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STAR

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NASA STI Program ... in Profile

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

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Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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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.

20050240987 Lawrence Livermore National Lab., Livermore, CA USA
Ultra-High Pressure Modeling and Experiments Review
Costantino, M.; Darnell, I.; Jun. 03, 2004; 14 pp.; In English
Report No.(s): DE2005-15014206; UCRL-CONF-204471; No Copyright; Avail.: Department of Energy Information Bridge

The RDHWT/MARIAH II energy addition, run time, and mass flow rate requirements imply large air and nitrogen fluid volumes at the highest practicable static enthalpy. The objective of the gas supply concept development is the satisfaction of ultra-high pressure (UHP), high temperature thermodynamic requirements in a facility with acceptable safety and economic risks. The primary challenges for the mechanical design are connecting multiple volumes at pressures greater than 1,400MPa and temperatures greater than 500 K; fabricating high strength steel sections approximately 2 m in typical dimension, and reacting the pressure-related forces in the system. In the 'octahedral module' concept, four UHP intensifiers and two UHP manifolds are arranged in an 'octahedral' geometry that results in acceptable deviatoric stresses at cross bores. Multiple modules join to provide the required UHP volume at a stagnation pressure of 2100MPa and stagnation temperature of 750 K. NTIS
Stagnation Pressure; Modules; Stagnation Temperature; Fabrication

20050241674 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Fatality and Injury Rates for Two Types of Rotorcraft Accidents
Palmerron, David; October 2005; 9 pp.; In English
Report No.(s): DOT/FAA/AM-05/17; No Copyright; Avail.: CASI: A02, Hardcopy

An analysis of the frequency of four different types of rotorcraft accidents was conducted to determine if the number of fatalities and injuries between accident conditions was different. Accidents involving rollover, no rollover, fire, and no fire were studied to determine if accidents with a rollover or fire might be creating evacuation delays that contribute to the fatality and injury rates. A search of the FAA Accident Incident Data Systems from January 1986 to March 1997 produced 2704 accident records for this analysis. A Chi-Square test for independence was used to determine the difference between the rollover and no rollover and fire and no fire accident categories. Further analysis were performed on combinations of the main categories to determine if an event such as a rollover and fire produced more fatalities or injuries than a rollover without a fire.
Author
Data Systems

20050243049 Army Research Lab., Aberdeen Proving Ground, MD USA
Numerical Computations of Supersonic Flow Over a Square Cross-Section Missile
Silton, Sidra I.; Sahu, Jubaraj; Aug. 1, 2005; 52 pp.; In English
Contract(s)/Grant(s): Proj-622617.H8000
Report No.(s): AD-A439496; ARL-TR-3562; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes a computational study undertaken to determine the aerodynamics of a nonaxisymmetric missile with a square cross section. Numerical solutions have been obtained at supersonic speeds for various roll orientations and angles of attack using a two-equation Reynolds-averaged Navier-Stokes turbulence model. Numerical results show the qualitative

features (vortices and cross-flow separation regions) of the flow field at various stream wise positions along the missile configurations. Aerodynamic coefficients have been obtained from the computed solutions and found to match well with the available experimental data for these configurations. These numerical results show the ability of computational fluid dynamics techniques to accurately predict the aerodynamics of nonaxisymmetric missiles with a square cross section.
DTIC
Aerodynamics; Computational Fluid Dynamics; Missiles; Supersonic Flow

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.

20050240907 Tennessee Dept. of Transportation, Nashville, TN, USA
Tennessee Long-Range Transportation Plan: 2004 Updated Aviation System Plan
Oct. 2004; 98 pp.; In English
Report No.(s): PB2006-101016; No Copyright; Avail.: National Technical Information Service (NTIS)

The Tennessee Department of Transportation desires to incorporate the existing Tennessee Airport System Plan into its Long Range Transportation Plan. HNTB Corporation completed a thorough Tennessee Airport System Plan in 2001. Although the Airport System Plan is only three years old, significant changes in the nature of the aviation industry and a desire for a longer-range planning horizon indicated that the System Plan should be updated at this time. Although the efforts from the 2001 Plan will be used to the extent feasible in this Update, no other mode has been affected as greatly as air transportation in this short three-year timeframe. The September 11, 2001 terrorist attacks and the prolonged economic slowdown have resulted in the loss of one major carrier (TWA) and the bankruptcy of two other carriers (United and US Airways). Today, although low cost airlines are leading a general trend toward lower airfares, demand is still languishing. Air cargo is also experiencing a dampening of demand. Recognizing timing and resource limitations as well as the thoroughness of the 2001 plan, the update is streamlined in nature and will only consider the State's six commercial service airports and 14 regional airports. Vertical infrastructure, or heliports, have not been identified for the purpose of this report. The tasks completed for this update included an inventory of facilities, aviation industry review, review and update of previous system plan forecasts, and development plans for each of the 20 airports included in this study.
NTIS
Air Transportation; Planning; Transportation

20050242980 Naval Postgraduate School, Monterey, CA USA
Prototyping a Web-Enabled Decision Support System to Improve Capacity Management of Aviation Training
Bostick, Randall W.; Booth, William D., II; Sep. 1, 2005; 151 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439356; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For organizations with training pipelines, this study offers insights to help identify and minimize undesirable effects that may result from often unavoidable demand variations within a resource- and time-constrained environment. The highly complex Naval aviation training process is used as a case study. However, any organization with a training pipeline may find this study to be useful. Within a training pipeline, like any resource constrained production line, variability may cause undesirable results to occur. Variability includes any change in the number of students to train, time-to-train, instructor availability, material availability, and other supporting factors. Undesirable effects may include delayed time-to-train, wasted valuable resources, reduced morale, reduced quality of training, or an increase in undesirable behaviors as a result of perceived production pressures. Wasted valuable resources can include human capital, money, material, and time. Although other sources of variability will be discussed, this study primarily examines the cause and effect relationships resulting from variations in the number of students to train. Potential solutions are explored.
DTIC
Decision Support Systems; Education; Flight Training; Management Systems; Military Aviation; Prototypes; Students

20050243047 Defense Acquisition Univ., Fort Belvoir, VA USA
Military Airlift: C-17 Aircraft Program
Bolkcom, Christopher; Aug. 19, 2005; 22 pp.; In English
Report No.(s): AD-A439493; CRS-RL30685; No Copyright; Avail.: CASI: A03, Hardcopy

The C-17 Globemaster III is a long-range cargo/transport aircraft operated by the U.S. Air Force since 1993. Congress approved development of the aircraft in thelate 1970s, when it was recognized that the Air Force did not have enough airlift capability. In 1981, the McDonnell Douglas C-17 emerged as winner of a competition with Boeing and Lockheed to develop a next-generation aircraft to replace C-130s and C-141s. Full-scale development of the C-17 got underway in 1986, but technical problems and funding shortfalls delayed the program, leading to slipped schedules and increased costs. Despite those difficulties, the C-17 has retained broad congressional support and enjoys strong Air Force and Army backing. Defense officials view the C-17 as essential in the post-Cold War environment, because of its ability to fly long distances with large payloads yet still use smaller bases in remote areas. The C-17 first flew in 1991, about a year later than originally scheduled. Deliveries began in 1993, and in January 1995, the Air Force declared the aircraft fully operational. C-17s have been successfully used in Bosnia, Kosovo, Afghanistan, Iraq, and other operations. Production problems in the late 1980s raised questions about the possibility of more cost-effective alternatives. In April 1990, Defense Secretary Cheney reduced the projected buy from 210 to 120 planes. In late 1993, the Department of Defense (DOD) gave the contractor two years to solve production problems or face termination of the contract, with airlift shortfalls to be filled by modified commercial transport planes or existing military airlifters. By the mid-1990s, the program s earlier difficulties had been largely resolved, although some questioned the number of C-17s to be procured. In 1996, DOD approved plans to order 80 more C-17s for a total of 120 aircraft increased in late 1998 to 134.
DTIC
C-17 Aircraft; Transport Aircraft

20050243072 RAND Corp., Santa Monica, CA USA
Supporting Air and Space Expeditionary Forces: Analysis of Maintenance Forward Support Location Operations
Geller, Amanda; George, David; Tripp, Robert S.; Amouzegar, Mahyar A.; Roll, C. R., Jr; Jan. 1, 2004; 136 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439531; RAND/MG-151; No Copyright; Avail.: CASI: A07, Hardcopy

Since 1990, the USA military has been called upon to support crises that range from Operation Desert Storm to humanitarian relief operations. These operations create a diverse and unpredictable set of sortie-generation needs, from air-to-ground combat to the transport of food and supplies. To meet these demands, the Air Force is reorganizing into an Air and Space Expeditionary Force (AEF). Behind this new vision of force management is the idea that forces able to deploy quickly and frequently from the continental USA can replace the permanent forward presence of airpower that the Air Force employed during the Cold War. However, deploying airpower quickly and frequently strains the Air Force's current combat support system. The original concept of the AEF called for deploying the entire combat and support infrastructure from the continental USA. However, the resources needed to support a combat deployment are heavy, and require significant airlift and time to move to the theater. Furthermore, the need to redeploy the entire support structure with each combat deployment limits flexibility and creates instability among personnel. The Air Force is consequently reexamining its support infrastructure to focus on new goals: faster deployment, reduction in the mass of materiel to move, increased flexibility, and greater personnel stability. This study examines one potential reconfiguration of the Air Force's current support system: the creation of maintenance Forward Support Locations (FSLs) to consolidate intermediate maintenance near, but not in, the theater of operations.
DTIC
Combat; Deployment; Maintenance; Military Operations; Position (Location); Support Systems

20050243232 Army Research Inst. Field Unit, Fort Rucker, AL USA
Developing an Adaptive Intelligent Flight Trainer
Ludwig, Jeremy; Ramachandran, Sowmya; Howse, William R.; Jan. 1, 2005; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439799; No Copyright; Avail.: CASI: A02, Hardcopy

