modeling of The Solar Corona and Solar Wind: Comparison with The Wang-Sheeley Model
Usmanov, A. V.; Goldstein, M. L.; [2003]; 4 pp.; In English; EGS/AGU Spring Meeting; No Copyright; Avail: Other Sources; Abstract Only

We present simulation results from a tilted-dipole steady-state MHD model of the solar corona and solar wind and compare the output from our model with the Wang-Sheeley model which relates the divergence rate of magnetic flux tubes near the Sun (inferred from solar magnetograms) to the solar wind speed observed near Earth and at Ulysses. The boundary conditions in our model specified at the coronal base and our simulation region extends out to 10 AU. We assumed that a flux of Alfven waves with amplitude of 35 km per second emanates from the Sun and provides additional heating and acceleration for the coronal outflow in the open field regions. The waves are treated in the WKB approximation. The incorporation of wave acceleration allows us to reproduce the fast wind measurements obtained by Ulysses, while preserving reasonable agreement with plasma densities typically found at the coronal base. We find that our simulation results agree well with Wang and Sheeley's empirical model.
Author
Astronomical Models; Three Dimensional Models; Solar Corona; Solar Wind; Computerized Simulation; Solar Wind Velocity

20030032939 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Solar Energetic Particle Variations
Reames, D. V.; [2003]; 11 pp.; In English; COSPAR Proceedings; Original contains black and white illustrations
Report No.(s): COSPAR-D2.3-E3.3-0032-02; No Copyright; Avail: CASI; A03, Hardcopy

In the largest solar energetic-particle (SEP) events, acceleration occurs at shock waves driven out from the Sun by coronal mass ejections (CMEs). In fact, the highest proton intensities directly measured near Earth at energies up to approximately 1 GeV occur at the time of passage of shocks, which arrive about a day after the CMEs leave the Sun. CME-driven shocks expanding across magnetic fields can fill over half of the heliosphere with SEPs. Proton-generated Alfven waves trap particles near the shock for efficient acceleration but also throttle the intensities at Earth to the streaming limit early in the events. At high energies, particles begin to leak from the shock and the spectrum rolls downward to form an energy-spectral 'knee' that can vary in energy from approximately 1 MeV to approximately 1 GeV in different events. All of these factors affect the radiation dose as a function of depth and latitude in the Earth's atmosphere and the risk to astronauts and equipment in space. SEP ionization of the polar atmosphere produces nitrates that precipitate to become trapped in the polar ice. Observations of nitrate deposits in ice cores reveal individual large SEP events and extend back approximately 400 years. Unlike sunspots, SEP events follow the approximately 80-100-year Gleissberg cycle rather faithfully and are now at a minimum in that cycle. The largest SEP event in the last 400 years appears to be related to the flare observed by Carrington in 1859, but the probability of SEP events with such large fluences falls off sharply because of the streaming limit.
Author
Shock Waves; Particle Acceleration; Wave-Particle Interactions; Solar Corpuscular Radiation; Solar Terrestrial Interactions; Coronal Mass Ejection; Spectral Energy Distribution

20030032979 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Comparison of Total Solar Irradiance with NASA/NSO Spectromagnetograph Data in Solar Cycles 22 and 23
Jones, Harrison P.; Branston, Detrick D.; Jones, Patricia B.; Popescu, Miruna D.; [2002]; 22 pp.; In English
Contract(s)/Grant(s): RTOP 344-12-52-14; RTOP 344-12-52-19; Copyright; Avail: CASI; A03, Hardcopy

An earlier study compared NASA/NSO Spectromagnetograph (SPM) data with spacecraft measurements of total solar irradiance (TSI) variations over a 1.5 year period in the declining phase of solar cycle 22. This paper extends the analysis to an eight-year period which also spans the rising and early maximum phases of cycle 23. The conclusions of the earlier work appear to be robust: three factors (sunspots, strong unipolar regions, and strong mixed polarity regions) describe most of the variation in the SPM record, but only the first two are associated with TSI. Additionally, the residuals of a linear multiple regression of TSI against SPM observations over the entire eight-year period show an unexplained, increasing, linear time variation with a rate of about 0.05 W m(exp -2) per year. Separate regressions for the periods before and after 1996 January 01 show no unexplained trends but differ substantially in regression parameters. This behavior may reflect a solar source of

TSI variations beyond sunspots and faculae but more plausibly results from uncompensated non-solar effects in one or both of the TSI and SPM data sets.
Author
Sunspots; Faculae; Solar Cycles; Light (Visible Radiation); Periodic Variations; Solar Radiation; Data Reduction