Intelligent tutoring systems (ITS) seek to mimic the learning improvement provided in a one-on-one tutor/student relationship. To effectively teach to a student, the ITS must adapt to the student's current understanding. Many ITSs judge a student's knowledge by current and historic performance in a subject area. From this information, an ITS can determine a number of facts about the student relevant to tutoring. This current/past performance view of tutoring ignores many aspects

particular to a student, which would be useful in teaching (e.g., personality factors, preferred learning style, confidence/anxiety). The authors view an adaptive instructional system (AIS) as an extension to an ITS that also takes into account these types of individual trait and state differences. The adaptations used by the AIS have been collected from both relevant literature and interviews with domain experts. Currently, the authors are applying these techniques to extend an ITS for training new helicopter pilots in the Army, where the subject matter experts are helicopter pilots. In current initial entry rotary wing (IERW) training, an instructor pilot (IP) is assigned two students. These two students train in the helicopter with the same IP until they complete the current training phase and check-ride. Researchers have examined replacing some of the actual flight training with simulation instruction for beginning pilots. The main drawback of this is that an IP is required for all simulator training to ensure that students don't acquire any bad habits. The Intelligent Flight Trainer (IFT) takes the simulator's role in training a step farther. Rather than have IPs train students in the simulator, the IFT takes on the tasks of an instructor pilot. This means that in addition to simulating helicopter flight, the IFT must also perform as an instructor pilot. The IFT consists of a helicopter flight simulator and an intelligent tutoring system (ITS) merged into a single system.
DTIC
Education; Expert Systems; Flight Simulators; Flight Training; Helicopters; Training Devices

20050243233 Stottler Henke Associates, Inc., San Mateo, CA USA
Intelligent Simulation-Based Tutor for Flight Training
Remolina, Emilio; Ramachandran, Sowmya; Fu, Daniel; Stottler, Richard; Howse, William R.; Jan. 1, 2004; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DASW01-01-C-5317
Report No.(s): AD-A439800; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Today's military flight simulators have dramatically reduced the cost of training by providing cheaper, effective alternatives to training on a real aircraft. However, flight training is still limited by the availability of instructor pilots. The adage 'practice makes perfect' is nowhere truer than in the learning of psychomotor skills such as flying. Ideally, trainees should be able to practice flying skills on their own to complement instructor-led training. However, most flight simulators do not have any automated assessment and tutoring facilities, making them ineffective as self-paced learning environments. The Army has funded pioneering research on developing automated tutors for flight training, specifically for training initial-entry rotor-wing pilots. An early rule-based system, called the Intelligent Flight Trainer (IFT), monitored trainees' flight performance and provided adaptive coaching. It provided instructional assistance by regulating the challenge level of a flight task, and through overt spoken feedback to inform trainees when they were flying out of range of specified flight parameters. Evaluations showed that while this system was effective in improving flying skills, it was inflexible in terms of it assessment and instruction strategies. The Army is currently funding research on a next-generation automatic flight trainer, called AIS-IFT, that improves upon the IFT. AIS-IFT is designed to be flexible and extensible in terms of assessment and tutoring procedures. A visual authoring tool lets Subject Matter Experts (SMEs) and course designers modify or create powerful instructional behavior with little programming effort. Whereas the previous effort had the instructional approach embedded deep in the tutoring system, the new approach separates the specific instructional strategies from the ITS infrastructure, thus empowering SMEs and course authors to create a tutor with pedagogy that is customized to their domain.
DTIC
Adaptation; Education; Expert Systems; Flight Simulators; Flight Training; Helicopters; Simulation; Training Devices

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.

20050240921 Airbus Industrie, Blagnac, France
Lateral Attenuation Based on A300 Noise Measurements
van Boven, M. W. P.; January 2005; 10 pp.; In English
Report No.(s): PB2006-100888; No Copyright; Avail.: National Technical Information Service (NTIS)

For the prediction of aircraft noise levels perceived at positions lateral to the flight track, lateral attenuation of noise has to be taken into account. Lateral attenuation contains all sound emission and propagation effects on noise, in addition to separately modeled spherical spreading and atmospheric absorption. AIR-1751 provides a method for prediction of lateral

attenuation, established by the Society of Automotive Engineers (SAE) in 1981. A particularity of this standard is that it is based on a noise measurements dataset dominated by aircraft with tail-mounted engines. Today's commercial wide-body aircraft fleet is dominated by aircraft with wing-mounted engines. A number of dedicated noise measurement projects have identified an overestimation of lateral noise attenuation in AIR1751 for aircraft with wing-mounted engines and the update process has been initiated by SAE. Airbus applies AIR-1751 in its operational noise level calculation program and therefore required insight in the quality of this standard. For this reason and to support the update work of SAE, supplementary noise measurements at lateral positions were conducted during a planned A300 external noise measurement campaign. This report describes these measurements and provides results in terms of lateral attenuation derived from the measurements.
NTIS
Noise Measurement; Aircraft Noise

20050240929 Wichita State Univ., Wichita, KS, USA
Damage Tolerance of Composite Sandwich Airframe Structures - Additional Results
Tomblin, J. S.; Raju, K. S.; Walker, T.; Acosta, J. F.; Oct. 2005; 86 pp.; In English
Contract(s)/Grant(s): 01-C-AQ-WISU-002
Report No.(s): PB2006-101515; No Copyright; Avail.: National Technical Information Service (NTIS)

The behavior of sandwich panels with open holes subjected to in-plane tensile and compressive loads were investigated experimentally. The objective of this study was to establish whether the open-hole damage was more severe compared to an impact damage of equal planar size. Hole diameters of 1, 2, and 4 inches were selected as they represented the planar dimensions of impact damage that produced contrasting failure modes in sandwich panels. The experimental results indicated that the open holes are more severe when compared to impact damage created with different impactor sizes. Comparison with past data revealed that residual strengths of impact damaged sandwich panels tend to approach that of the open hole with increasing residual indentation depth. Similar to impact damage, the single facesheet holes in sandwich panels under compression produced distinct failure modes, which was a function of the hole diameter. A facesheet fracture failure mode was observed for small diameter holes (and through holes of all sizes investigated), while a local instability mode was observed for the 4-inch-diameter hole. The buckling mode seen in sandwich panels with 4-inch-diameter single facesheet holes appeared to blunt the strain concentration due to facesheet bending, resulting in higher compressive strengths compared to smaller size holes.
NTIS
Aircraft Structures; Airframe Materials; Airframes; Composite Materials; Composite Structures; Damage; Sandwich Structures; Tolerances (Mechanics)

20050242986 Naval Postgraduate School, Monterey, CA USA
Explanatory Factors for Marine Corps Aviation Maintenance Performance
Chesterton, Gregory L.; Sep. 1, 2005; 131 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439388; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The thesis identifies F/A-18 squadron characteristics that are important predictors of maintenance performance and draws insights on the linkage between the utilization of engineering and technical services (ETS) and maintenance performance measures. Statistical analysis is conducted to identify squadron characteristics that have a detectable contribution to the variability of the performance measure man-hours per maintenance action, and how much additional variability is explained by the squadron that is not accounted for by the squadron characteristics already considered. Thirty months of data were collected for thirteen active duty Marine Corps F/A-18 squadrons. Regression is used to model man-hours per maintenance action as a linear combination of explanatory variables that describe the squadrons in terms of manpower, inventory, and ETS metrics. The test for significance indicates that the model developed in this study is highly likely to have better explanatory power than an intercept-only (average) estimate of the response variable. The study concludes with recommendations for data collection methods that would facilitate the correlation of squadron characteristics to ETS utilization. Critical to the success of this approach is the linkage of ETS utilization to specific squadron maintenance activities, and the development of methods to quantify maintainer training currency.
DTIC
Aircraft Maintenance; Maintenance

20050243094 Naval Postgraduate School, Monterey, CA USA
Performance Analysis for a Vision-Based Target Tracking System of a Small Unmanned Aerial Vehicle
Trago, Todd M.; Sep. 1, 2005; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439564; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis analyzes performance of the vision-based target-tracking system developed at the Naval Postgraduate School using the Monte Carlo method. Specifically, sensitivities of the target position estimation algorithm to various sensor errors are computed and analyzed. Furthermore, dependence of this algorithm on the performance of the target-tracking control system is established.
DTIC
Drone Vehicles; Pilotless Aircraft; Radar Tracking; Reliability Analysis; Tracking (Position)

20050243108 Maryland Univ., College Park, MD USA
The Hybrid Motor Prototype: Design Details and Demonstration Results
Venkataraman, R.; Dayawansa, W. P.; Krishnaprasad, P. S.; Jan. 1, 1998; 15 pp.; In English
Contract(s)/Grant(s): DAAG55-97-1-0114; DAAL03-92-G0121
Report No.(s): AD-A439584; CDCSS-TR-98-2; ISR-TR-98-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)
A novel hybrid rotary motor incorporating piezoelectric and magnetostrictive actuators has been designed and demonstrated. The novelty of this motor was the creation of an electrical resonant circuit, whereby reactive power requirement on the power source is reduced. It was envisaged that the motor would be suitable for low output speed, high torque applications because of its design. This report presents the constructional details of this motor and the results of the demonstration.
DTIC
Actuators; Computerized Simulation; Electric Motors; Prototypes

20050243123 Washington Univ., Seattle, WA USA
Seaglider in AUVFEST 2005
Stewart, Marc S.; Newton, Jan; Oct. 1, 2005; 5 pp.; In English
Report No.(s): AD-A439604; No Copyright; Avail.: CASI: A01, Hardcopy
Use existing glider operation and maintenance procedures to prepare, employ, and recovery a glider in Dabob Bay and Hood Canal. Use existing glider interface software to 1) automatically reformat measured environmental data from the glider into Navy standard message format files, and 2) transmit those files to Navy channels for assimilation and application.
DTIC
Computer Programs; Gliders; Message Processing

20050243144 Naval Postgraduate School, Monterey, CA USA
Unmanned Aerial Vehicle Survivability: The Impacts of Speed, Detectability, and Enemy Capabilities
McMindes, Kevin L.; Sep. 1, 2005; 175 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439645; No Copyright; Avail.: CASI: A08, Hardcopy
Warfighters are increasingly relying on Unmanned Aerial Vehicle (UAV) systems at all levels of combat operations. As these systems weave further into the fabric of our tactics and doctrine, their loss will seriously diminish combat effectiveness. This makes the survivability of these systems of utmost importance. Using Agent-based modeling and a Nearly Orthogonal Latin Hypercube design of experiment, numerous factors and levels are explored to gain insight into their impact on, and relative importance to, survivability. Factors investigated include UAV speed, stealth, altitude, and sensor range, as well as enemy force sensor ranges, probability of kill, array of forces, and numerical strength. These factors are varied broadly to ensure robust survivability results regardless of the type of threat. The analysis suggests that a speed of at least 135 knts should be required and that increases in survivability remain appreciable up to about 225 knts. The exception to speed's dominance is in the face of extremely high capability enemy assets. In this case, stealth becomes more important than speed alone. However, the interactions indicate that as both speed and stealth increase, speed yields a faster return on overall survivability and that speed mitigates increased enemy capabilities.
DTIC
Combat; Detection; Drone Vehicles; Pilotless Aircraft

20050243148 Naval Postgraduate School, Monterey, CA USA
Error Analysis of Sensor Measurements in a Small UAV
Ackerman, James; Sep. 1, 2005; 63 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439651; No Copyright; Avail.: CASI: A04, Hardcopy

This thesis focuses on evaluating the measurement errors in the gimbal system of the SUAV autonomous aircraft developed at NPS. These measurements are used by the vision based target position estimation system developed at NPS. Analysis of the errors inherent in these measurements will help direct future investment in better sensors to improve the estimation system's performance.
DTIC
Detection; Drone Vehicles; Error Analysis; Target Acquisition

20050243210 Air Force Logistics Management Center, Gunter AFS, AL USA
Kadena F-15 C/D Cost per Flying Hour Analysis
Howe, Jeremy; Dawson, Kevin; Aug. 16, 2005; 8 pp.; In English
Report No.(s): AD-A439752; AFLMA-LM20050700; No Copyright; Avail.: CASI: A02, Hardcopy

Although largely focused on illustrating the impact ofAverage Sortie Duration (ASD) changes on Cost per Flying Hour (CPFH) calculations, this study was also an effort to broadly examine the variety of component failure modes and their influence on aircraft break events during sorties. In conjunction with a notional CPFH calculation moded, correlation and regression techniques were used to examine historical PACAF F-15C/D maintenance data, to include Break Rate, Pilot Reported Discrepancies (PRD) and Total Non-mission Capable for Maintenance (TNMCM) time. The findings of this research indicate that CPFH will increase as ASD decreases, irrespective of the amount of sorties or hours flown.
DTIC
Cost Analysis; F-15 Aircraft; Fighter Aircraft; Flight; Maintenance

20050243230 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Examining the Impact of Quality Assurance Manning Practices in USAF aircraft Maintenance Units
Moore, Terry D.; Mar. 1, 2005; 297 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439793; AFIT/GLM/ENS/05-18; No Copyright; Avail.: CASI: A13, Hardcopy

The purpose of this research was to examine the impact that current USAF quality Assurance (QA) manning practices has on key aircraft wing- and unit-level metrics. Interviews and surveys culminated in development of a QA Manning Effectiveness Matrix. We then used the matrix to calculate historical QA manning effectiveness at 16 ACC bases. Effectiveness scores were regressed with associated historical data for 26 metrics derived from a Delphi survey. Nine metrics were deemed statistically significant, including break rates, cannibalization rates, flying schedule effectiveness rates, key task list pass rates, maintenance scheduling effectiveness rates, quality verification inspection pass rates, repeat rates, dropped objects counts and safety/technical violations counts. An example benefit cost analysis for changes in QA manning effectiveness was performed, using reasonable cost values. The results present compelling evidence for maintenance managers to carefully weigh decisions to leave QA manning slots empty, or to assign personnel possessing other than authorized credentials. Maintenance managers can use this tool to help determine mitigating strategies for improving unit performance with respect to the nine metrics.
DTIC
Maintenance; Procedures; Quality Control

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.

20050241829 Air Force Research Lab., Edwards AFB, CA USA
The Case for Small Spacecraft: An Integrated Perspective on Electric Propulsion
Barnhart, D.; Wojnar, R.; Tilley, D.; Spores, R.; Jan. 1, 1995; 13 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A438994; IEPC-95-148; No Copyright; Avail.: CASI: A03, Hardcopy

As economies of scale were reduced in commercial and military endeavors, and with the international climate trending toward cooperation and stabilization, the aerospace industry today has taken a decided turn toward decreasing expenditures. This reduction in funding has challenged project managers and engineers to reduce the overall size of spacecraft while still accomplishing the same or similar tasks as larger spacecraft. Solutions to reconnaissance, environmental monitoring, and ground imaging are flow currently being demonstrated by small satellites. Physical reductions in the sire of overall spacecraft

have been accompanied by reductions in subsystems and components. All manor of subsystems including propulsion, command and data handling, telemetry and electrical power must respond to the sire challenge of smaller mass and volumetric requirements. This applies equally to electric propulsion. Overall power requirements for a small satellite can be considered between 100-300 Watts for LEO/GEO/ missions, and between 300-650 Watts for long duration missions. This paper will discuss the small satellite paradigm shift, unique approaches to electric propulsion integration into small satellite architectures, and develop a sample mission that focuses on enabling one of the emerging markets' for small satellites using electric propulsion as the performance-merit enhancer.
DTIC
Electric Propulsion; Aerospace Industry; Economy; Imaging Techniques

20050243001 Naval Postgraduate School, Monterey, CA USA
Improved Aerothermodynamic Measurements of the T63-A-700 Gas Turbine Engine
Garrott, Kristine B.; Sep. 1, 2005; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439420; No Copyright; Avail.: CASI: A05, Hardcopy

This thesis contains an analysis of the failure of the instrumentation ring for measuring the combustor exit temperature and total pressure in the T63-A-700 gas turbine engine. An improved ring design has been constructed and installed. Extensions to the exhaust stacks have been installed to keep the cell temperature reasonable. A water-cooled heat exchanger was installed in place of an air-cooled heat exchanger that was not adequately cooling the oil temperature while running the engine. In the program GASTURB, a compressor map with data from the manufacturer was created and an operating line from three separate speeds was plotted.
DTIC
Aerothermodynamics; Gas Turbine Engines; Gas Turbines

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*.

20050240908 California Univ., Los Angeles, CA, USA
Nanotechnology: Opportunity and Challenge for Industry. Held in Los Angeles, California on September 10, 2001
January 2001; 48 pp.; In English; Nanotechnology: Opportunity and Challenge for Industry., September 10, 2001, Los Angeles, California
Report No.(s): PB2006-101110; No Copyright; Avail.: CASI: A03, Hardcopy

Nanotechnology: Opportunities and Challenges was held on September 10, 2001. This was the first in a series of conferences on nanoscience and technology that are being sponsored by the U.S. Department of Commerce and other Federal agencies. Additional conferences will be held in 2002 at a number of locations around the country. Nanoscale science and engineering has been the growing focus of exciting research and discovery over the last decade and a half. A major Federal multi-agency nanotechnology research initiative is underway to enhance and facilitate the collaboration across disciplines that is required to advance both scientific knowledge and the practical applications of nanotechnology. This conference was organized to explore the status of research at the nanometer scale and its utilization by industry. There was a special interest in how to bring the 'nano' into the marketplace promptly by identifying obstacles and the ways to remove them. The conference addressed three specific industry sectors - information technology, bioscience, and aerospace - and drew many of its participants from Southern California and the western USA.
NTIS
Industries; Nanotechnology

20050242046 Lawrence Livermore National Lab., Livermore, CA USA
Solar Sail Fresnel Zone Plate Lens for a Large Space Based Telescope
Early, J. T.; Feb. 13, 2003; 12 pp.; In English
Report No.(s): DE2005-15013441; UCRL-JC-147405; No Copyright; Avail.: Department of Energy Information Bridge

A Fresnel zone plat lens made with solar sail material could be used as the primary optic for a very large aperture telescope

on deep space probes propelled by solar sails. The large aperture telescope capability could enable significant science on fly-by missions to the asteroids, Pluto, Kuiper belt or the tort cloud and could also enable meaningful interstellar fly-by missions for laser propelled sails. This type of lens may also have some potential for laser communications and as a solar concentrator. The techniques for fabrication of meter size and larger Fresnel phase plate optics are under development at LLNL, and we are extending this technology to amplitude zone plates made from sail materials. Corrector optics to greatly extend the bandwidth of these Fresnel optics will be demonstrated in the future. This novel telescope concept will require new understanding of the fabrication, deployment and control of gossamer space structures. It will also require new materials technology for fabricating these optics and understanding their long term stability in a space environment.
NTIS
Fresnel Lenses; Fresnel Region; Hubble Space Telescope; Solar Sails; Telescopes

20050243124 Air Force Occupational Measurement Center, Randolph AFB, TX USA
Occupational Survey Report AFSC 1C6X1 Space Systems Operations
Pickett, Bryan; Sep. 1, 2004; 58 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439606; AFSC-1C6X1; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The mission of the Squadron is to provide occupational programs to optimize USA Air Force personnel and training decisions.
DTIC
Aerospace Systems; Personnel Management; Surveys

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*.