20030033877 Smithsonian Institution, Cambridge, MA, USA
Structure and Dynamics of the Quiet Solar Chromosphere
Kalkofen, Wolfgang; Wagner, William, Technical Monitor; March 2003; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10927; No Copyright; Avail: CASI; A01, Hardcopy

For the meeting of the AAS/SPD in Albuquerque, NM, I organized a Topical Session of the AAS on Structure and Dynamics of Chromospheres. The grant support was used to bring to the US two of the speakers from abroad. I had invited them for presentations at the Session: Dr. Klaus Wilhelm, the former PI of the SUMER instrument on SOHO, from the Max-Planck Institut in Lindau, Germany, and Dr. Sirajul Hasan, from the Indian Institute of Astrophysics in Bangalore, India. Both speakers preceded their trip to the AAS meeting with a stay at the Smithsonian Astrophysical Observatory, where they interacted with members of the Solar and Stellar Physics division. The highlights of the visits were the talks at the AAS/SPD meeting, in which six invited speakers told the audience of astronomers about current problems in solar physics and their relation to stellar problems. An important result of the visits is a paper by Dr. Wilhelm and me on 'Observations of the upper solar chromosphere with SUMER on SOHO', which has been submitted to Astronomy and Astrophysics for publication.
Author
Chromosphere; Solar Physics

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*.

20030032352 NASA Johnson Space Center, Houston, TX, USA
Physics of the Isotopic Dependence of Galactic Cosmic Ray Fluence Behind Shielding
Cucinotta, Francis A.; Saganti, Premkumar B.; Hu, Xiao-Dong; Kim, Myung-Hee Y.; Cleghorn, Timothy F.; Wilson, John W.; Tripathi, Ram K.; Zeitlin, Cary J.; February 2003; 52 pp.; In English
Report No.(s): NASA/TP-2003-210792; NAS 1.60:210792; S-891; No Copyright; Avail: CASI; A04, Hardcopy

For over 25 years, NASA has supported the development of space radiation transport models for shielding applications. The NASA space radiation transport model now predicts dose and dose equivalent in Earth and Mars orbit to an accuracy of plus or minus 20\%. However, because larger errors may occur in particle fluence predictions, there is interest in further assessments and improvements in NASA's space radiation transport model. In this paper, we consider the effects of the isotopic composition of the primary galactic cosmic rays (GCR) and the isotopic dependence of nuclear fragmentation cross-sections on the solution to transport models used for shielding studies. Satellite measurements are used to describe the isotopic composition of the GCR. Using NASA's quantum multiple-scattering theory of nuclear fragmentation (QMSFRG) and high-charge and energy (HZETRN) transport code, we study the effect of the isotopic dependence of the primary GCR composition and secondary nuclei on shielding calculations. The QMSFRG is shown to accurately describe the iso-spin dependence of nuclear fragmentation. The principal finding of this study is that large errors (plus or minus 100\%) will occur in the mass-fluence spectra when comparing transport models that use a complete isotope grid (approximately 170 ions) to ones that use a reduced isotope grid, for example the 59 ion-grid used in the HZETRN code in the past, however less significant errors (less than 20\%) occur in the elemental-fluence spectra. Because a complete isotope grid is readily handled on small computer workstations and is needed for several applications studying GCR propagation and scattering, it is recommended that they be used for future GCR studies.
Author
Fluence; Galactic Cosmic Rays; Primary Cosmic Rays; Isotopes; Radiation Shielding; Mathematical Models; Radiation Transport; Radiation Absorption

20030032417 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Gyrophase-bunched Electrons: Cluster Observations and Simulations

Gurgiolo, C.; Vinas, A. F.; Goldstein, Melvyn L.; [2003]; 1 pp.; In English; Yosemite 2003 Conference, 2003, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The interaction of the solar wind with the Earth's bow shock is responsible for a number of phenomena both upstream and downstream. One of the least understood and studied of these is the generation of gyrophase-bunched electrons. We will describe initial work searching for and analyzing such events in (Plasma Electron And Current Experiment (PEACE) data from CLUSTER. Plasma simulations will complement the data analysis. Recent analyses suggest that gyrophase-bunched electrons are present rather frequently in the upstream region, due either to energization in the reflection off the shock front or, more likely, to phase trapping in locally produced whistler wave fields.