20050243130 Spectral Sciences, Inc., Burlington, MA USA
Predictions of Observations of Shuttle Engine Firings
Braunstein, M.; Bernstein, L.; Venner, M.; Dressler, R.; Aug. 22, 2005; 19 pp.; In English
Contract(s)/Grant(s): F04611-03-C-0015; Proj-BMSB
Report No.(s): AD-A439623; No Copyright; Avail.: CASI: A03, Hardcopy
This viewgraphs report on the following: 1) Chemical Mechanisms; 2) Source and Apparent Signals; 3) Instrumentation; 4) Conclusions and Future Work.
DTIC
Chemical Reactions; Space Shuttles

20050243160 Naval Postgraduate School, Monterey, CA USA
Army Space and Transformation
Scherer, Clay S.; Sep. 1, 2005; 145 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439668; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The Army is undergoing a Transformation process, the outcome of which will be an enhanced warfighting capability via the Objective Force. Space is a key enabler for the Army s Objective Force capabilities and Joint combat operations. The Army has a long history of success in the space mission area that stretches back to the 1940s. The Army established doctrine for conducting space operations in support of the Objective Force. This thesis explains why the Army is involved in space from historical, doctrinal and policy perspectives. The Army created force structure for Space Support Elements (SSE) at the tactical level and organic to Division headquarters, and has planned and proposed additional space elements at the Brigade, Corps and Army organizational levels. The FA40, (Space Operations), Career Field is a relatively new personnel category that brings space products and services to the warfighter. Proper distribution of the FA40 personnel pool is a critical part of assuring the success of the FA40 Career Field. This thesis presents recommendations on how the Army can better organize its space force structure, allocate personnel and develop future space capabilities requirements documents to ensure relevancy in a transformed Army.
DTIC
Combat; Military Operations; Space Missions

20050243187 Army Research Lab., Adelphi, MD USA
Reliable Multicasting Based on Air Caching for Flat Hierarchy Networks
Manousakis, Kyriakos; Jan. 1, 2002; 219 pp.; In English
Report No.(s): AD-A439717; CSHCN-MS-2002-2; No Copyright; Avail.: CASI: A10, Hardcopy

The evolution of satellite networks in the commercial and military world has pushed the research community towards the solution of important problems related to this kind of networks, which are characterized from the lack of physical hierarchy. One of those important problems is how to design an efficient reliable multicasting protocol for one-hop (flat) networks where the link may present characteristics like high propagation delay and high BER. The existing reliable multicasting protocols are inefficient when applied to flat networks, since those are based on intermediate receivers and local recovery techniques. We introduce the Air Cache, which serves as a fast access memory that is realized on the air and contains packets for the recovery of corrupted or erroneous data packets at the receivers. In this thesis we present two classes of reliable multicasting protocols, which are based on the combination of FEC and ARQ with air caching. The non-adaptive class of protocols (UDPAC, RDPAC, PPAC) is characterized by the static nature of the Air Cache in term of size and content and the second class of protocols (ACDAC, ASPAC, HADAC) is characterized by the dynamic nature of the Air Cache.
DTIC
Hierarchies; Protocol (Computers); Satellite Networks

20050243194 Army Research Lab., Adelphi, MD USA
Resource Allocation in Ka-band Satellite Systems
Feng, Youyu; Jan. 1, 2001; 99 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439725; CSHCN-MS-2001-1; No Copyright; Avail.: CASI: A05, Hardcopy

The Ka-band satellite system is of increasing interest around the world due to its huge bandwidth. Rain fading is one of the primary factors affecting performance and availability of the Ka-band system. Extra power on the satellite can provide compensation for rain attenuation. In this thesis, we study the rain fade compensation problem for downlink transmission in the Ka-band satellite by dynamic resource allocation. The resources we consider include power and antennas onboard the satellite. The goal is to maximize the aggregate priority of packets arriving at all downlink spots as well as maintain fairness among downlinks. We formulate the problem mathematically in the framework of Knapsack Problems (KP). In particular, we show the resource allocation problem is equivalent to a Multi-choice Multiple Knapsack Problem (MCMKP), which, in general, is very hard to solve in a reasonable time. By introducing the seeding theory into the antenna scheduling, we decompose the original MCMCP into a sequence of Multiple-choice Knapsack Problems (MCKP), which are easier to solve. The effectiveness of our approach is demonstrated through simulations in OPNET. Comparison with the Multiple Knapsack Problem (MKP) approach proposed by Birmani is also provided.
DTIC
Artificial Satellites; Extremely High Frequencies; Resource Allocation; Resources Management

20050243203 Maryland Univ., College Park, MD USA
Resource Allocation for KA-Band Broadband Satellite Systems
Birmani, Vineet; Jan. 1, 1999; 92 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439738; No Copyright; Avail.: CASI: A05, Hardcopy

Forthcoming high data rate geostationary satellite systems, which are planned to work in rain affected Ka-band, would need effective resource management from a network management perspective. In this thesis we have looked at satellite power and bursting time-slots needed for the downlink channel, as satellite resources that need to be managed. Some solutions are proposed in order to tackle the above-mentioned problem.
DTIC
Allocations; Artificial Satellites; Broadband; Extremely High Frequencies; Resource Allocation

20050243216 Spectral Sciences, Inc., Burlington, MA USA
Predictions of AMOS Observations of Space Shuttle Engine Firings. Draft
Braunstein, Matthew; Bernstein, Larry; Dressler, Rainer; Venner, Marty; Aug. 2, 2005; 15 pp.; In English
Contract(s)/Grant(s): F04611-03-C-0015; F19628-00-C-0006; Proj-5503
Report No.(s): AD-A439770; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Engine firings of the Space Shuttle primary control system (PRCS) thrusters can give rise to radiation observable from ground-based telescopes such as AMOS. Such observations would yield valuable information on the environment near the

spacecraft during engine operation. The radiation and the mechanisms that produce it are also important to characterize because such radiation can be a significant background noise source for telescopes mounted on spacecraft in low-Earth-orbit or LEO in general. Furthermore, observations of radiation associated with engine firings can give valuable information on fundamental chemical reactions that can be studied over the very large length scales, high energies, and rarefied conditions that are achievable in space but are especially difficult to reproduce in ground-based laboratories.
DTIC
Engines; Space Shuttles; Supercomputers; Telescopes

23
CHEMISTRY AND MATERIALS (GENERAL)

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

20050240859 Lawrence Livermore National Lab., Livermore, CA USA
Including Dislocation Flux in a Continuum Crystal Plasticity Model to Produce Size Scale Effects
Escobedoo, J. P.; Field, D. P.; Leblanc, M. M.; Feb. 24, 2004; 22 pp.; In English
Report No.(s): DE2005-15013904; UCRL-TR-202509; No Copyright; Avail.: Department of Energy Information Bridge

An experimental procedure is reported to perform shear tests on specimens held under moderately high hydrostatic pressures (on the order of 0 GPa). The mechanical behavior of materials subjected to such pressures, varies substantially from that observed at atmospheric pressure or even pressures typically attained during industrial processing. These differences must be incorporated into models such as the Steinberg-Guinan hardening model or discrete dislocation dynamics simulations. The goal of the proposed research is to develop and implement testing procedures that experimentally determine pressure-dependent dislocation mobilities in oriented single crystals of the BCC transition metals. These experiments will provide calibration data for models of materials subjected to extreme pressures and will assist in model validation. This paper reports the development of the experimental procedures. A thin foil of polycrystalline Ta was used to perform the initial experiments under hydrostatic pressures ranging from 2.1 to 4.2 GPa. Both yielding and hardening behavior are observed to be sensitive to the imposed pressure.
NTIS
Body Centered Cubic Lattices; Shear Strength

20050240860 Lawrence Livermore National Lab., Livermore, CA USA
Including Dislocation Flux in a Continuum Crystal Plasticity Model to Produce Size Scale Effects
Arsenlis, A.; Becker, R.; Parks, D. M.; Bulatov, V. V.; Jun. 13, 2004; 12 pp.; In English
Report No.(s): DE2005-15013845; UCRL-PROC-202356; No Copyright; Avail.: National Technical Information Service (NTIS)

A novel model has been developed to capture size scale and gradient effects within the context of continuum crystal plasticity by explicitly incorporating details of dislocation transport, coupling dislocation transport to slip, evolving spatial distributions of dislocations consistent with the flux, and capturing the interactions among various dislocation populations. Dislocation flux and density are treated as nodal degrees of freedom in the finite element model, and they are determined as part of the global system of equations. The creation, annihilation and flux of dislocations between elements are related by transport equations. Crystallographic slip is coupled to the dislocation flux and the stress state. The resultant gradients in dislocation density and local lattice rotations are analyzed for geometrically necessary and statistically stored dislocation contents that contribute to strength and hardening. Grain boundaries are treated as surfaces where dislocation flux is restricted depending on the relative orientations of the neighboring grains. Numerical results show different behavior near free surfaces and non-deforming surfaces resulting from differing levels of dislocation transmission. Simulations also show development of dislocation pile-ups at grain boundaries and an increase in flow strength reminiscent of the Hall-Petch model. The dislocation patterns have a characteristic size independent of the numerical discretization.
NTIS
Continuum Modeling; Continuums; Crystals; Plastic Properties; Scale Effect

20050240901 Lawrence Livermore National Lab., Livermore, CA USA
Chemical Kinetic Study of Toluene Oxidation Under Premixed and Nonpremixed Conditions
Pitz, W. J.; Seiser, R.; Boezzelli, J. W.; Seshadri, K.; Chen, C. J.; Dec. 22, 2003; 26 pp.; In English
Report No.(s): DE2005-15013742; UCRL-CONF-201575; No Copyright; Avail.: Department of Energy Information Bridge

A study was performed to elucidate the chemical-kinetic mechanism of combustion of toluene. A detailed chemical-kinetic mechanism for toluene was improved by adding a more accurate description of the phenyl + O(sub 2) reaction channels, toluene decomposition reactions and the benzyl + O reaction. Results of the chemical kinetic mechanism are compared with experimental data obtained from premixed and nonpremixed systems. Under premixed conditions, predicted ignition delay times are compared with new experimental data obtained in shock tube. Also, calculated species concentration histories are compared to experimental flow reactor data from the literature. Under nonpremixed conditions, critical conditions of extinction and autoignition were measured in strained laminar flows in the counterflow configuration. Numerical calculations are performed using the chemical-kinetic mechanism at conditions corresponding to those in the experiments. Critical conditions of extinction and autoignition are predicted and compared with the experimental data. Comparisons between the model predictions and experimental results of ignition delay times in shock tube, and extinction and autoignition in nonpremixed systems show that the chemical-kinetic mechanism predicts that toluene/air is overall less reactive than observed in the experiments. For both premixed and nonpremixed systems, sensitivity analysis was used to identify the reaction rate constants that control the overall rate of oxidation in each of the systems considered. Under shock tube conditions, the reactions that influence ignition delay time are H + O(sub 2) chain branching, the toluene decomposition reaction to give an H atom, and the toluene + H abstraction reaction. The reactions that influence autoignition in nonpremixed systems involve the benzyl + HO(sub 2) reaction and the phenyl + O(sub 2) reaction.
NTIS
Combustion; Oxidation; Premixing; Reaction Kinetics; Toluene

20050240905 Forest Products Lab., Madison, WI USA, Marcel Dekker, Inc., New York, USA
Wood as an Adherend. (Chapter 1 from Volume 7: Treatise on Adhesion and Adhesives)
River, B. H.; Vick, C. B.; Gillespie, R. H.; January 1991; 242 pp.; In English
Report No.(s): PB2006-101057; No Copyright; Avail.: CASI: A11, Hardcopy

Wood is a porous, permeable, hygroscopic, orthotropic, biological composite material of extreme chemical diversity and physical intricacy. Table 1.1 provides an overview of the many variables, including wood variables, that bear on the bonding and performance of wood in wood joints and wood-based materials. Of particular note is the fact that wood properties vary between species, between trees within a species, and even within a tree. Variability within a single species alone is enough to significantly challenge an adhesive to perform consistently and satisfactorily. In this chapter, we have attempted to describe wood and to explore how this complex biological material interacts with adhesives to affect the bonding process and the quality of the bonded joint or material. First, we will present a short review of the history connecting wood and adhesives.
NTIS
Adhesion; Adhesive Bonding; Adhesives; Bonding; Wood

20050240946 Department of Energy, Washington, DC, USA
Energy Materials Coordinating Committee (EMaCC) Annual Technical Report, Fiscal Year 2003
Oct. 18, 2004; 200 pp.; In English
Report No.(s): PB2006-101408; DOE/SC-0088; No Copyright; Avail.: CASI: A09, Hardcopy

The DOE Energy Materials Coordinating Committee (EMaCC) serves primarily to enhance coordination among the Department's materials programs and to further effective use of materials expertise within the Department. These functions are accomplished through the exchange of budgetary and planning information among program managers and through technical meetings/workshops on selected topics involving both DOE and major contractors. In addition, EMaCC assists in obtaining materials-related inputs for both intra- and interagency compilations.
NTIS
Management Systems; Budgets

20050240948 Department of Energy, Washington, DC, USA
Energy Materials Coordinating Committee (EMaCC) Annual Technical Report, Fiscal Year 2002
Aug. 08, 2003; 226 pp.; In English
Report No.(s): PB2006-101407; DOE/SC-0077; No Copyright; Avail.: CASI: A11, Hardcopy

The DOE Energy Materials Coordinating Committee (EMaCC) serves primarily to enhance coordination among the Department's materials programs and to further effective use of materials expertise within the Department. These functions are accomplished through the exchange of budgetary and planning information among program managers and through technical meetings/workshops on selected topics involving both DOE and major contractors. In addition, EMaCC assists in obtaining materials-related inputs for both intra- and interagency compilations.
NTIS
Management Planning; Coordination

20050240949 Department of Energy, Washington, DC, USA
Energy Materials Coordinating Committee (EMaCC) Annual Technical Report, Fiscal Year 2001
Aug. 2002; 218 pp.; In English
Report No.(s): PB2006-101406; DOE/SC-0061; No Copyright; Avail.: CASI: A10, Hardcopy
The DOE Energy Materials Coordinating Committee (EMaCC) serves primarily to enhance coordination among the Department's materials programs and to further effective use of materials expertise within the Department. These functions are accomplished through the exchange of budgetary and planning information among program managers and through technical meetings/workshops on selected topics involving both DOE and major contractors. In addition, EMaCC assists in obtaining materials-related inputs for both intra- and interagency compilations.
NTIS
Coordination; Management Systems

20050240950 Department of Energy, Germantown, MD, USA
Energy Materials Coordinating Committee (EMaCC) Annual Technical Report, Fiscal Year 2000
Jul. 31, 2001; 234 pp.; In English
Report No.(s): PB2006-101405; DOE/SC-0040; No Copyright; Avail.: CASI: A11, Hardcopy
The DOE Energy Materials Coordinating Committee (EMaCC) serves primarily to enhance coordination among the Department's materials programs and to further effective use of materials expertise within the Department. These functions are accomplished through the exchange of budgetary and planning information among program managers and through technical meetings/workshops on selected topics involving both DOE and major contractors. In addition, EMaCC assists in obtaining materials-related inputs for both intra- and interagency compilations.
NTIS
Coordination; Management Methods

20050240961 Lawrence Livermore National Lab., Livermore, CA USA
Distributed Activation Energy Model of Thermodynamically Inhibited Nucleation and Growth Reactions and Its Application to the Phase Transition of HMX
Burnham, A. K.; Weese, R. K.; Weeks, B. L.; Jul. 20, 2004; 18 pp.; In English
Report No.(s): DE2005-15014551; UCRL-CONF-203167; No Copyright; Avail.: Department of Energy Information Bridge
Detailed and global models are presented for thermodynamically inhibitednucleation-growth reactions and applied to the beta-delta Phase Transition of HMX (nitramine octahydro-1, 3,5,7-tetranitro- 1,3,5,7-tetrazocine). The detailed model contains separate kinetic parameters for the nucleation process, including an activation energy distribution resulting from a distribution of defect energies, and for movement of the resulting reaction interface within a single particle. A thermodynamic inhibition term is added to both processes so that the rates go to zero at the transition temperature. The global model adds the thermodynamic inhibition term to the extended Prout-Tompkins nucleation-growth formalism for single particles or powders. Model parameters are calibrated from differential scanning calorimetry data. The activation energy for nucleation (333 kJ/mol) is substantially higher than that forgrowth (29.3 kJ/mol). Use of a small activation energy distribution (approximately 400 J/mol) for the defects improves the fit to a powered sample for both the early and late stages of the transition. The effective overall activation energy for the global model (208.8 kJ/mol) is in between that of nucleation and growth. Comparison of the two models with experiment indicates the thermodynamic inhibition term is more important than the energy distribution feature for this transition.Based on the applicability of the Prout-Tompkins kinetics approach to a wide range of organic and inorganic materials, both models should have equally broad applicability for thermodynamically constrained reactions.
NTIS
Activation Energy; HMX; Nucleation; Phase Transformations; Thermodynamics; Transition Temperature

20050240977 Lawrence Livermore National Lab., Livermore, CA USA
Hybrid Passive/Active Magnetic Bearing System
Hagler, L. B.; Jun. 11, 2004; 28 pp.; In English
Report No.(s): DE2005-15014167; UCRL-TR-204664; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Machining; Magnetic Bearings; Precision

20050242954 Texas Univ., Austin, TX, USA
Thermodynamics and Kinetics of Aqueous Piperazine with Potassium Carbonate for Carbon Dioxide Absorption. Topical Report, January 1, 2005-March 31, 2005
Cullinane, J. T.; Apr. 18, 2005; 400 pp.; In English
Report No.(s): DE2005-839556; No Copyright; Avail.: Department of Energy Information Bridge
This work proposes an innovative blend of potassium carbonate (K2CO3) and piperazine (PZ) as a solvent for CO2 removal from combustion flue gas in an absorber/stripper. The equilibrium partial pressure and the rate of absorption of CO2 were measured in a wetted-wall column in 0.0 to 6.2 m K(sup +) and 0.6 to 3.6 m PZ at 25 to 110 C. The equilibrium speciation of the solution was determined by H-1 NMR under similar conditions. A rigorous thermodynamic model, based on electrolyte non-random two-liquid (ENRTL) theory, was developed to represent equilibrium behavior. A rate model was developed to describe the absorption rate by integration of eddy diffusivity theory with complex kinetics. Both models were used to explain behavior in terms of equilibrium constants, activity coefficients, and rate constants. The addition of potassium to the amine increases the concentration of CO3(sup 2-)/HCO3(sup -) in solution.
NTIS
Aqueous Solutions; Carbon Dioxide; Carbonates; Electrolytes; Potassium; Thermodynamics; Kinematics