Author

Solar Wind; Electrons; Shock Waves; Electron Plasma; Simulation

20030032480 NASA Langley Research Center, Hampton, VA, USA

Comparison of Stratus Cloud Properties Deduced from Surface, GOES, and Aircraft Data during the March 2000 ARM Cloud IOP

Minnis, Patrick; Smith, William L., Jr.; Dong, Xiquan; Mace, Gerald G.; Poellot, Michael; Marchand, Roger T.; Rapp, Anita D.; Journal of the Atmospheric Sciences; December 2002; 59, 23, pp. 3265-3284; In English; Original contains color illustrations; Copyright; Avail: Other Sources

Low-level stratus cloud microphysical properties derived from surface and Geostationary Operational Environmental Satellite (GOES) data during the March 2000 cloud intensive observational period (IOP) at the Atmospheric Radiation Measurement (ARM) program Southern Great Plains (SGP) site are compared with aircraft in situ measurements. For the surface retrievals, the cloud droplet effective radius and optical depth are retrieved from a delta2-stream radiative transfer model with the input of ground-based measurements, and the cloud liquid water path (LWP) is retrieved from ground-based microwave-radiometer-measured brightness temperature. The satellite results, retrieved from GOES visible, solar-infrared, and infrared radiances, are averaged in a 0.5 deg x 0.5 deg box centered on the ARM SGP site. The forward scattering spectrometer probe (FSSP) on the University of North Dakota Citation aircraft provided in situ measurements of the cloud microphysical properties. During the IOP, four low-level stratus cases were intensively observed by the ground- and satellite-based remote sensors and aircraft in situ instruments resulting in a total of 10 h of simultaneous data from the three platforms. In spite of the large differences in temporal and spatial resolution between surface, GOES, and aircraft, the surface retrievals have excellent agreement with the aircraft data overall for the entire 10-h period, and the GOES results agree reasonably well with the surface and aircraft data and have similar trends and magnitudes except for the GOES-derived effective radii, which are typically larger than the surface- and aircraft-derived values. The means and standard deviations of the differences between the surface and aircraft effective radius, LWP, and optical depth are -4\% +/- 20.1\%, -1\% +/- 31.2\%, and 8\% l+/- 29.395, respectively: while their correlation coefficients are 0.78, 0.92, and 0.89, respectively, during the 10-h period. The differences and correlations between the GOES-8 and aircraft results are of a similar magnitude, except for the droplet sizes. The averaged GOES-derived effective radius is 23\% or 1.8 microns greater than the corresponding aircraft values. resulting in a much smaller correlation coefficient of 0.18. Additional surface-satellite datasets were analyzed for time periods when the aircraft was unavailable. When these additional results are combined with the retrievals from the four in situ cases, the means and standard deviations of the differences between the satellite-derived cloud droplet effective radius, LWP, and optical depth and their surface-based counterparts are 16\% +/- 31.2\%, 4\% +/- 31.6\%, and -6\% +/- 39.9\%, respectively. The corresponding correlation coefficients are 0.24, 0.88, and 0.73. The frequency distributions of the two datasets are very similar indicating that the satellite retrieval method should be able to produce reliable statistics of boundary layer cloud properties for use in climate and cloud process models.

Author

Cloud Physics; Radiation Measurement; Atmospheric Radiation; Radiative Transfer; Particle Size Distribution; Infrared Radiation; Water

20030032987 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A New Estimate of the Extragalactic Gamma-ray Background from EGRET Data

Moskalenko, I. V.; Strong, A.; Reimer, O.; March 12, 2003; 1 pp.; In English; 28th ICRC Meeting, 31 Jul - 7 Aug. 2003, Japan; Copyright; Avail: Other Sources; Abstract Only

We use the GALPROP model for cosmic-ray propagation to obtain our best prediction of the Galactic component of gamma rays, and show that away from the Galactic plane it gives an accurate prediction of the observed Energetic Gamma

Ray Experiment Telescope (EGRET) intensities. On this basis we re-evaluate the isotropic extragalactic gamma-ray background. We find that for some energies previous work underestimated the Galactic contribution and hence overestimated the background. Our new background spectrum shows a positive curvature similar to that expected for models of the extragalactic emission based on the blazar population.
Author
Gamma Ray Observatory; Background Radiation; Astronomical Models; Computer Programs; Gamma Ray Astronomy

20030032988 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evaluation of Production Cross Sections of Li, Be, B in CR
Moskalenko, I. V.; Mashnik, S. G.; March 27, 2003; 1 pp.; In English; 28th ICRC Meeting, 31 Jul. - 7 Aug. 2003, Japan; No Copyright; Avail: Other Sources; Abstract Only