20050243169 Geological Survey, Reston, VA USA
The Stability of Chlorofluorocarbons (CFCs) in Ground-Water Samples Archived in Borosilicate Ampoules
Shapiro, StephanieD.; Busenberg, Eurybiades; Plummer, L. N.; Jan. 1, 2004; 37 pp.; In English
Report No.(s): AD-A439685; No Copyright; Avail.: CASI: A03, Hardcopy
The U.S. Geological Survey (USGS) Chlorofluorocarbon (CFC) Laboratory in Reston, Va., has been measuring concentrations of CFCs in ground-water samples since 1989 to estimate the year that a water sample was recharged to a ground-water flow system. The water samples have been collected in flamesealed borosilicate ampoules. Typically for each site, three samples were analyzed within days to a few months after collection, and additional samples were archived for extended periods of time (up to four years). The stability of CFC concentrations in the archived water samples from the USGS CFC Laboratory was investigated by analyzing the CFC concentrations in archived water samples and comparing them with the CFC concentrations that were obtained soon after the samples were collected. The archived samples selected for analysis were chosen from sites with a wide variety of hydrogeologic and geochemical conditions. For CFC-11 and CFC-12 concentrations, approximately 14% and 10.5%, respectively, of the archived samples were statistically different (both higher and lower) from the concentrations obtained from analyses conducted soon after the sample collection. Most of the extraneous values were attributed to natural variability of CFC concentrations originally in the water discharged from wells, rather than to microbial degradation within the ampoule on storage.
DTIC
Ampoules; Borosilicate Glass; Chlorofluorocarbons; Fluorohydrocarbons; Ground Water; Sampling; Stability

24
COMPOSITE MATERIALS

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

20050240862 Lawrence Livermore National Lab., Livermore, CA USA
Including Dislocation Flux in a Continuum Crystal Plasticity Model to Produce Size Scale Effects
Nersessian, N.; Or, S. W.; Carman, G. P.; McCall, S. K.; Jun. 01, 2004; 20 pp.; In English
Report No.(s): DE2005-15013898; UCRL-PROC-204423; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Composite Materials; Magnetostriction

20050243141 Michigan Univ., Ann Arbor, MI USA
Active Aeroelastic Tailoring of High-Aspect-Ratio Composite Wings
Cesnik, Carlos E.; Sep. 1, 2005; 320 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0425
Report No.(s): AD-A439640; CESC-F005639-FINAL; AFRL-SR-AR-TR-05-0482; No Copyright; Avail.: CASI: A14, Hardcopy

Nonlinear aeroelastic modeling and the fundamental mechanisms of active aeroelastic tailoring of high-aspect-ratio composite wings for High-altitude Long-endurance (HALE) aircraft is presented. To investigate the effects of distributed anisotropic strain actuation and their synergism with the passive aeroelastic tailored composite structure, a new framework was developed for analysis and design of high aspect ratio active flexible wings. The formulation is capable of modeling the nonlinear large deflection behavior of slender wings and other structural members, deformation due to applied voltages on the active plies in the skin of the wing, and the unsteady subsonic aerodynamic forces acting on the wing. Because HALE wings are long and slender, they can be well modeled as beams undergoing three dimensional displacements and rotations. The cross sectional stiffness, inertia, and actuation properties of the wing are calculated along the span, and then a nonlinear beam model is constructed. A novel beam representation was developed and it was based entirely on the beam strains, resulting in a computationally efficient low-order model suitable for preliminary structural design and control synthesis. The formulation was then extended to analyze different beam configurations, particularly in the presence of joints and splits. With that, the entire vehicle can be modeled and non-conventional wing configurations such as the joined wing could be analyzed. Finally, different aircraft configurations such as the ones being considered for the new Air Force Sensor Craft vehicle were studied.
DTIC
Aeroelasticity; Composite Structures; High Aspect Ratio; Wings

20050243192 Air Force Research Lab., Edwards AFB, CA USA
Solid Rocket Motor Insulation Testing
Blanski, Rusty; Jul. 13, 2005; 16 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A439723; No Copyright; Avail.: CASI: A03, Hardcopy

GOAL: 50% lower erosion of insulation (44% weight reduction, 7.4% booster payload increase); OBJECTIVE: Development of ceramic forming polymer and/or structurally reinforced char layer.
DTIC
Insulation; Rocket Engines; Solid Propellant Rocket Engines; Solid Rocket Propellants

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20050240883 Lawrence Livermore National Lab., Livermore, CA USA
Kinetics of HMX and CP Decomposition and Their Extrapolation for Lifetime Assessment
Burnham, A. K.; Weese, R. K.; Andrzejewski, W. J.; Dec. 06, 2004; 28 pp.; In English
Report No.(s): DE2005-15011799; UCRL-TR-208411; No Copyright; Avail.: Department of Energy Information Bridge

Decomposition kinetics are determined for HMX (nitramine octahydro-1,3,5,7-tetranitro- 1,3,5,7-tetrazocine) and CP (2-(5-cyanotetrazalato) pentaammine cobalt (III) perchlorate) separately and together. For high levels of thermal stress, the two materials decompose faster as a mixture than individually. This effect is observed both in high-temperature thermal analysis experiments and in long-term thermal aging experiments. An Arrhenius plot of the 10% level of HMX decomposition by itself from a diverse set of experiments is linear from120 to 260 degrees C, with an apparent activation energy of 165 kJ/mol. Similar but less extensive thermal analysis data for the mixture suggests a slightly lower activation energy for the mixture, and an analogous extrapolation is consistent with the amount of gas observed in the long-term detonator aging experiments, which is about 30 times greater than expected from HMX by itself for 50 months at 100 degrees C.
NTIS
Chemical Reactions; Cobalt; Decomposition; Extrapolation; HMX; Kinetics; Reaction Kinetics

20050240963 Florida Univ., Gainesville, FL, USA, Los Alamos National Lab., NM USA

Influence of Radiation of Pit Solution Chemistry as it Pertains to the Transition from Metastable to Stable Pitting in Steels. (Report for September 15, 2001 to February 28, 2005)

January 2005; 20 pp.; In English

Report No.(s): DE2005-840166; No Copyright; Avail.: National Technical Information Service (NTIS)

An investigation was undertaken of the effect of gamma radiation on metastable pitting of mild carbon steels immersed in a solution similar to those existing at high level waste (HLW) deposits in the US. The object was to observe the extent to which a dosage rate of 1 Mrad/hour (10 Kgrey/hour) affected measurable electrochemical parameters such as pitting potential, open circuit potential, rate of metastable pitting and repassivation potential. Methods for reliably measuring electrochemical potentials in a high radiation field were developed. Exploratory analyses were made of the ion product release and electrolyte composition change in a confined volume simulating the conditions of a corrosion initiated pit during gamma irradiation. As expected the results indicated that the metastable pitting rate (as well as the general rate of corrosion) was significantly enhanced by a radiation field.

NTIS

Carbon Steels; Corrosion; Gamma Rays; Irradiation; Metastable State; Pitting; Radiation Chemistry; Solutions; Steels

20050242966 Savannah River National Lab., Aiken, SC, USA

Order-of-Magnitude Estimation of Benzene Concentration in Saltstone Vault

Choi, A. S.; Feb. 2005; 42 pp.; In English

Report No.(s): DE2005-839498; WSRC-TR-2005-00071; No Copyright; Avail.: Department of Energy Information Bridge

The contents of Tank 48 that include the tetraphenylborate (TPB) precipitates of potassium and cesium will be grouted and stored in the Saltstone vault. The grouting process is exothermic, which should accelerate the decomposition of TPB precipitates eventually to benzene. Because the vault is not currently outfitted with an active ventilation system, there is a concern that a mixture of flammable gases may form in the vapor space of each cell filled with the curing grout. The purpose of this study was to determine if passive breathing induced by the diurnal oscillations of atmospheric pressure would provide any mitigating measure against potential flammability. Specifically, it was requested that a set of algorithms be developed that would predict the equilibrium concentration of benzene as a function of benzene generation rate, fill height, and the amplitude of the barometric pressure oscillations. These algorithms were to be derived based on several simplifying assumptions so that order of magnitude estimates could be made quickly for scoping purposes. This memo documents the resulting algorithms along with those key assumptions made. These algorithms were then applied to simulate several test cases, including the baseline case where the cell was filled to the maximum height of 25 ft at the bulk benzene generation rate of 3.4 g/hr.

NTIS

Benzene; Concentration (Composition); Estimates

20050243069 Army Research Lab., Aberdeen Proving Ground, MD USA

Self-Assembled, Ultra-Hydrophobic Micro/Nano-Textured Surfaces

Rawlett, Adam M.; Orlicki, Joshua A.; Karikari, Afia; Long, Tim; Aug. 1, 2005; 18 pp.; In English

Report No.(s): AD-A439525; ARL-TR-3547; No Copyright; Avail.: CASI: A03, Hardcopy

Hierarchical self assembly of nano-scale components (i.e., abalone shells, etc.) has been perfected by nature, yet the ability for scientists to utilize similar techniques is still in its infancy. The assembly of complex nano- and micro-components via self organizing means, rather than serial or parallel processing methods (e.g., electron beam lithography or nano-imprinting, respectively), could exploit the inherent benefit of these entities in a more elegant, economic means. The self assembly of regular arrays of nano- and microscale pores in polymer matrices, generated by so-called breath figures, will be discussed. Experimental parameters to vary the size, spacing, organization, long-range order, etc., of these selforganizing surfaces will also be discussed. Utilizing these regular arrays of pores as templates, we have patterned analogous arrays of pillars (inverse pores) from a polymer film cast onto the patterned surface. These micro-/nano-textured surfaces have greatly enhanced the hydrophobicity of the textured polymer when measured by contact angle. This method of producing ultrahydrophobic textured surfaces should be amenable to high-throughput, low-cost manufacturing of myriad polymeric surfaces.

DTIC

Hydrophobicity; Nanotechnology; Polymers

20050243134 Eagle-Picher Technologies, LLC, Joplin, MO USA
Propulsion and Power Rapid Response To Research and Development Support. Delivery Order 0028: Lithium Carbon Monoflouride Cell Development
Counts, Timothy; Mar. 1, 2005; 49 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-02-D-2299-0028; Proj-3145
Report No.(s): AD-A439631; AFRL-PR-WP-TR-2005-2141; No Copyright; Avail.: CASI: A03, Hardcopy

This document reports the work performed and the results obtained in developing materials and processes that could lead to a relatively high rate primary Li/CFx D cell.
DTIC
Carbon; Electrochemical Cells; Lithium Batteries; Propulsion

20050243175 Joint Inst. for Lab. Astrophysics, Boulder, CO USA
Thermochemistry and Dynamics of Reactive Species: Nitrogen-rich Compounds, Metals and SiC Clusters in Free and Solvated Environment
Lineberger, William C.; Bierbaum, Veronica M.; Oct. 31, 2005; 17 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0371
Report No.(s): AD-A439698; AFRL-SR-AR-TR-05-0478; No Copyright; Avail.: CASI: A03, Hardcopy

We have completed a three-year program of research into the properties of nitrogen-rich heterocyclic compounds, all nitrogen compounds and silicon carbide clusters with adatoms. The research projects all include a very strong blend of experiment and state-of-the-art theory, obtaining structural and thermochemical properties of unusual and unstable species. The experimental approaches include anion photoelectron spectroscopy and detailed investigations of ion-molecule reactions using flowing afterglow and drift tube reactors. These techniques together provide complementary information that yields quantitative thermochemical information on very unstable species. The ability of the flow reactor to study minute quantities of ions also allows the investigation of speculative, possibly low-yield pathways to these energetic molecules. Specifically, we are studying the ion chemistry and thermochemical properties of a number of nitrogen-rich heterocyclic compounds and their radicals. Time-resolved photoelectron imaging measurements yield new insight into the ultrafast dynamics.
DTIC
Metals; Nitrogen Compounds; Reactivity; Silicon Carbides; Thermochemistry

26
METALS AND METALLIC MATERIALS

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

20050240939 Environmental Protection Agency, Washington, DC, USA
Profile of the Fabricated Metal Products Industry. EPA Office of Compliance Sector Notebook Project
Sep. 1995; 142 pp.; In Spanish
Report No.(s): PB2006-101410; EPA/310/R-95/007-SP; No Copyright; Avail.: CASI: A07, Hardcopy

The key elements chosen for inclusion are: general industry information (economic and geographic); a description of industrial processes; pollution ouputs; pollution prevention opportunities; Federal statutory and regulatory framework; compliance history; and a description of partnerships that have been formed between regulatory agencies, the regulated community, and the public.
NTIS
Fabrication; Industries; Regulations; Waste Management

20050242043 Savannah River National Lab., Aiken, SC, USA
Microstructural Study of Fusion Welds on 304L and 21Cr-6Ni-9Mn Stainless Steels
Tosten, M. H.; Morgan, M. J.; Mar. 2005; 34 pp.; In English
Report No.(s): DE2005-840795; WSRC-TR-2004-00456; No Copyright; Avail.: National Technical Information Service (NTIS)

Light-optical and transmission electron microscopy (TEM) have been employed to characterize the microstructures of a series of fusion welds made on 304L and 21-6-9 stainless steels. The materials investigated in this study included high-energy-rate-forged 304L, conventionally forged 21-6-9, and 304L weld critical plate (higher ferrite potential). The weld critical plate contained an electron beam weld (no filler wire) while other specimens were welded with various combinations

of 308L, 309L modified (MOD) and 312 MOD stainless steel filler wires to produce samples with a range of delta ferrite contents (4 to 33 percent) in the resulting welds. TEM specimens were prepared from broken arc-shaped, mechanical property test specimens that had been used to measure fracture toughness of the fusion welds. Specimens were prepared from regions of the weld heat-affected zones as well as from areas within the weld metal, including areas close to the fracture surface (plastically deformed regions). The observed microstructures varied according to the amount of ferrite in each weld. At the lowest ferrite levels the microstructure consisted of austenite and skeletal ferrite with austenite being the majority (matrix) phase. At intermediate levels of ferrite, lathy austenite/ferrite was observed and the ferrite became continuous throughout the specimens examined. In the weld with the most ferrite, many austenite morphologies were observed and ferrite was the matrix phase. Closest to the fracture surface an increase in dislocation density in both the ferrite and austenite were observed in all welds. Deformation twinning was also observed in the austenite. Many of the welds contained a large number of non-metallic inclusions (oxide particles) which most likely originated from impurities in the weld wires.
NTIS
Microstructure; Stainless Steels; Welded Joints

20050242967 Electric Power Research Inst., Palo Alto, CA, USA
BWRVIP-140NP: BWR Vessels and Internals Project Fracture Toughness and Crack Growth Program on Irradiated Austenitic Stainless Steel
January 2005; 50 pp.; In English
Report No.(s): DE2005-839513; No Copyright; Avail.: Department of Energy Information Bridge

To prepare for this project, EPRI and BWRVIP conducted a workshop at Ponte Vedra Beach, Florida during February 19-21, 2003 (EPRI report 1007822). Attendees were invited to exchange relevant information on the effects of irradiation on austenitic materials in light water reactors and to produce recommendations for further work. EPRI reviewed the data, recommendations, and conclusions derived from the workshop and developed prioritized test matrices defining new data needs. Proposals were solicited, and selected proposals are the basis for the program described in this report. Results The planned test matrix for fracture toughness testing includes 21 tests on 5 materials.
NTIS
Austenitic Stainless Steels; Fracture Strength; Stress Corrosion Cracking; Austenite

20050243012 North Carolina State Univ., Raleigh, NC USA
A Homogenized Energy Framework for Ferromagnetic Hysteresis
Smith, Ralph C.; Dapino, Marcelo J.; Braun, Thomas R.; Mortensen, Anthony P.; Jan. 1, 2005; 41 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0107; FA9550-04-1-0203
Report No.(s): AD-A439433; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, we develop a macroscopic framework quantifying the hysteresis and constitutive nonlinearities inherent to ferromagnetic materials. In the first step of the development, we construct Helmholtz and Gibbs energy relations at the mesoscopic or lattice level based on the assumption that magnetic moments or spins are restricted to two orientations. Direct minimization of the Gibbs energy yields local average magnetization relations appropriate for operating regimes in which relaxation mechanisms are negligible, whereas the balance of the Gibbs and relative thermal energies through Boltzmann principles provides local models which incorporate mechanisms such as thermal after-effects. To construct macroscopic relations that incorporate material nonhomogeneities, poly-crystallinity, and variable effective fields, we employ stochastic homogenization techniques based on the assumption that parameters such as local coercive and interaction fields are manifestations of underlying distributions. The resulting framework quantifies in a natural manner the anhysteretic magnetization provided by decaying AC fields and guarantees the closure of biased minor loops once transient accommodation and after-effects are complete. Furthermore, noncongruency is achieved with certain choices for the energy functionals. Hence the framework provides an energy basis for certain extended Preisach models and the relation of the framework to several macroscopic hysteresis models is detailed. The behavior of both the nonlinear anhysteretic relations and full hysteresis model are validated through comparison with experimental steel and nickel data.
DTIC
Ferromagnetic Materials; Homogeneity; Hysteresis

20050243025 Naval Postgraduate School, Monterey, CA USA
Thermo-Mechanical Response of Monolithic and NiTi Shape Memory Alloy Fiber Reinforced Sn-3.8Ag-0.7Cu Solder
Fountoukidis, Evangelos; Sep. 1, 2005; 89 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439457; No Copyright; Avail.: CASI: A05, Hardcopy

In electronic packaging, the reliability of solders is a critical issue, since serve as both electrical and mechanical connections. The most common failures arise from the thermo-mechanical fatigue (TMF) of solders, due to mismatches in the coefficient of thermal expansion between the Si-chip and the printed circuit board. In order to meet the demands of miniaturization and enhanced performance in severe environments, a novel adaptive Tin-Silver-Copper (SnAgCu) solder reinforced with NiTi shape-memory alloy (particles or fiber) developed. An experimental apparatus has been designed to investigate the thermo-mechanical straincontrolled fatigue life of the solder during both single and multiple thermal cycling under double-shear loading. For comparison, thermo-mechanical single shear tests were also performed in monolithic Tin-Silver-Copper solder and in solder reinforced with Cu fiber. Also, micro-structural evaluation of the solders during the 5th cycle was possible using Scanning and Optical microcopy together with EDS analysis.
DTIC
Binary Alloys; Fiber Composites; Nickel Alloys; Shape Memory Alloys; Soldering; Solders; Thermodynamics; Titanium Alloys

20050243410 Jefferson (Thomas) National Accelerator Facility, Newport News, VA, USA, Reference Metals Co., Inc., Bridgeville, PA, USA
Preliminary Results from Single Crystal Niobium Cavities
Kneisel, P.; Myneni, G. R.; Ciovati, G.; Sekutowicz, J.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840252; No Copyright; Avail.: National Technical Information Service (NTIS)
We have fabricated and tested several single cell cavities using material from very large grain niobium ingots. In one case the central grain exceeded 7 inches in diameter and this was used to fabricate two 2.2 GHz cavities. This activity had a dual purpose: to investigate the influence of grain boundaries on the often observed Q-drop at gradients E(sub acc) \g 20 MV/m in the absence of field emission, and to study the possibility of using ingot material for cavity fabrication without going through the expensive rolling process. The sheets for these cavities were cut from the ingot by wire electro-discharge machining (EDM) and subsequently formed into half-cells by deep drawing. The following fabrication steps were standard: machining of weld recesses, electron beam welding of beam pipes onto the half cells and final equator weld to join both half cell/beam pipe subunits. The cavities showed heavy Q-disease caused by the EDM. After hydrogen degassing at 800 C for 3 hrs in UHV and about 200 (micro)m total removals from the inner surface by BCP 1:1:1, the cavities showed promising results, however, the Q-drop was still present. In the two cavities made from large grain material accelerating gradients of 30 MV/m have been reached. After 'in-situ' baking the Q-drop disappeared. The smaller cavities made from single crystal material showed very low residual resistances and accelerating gradients up to E(sub acc) = 45 MV/m were reached (one of the highest ever achieved), corresponding to a peak surface magnetic fields (B(sub p)) of 160 mT. In one rf test at 2 K, a B(sub p) = 185 mT was reached for few hundred milliseconds, close to the theoretical critical field of this material.
NTIS
Crystals; Niobium; Single Crystals

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*.