Accurate evaluation of the production cross section of light elements is important for models of cosmic ray (CR) propagation, galactic chemical evolution, and cosmological studies. However, the experimental spallation cross section data are scarce and often unavailable to CR community while semi-empirical systematics are frequently wrong by a significant factor. Running sophisticated nuclear codes is not an option of choice for everyone either. We use the Los Alamos versions of the Quark-Gluon String Model code LAQGSM and the improved Cascade-Exciton Model code CEM2k together with all available data from Los Alamos Nuclear Laboratory (LANL) nuclear database to produce evaluated production cross sections of isotopes of Li, Be, and B suitable for astrophysical applications. The LAQGSM and CEM2k models have been shown to reproduce well nuclear reactions and hadronic data in the range 0.01-800 GeV/nucleon.
Author
Cosmic Rays; Cross Sections; Lithium; Beryllium; Boron; Computerized Simulation

20030033923 Georgia Univ., Athens, GA, USA
Ultraviolet and Visible Emission Mechanisms in Astrophysics
Stancil, Phillip C.; Schultz, David R.; April 29, 2003; 6 pp.; In English
Contract(s)/Grant(s): NAG5-9088; No Copyright; Avail: CASI; A02, Hardcopy

The project involved the study of ultraviolet (UV) and visible emission mechanisms in astrophysical and atmospheric environments. In many situations, the emission is a direct consequence of a charge transferring collision of an ion with a neutral with capture of an electron to an excited state of the product ion. The process is also important in establishing the ionization and thermal balance of an astrophysical plasma. As little of the necessary collision data are available, the main thrust of the project was the calculation of total and state-selective charge transfer cross sections and rate coefficients for a very large number of collision systems. The data was computed using modern explicit techniques including the molecular-orbital close-coupling (MOCC), classical trajectory Monte Carlo (CTMC), and continuum distorted wave (CDW) methods. Estimates were also made in some instances using the multichannel Landau-Zener (MCLZ) and classical over-the-barrier (COB) models. Much of the data which has been computed has been formatted for inclusion in a charge transfer database on the World Wide Web (cfadc.phy.ornl.gov/astro/ps/data/). A considerable amount of data has been generated during the lifetime of the grant. Some of it has not been analyzed, but it will be as soon as possible, the data placed on our website, and papers ultimately written.
Derived from text
Ultraviolet Emission; Ultraviolet Astronomy; Space Plasmas; Ionic Collisions; Charge Transfer; Cross Sections

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20030032368 NASA Ames Research Center, Moffett Field, CA, USA
Memoirs of an Aeronautical Engineer: Flight Tests at Ames Research Center: 1940-1970
Anderson, Seth B.; [2002]; 173 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/SP-2002-4526; NAS 1.21:4526; No Copyright; Avail: CASI; A08, Hardcopy

Seth worked over a period of several years to prepare this monograph-collecting information, drafting the text, and finding and selecting the historic photographs. He describes the beginnings of flight research as he knew it at Ames Research Center,

recalls numerous World War II programs, relates his experiences with powered-lift aircraft, and concludes with his impressions of two international flight research efforts. His comprehensive collection of large-format photographs of the airplanes and people involved in the various flight activities related in the text constitutes a compelling part of his work.
Derived from text
Biography; Research Facilities; Engineers; Aeronautical Engineering; Flight Tests

20030033087 Elsevier Engineering Information, Inc., Hoboken, NJ, USA
PIE Publications in Engineering 2001-2002: Publications Abstracted and Indexed for Engineering
Aleva, Bernard; Katz, Peter; Sidi, Rafael; [2002]; ISSN 0085-4581; 622 pp.; In English; Copyright; Avail: Other Sources

This edition includes publications covered in Ei Compendex. Features include: 1) A list of all titles covered as Ei Page One or Ei Compendex. Titles abstracted completely are indicated in boldface; 2) Special section devoted to 2001/2002 coverage of conference proceedings; 3) A list of serials by Engineering discipline; 4) An alphabetical list of publisher names with addresses; and 5) A list of publisher names with addresses sorted by country and city. This edition lists 4267 serial publications (including journals, conferences and report series). Of these, 3624 are considered core to engineering and therefore are indexed and abstracted completely. Core journals are listed in boldface. 50 multidisciplinary, scientific and trade journals are covered selectively. Articles selected from these journals depend on the relevance of the article to engineering, its treatment and technical quality. Titles covered selectively are indicated by an asterisk (*). PIE: Publications In Engineering covers the following products: 1) The Engineering Index Annual; 2) The Engineering Index Monthly; 3) Ei Compendex; and 4) Ei Engineering Specialty Discs.
Derived from text
Engineering; Conferences; Indexes (Documentation); Abstracts

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