20050240893 Lawrence Livermore National Lab., Livermore, CA USA
Characterization of Thermal Sprayed Aluminum and Stainless Steel Coatings for Clean Laser Enclosures
Chow, R.; Decker, T. A.; Gansert, R. V.; Gansert, D.; Apr. 06, 2000; 18 pp.; In English
Report No.(s): DE2005-15013184; UCRL-JC-138734; No Copyright; Avail.: Department of Energy Information Bridge
Surfaces of steel structures that enclose high-fluence, large-beam lasers have conventional and unconventional requirements. Aside from rust prevention, the surfaces must resist laser-induced degradation and the contamination of the optical components. The latter requires a surface that can be precision cleaned to low levels of particulate and organic residue. In addition, the surface treatment for the walls should be economical to apply because of the large surface areas involved, and accommodating with intricate joint geometries. Thermal sprayed coatings of aluminum (Al) and stainless steel are candidate surface materials. Coatings are produced and characterized for porosity, smoothness, and hardness. These properties have a bearing on the cleanliness of the coating. The laser resistance of Al and 316L coatings are given. The paper summarizes the

characterization of twin-wire-arc deposited Al, high-velocity-oxygen-fueled (HVOF) deposited Al, flame-sprayed 316L, and HVOF deposited 316L.
NTIS
Aluminum Coatings; Lasers; Stainless Steels

20050240910 Forest Products Lab., Madison, WI USA, Purdue Univ., West Lafayette, IN USA
Wood Finishing: Paint Failure Problems and Their Cure
Cassens, D. L.; Feist, W. C.; January 2005; 10 pp.; In English
Report No.(s): PB2006-100995; NCRE/PUB-133; No Copyright; Avail.: CASI: A02, Hardcopy

Paint is probably the most common exterior finish in use on wood today. It appears somewhere on practically every house and most commercial buildings. Even brick and aluminum sided houses usually have some painted wood trim. When properly applied to the appropriate type of wood substrate, paint can give a service life of up to 10 years. All too often, however, problems may develop during the application of the paint or the paint coat fails to achieve the expected service life. This bulletin will describe various paint problems and will provide information on how to correct or prevent them.
NTIS
Failure; Paints; Wood; Wooden Structures

20050240915 Forest Products Lab., Madison, WI USA, Purdue Univ., West Lafayette, IN USA
Wood Finishing: Discoloration of House Paint, Causes and Cures
Cassens, D. L.; Feist, W. C.; January 2005; 10 pp.; In English
Report No.(s): PB2006-100996; NCRE/PUB-134; No Copyright; Avail.: CASI: A02, Hardcopy

Under normal conditions paint deteriorates by first soiling or by a slight accumulation of dirt. Next, a flattening stage develops when the coating gradually starts to chalk and erode away. Unfortunately, paint is sometimes discolored by mildew, blue stain, wood extratives and metals long before repainting is necessary. In these cases, a simple repainting will not correct the problem for long. Furthermore, excessive painting is expensive, and a build-up of paint on the wood surface may lead to cross-grain cracking or other severe paint failures. If the old paint surface is not properly cleaned before repainting, intercoat peeling may also result.
NTIS
Cracking (Fracturing); Discoloration; Failure; Paints; Wood

20050240934 Environmental Protection Agency, Washington, DC, USA
Profile of the Rubber and Plastics Industry, 2nd Edition. EPA Office of Compliance Sector Notebook Project
Feb. 2005; 160 pp.; In English
Report No.(s): PB2006-101417; EPA/310/R-05/003; No Copyright; Avail.: CASI: A08, Hardcopy

Environmental policies based upon comprehensive analysis of air, water, and land pollution (such as economic sector and community-based approaches) are becoming an important supplement to traditional single-media approaches to environmental protection. Environmental regulatory agencies are beginning to embrace comprehensive, multistatute solutions to facility permitting, compliance assurance, education/outreach, research, and regulatory development issues. The central concepts driving the new policy direction are that pollutant releases to each environmental medium (air, water and land) affect each other, and that environmental strategies must actively identify and address these interrelationships by designing policies for the 'whole' facility. One way to achieve a whole facility focus is to design environmental policies for similar industrial facilities. By doing so, environmental concerns that are common to the manufacturing of similar products can be addressed in a comprehensive manner. Recognition of the need to develop the industrial sector-based approach within EPAs Office of Compliance led to the creation of this document.
NTIS
Industries; Plastics; Rubber; Streams

20050240954 Kentucky Univ., Lexington, KY USA
Environmental Impacts of Bridge Cleaning Operations
Hopwood, T.; Palle, S.; Younce, R.; Feb. 2003; 72 pp.; In English
Contract(s)/Grant(s): KYSPR-03-224
Report No.(s): PB2006-101149; KTC-03-03/SPR224-01-1F; No Copyright; Avail.: National Technical Information Service (NTIS)

Cleaning (washing) operations of existing leaded paints on bridges were studied to determine the level of lead contamination in the resulting wastewater. Twelve experimental overcoating projects were let on bridges with various types of existing paint in varying states of deterioration. The projects employed different washing pressures ranging from 2500 psi to 10000 psi and various wash nozzles. Kentucky Transporation Center (KTC) standard filtration was used on 10 projects and 2 projects used an experimental filtration unit having a sand filter and two types of chemical filter media.
NTIS
Cleaning; Bridges; Washing

20050241971 Michigan Technological Univ., Houghton, MI, USA
Improvement of Wear Component's Performance by Utilizing Advanced Materials and New Manufacturing Technologies: Castcon Process for Mining Applications. (Report for January 1, 2001-June 30, 2004)
Huang, X.; Gertsch, R.; Feb. 04, 2005; 60 pp.; In English
Report No.(s): DE2005-839566; No Copyright; Avail.: Department of Energy Information Bridge
Michigan Technological University, together with The Robbins Group, Advanced Ceramic Research, Advanced Ceramic Manufacturing, and Superior Rock Bits, evaluated a new process and a new material for producing drill bit inserts and disc cutters for the mining industry. Difficulties in the material preparation stage slowed the research initially. Prototype testing of the drill bit inserts showed that the new inserts did not perform up to the current state of the art. Due to difficulties in the prototype production of the disc cutters, the disc cutter was manufactured but not tested. Although much promising information was obtained as a result of this project, the objective of developing an effective means for producing rock drill bits and rock disc cutters that last longer, increase energy efficiency and penetration rate, and lower overall production cost was not met.
NTIS
Cutters; Manufacturing; Mining; Tungsten Carbides; Wear

20050243010 North Carolina State Univ., Raleigh, NC USA
Monte Carlo Simulation of a Solvated Ionic Polymer with Cluster Morphology
Matthews, Jessica L.; Lada, Emily K.; Weiland, Lisa M.; Smith, Ralph C.; Leo, Donald J.; Jan. 1, 2005; 31 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-04-1-0203
Report No.(s): AD-A439431; No Copyright; Avail.: Defense Technical Information Center (DTIC)
A multiscale modeling approach for the prediction of material stiffness of the ionic polymer Nafion is presented. Traditional rotational isomeric state theory is applied in combination with a Monte Carlo methodology to develop a simulation model of the conformation of Nafion polymer chains on a nanoscopic level from which a large number of end-to-end chain lengths are generated. The probability density function of end-to-end distances is then estimated and used as an input parameter to enhance existing energetics-based macroscale models of ionic polymer behavior. Several methods for estimating the probability density function are compared, including estimation using Johnson distributions, Bezier distributions, and cubic splines.
DTIC
Computerized Simulation; Monte Carlo Method; Morphology; Polymers; Solvation

20050243193 Air Force Research Lab., Edwards AFB, CA USA
Synthesis and Characterization of Fluoropropyl POSS
Grabow, Wade; Jul. 1, 2005; 28 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A439724; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Fluorinated polyhedral oligomeric silsesquioxanes (POSS) are under investigation for potential lubricant applications. POSS compounds are characterized by a rigid, inorganic core consisting of silicon and oxygen, offering properties similar to those of ceramics; in addition to organic functional groups protruding from the inorganic core, offering organic functionality. Synthesis of POSS generally yields cage mixtures giving varying confirmations of the POSS (Si-O) core denoted by the number of silicon atoms present with T8 being the most abundant conformation. Synthesis of trifluoropropyl-POSS is an exception to this generalization which adopts a preferred T10 conformation, with a minor amount of T8 and T12 isomers. Herein, we describe an alternate synthetic route for the preparation of pure T8 trifluoropropyl-POSS not possible by

conventional methods. The POSS cages are characterized by multinuclear NMR as well as low-temperature, single crystal x-ray diffraction studies.
DTIC
Fluoropolymers; Oligomers; Siloxanes

20050243399 Savannah River Technology Center, Aiken, SC, USA
Impacts of Uranium and Thorium on the Defense Waste Processing Facility (DWPF) Viscosity Model
Jantzen, C. M.; Feb. 2005; 150 pp.; In English
Report No.(s): DE2005-839552; WSRC-TR-2004-00311; No Copyright; Avail.: National Technical Information Service (NTIS)

The Defense Waste Processing Facility (DWPF) at the Savannah River Site (SRS) vitrifies high level liquid waste (HLLW) into borosilicate glass for stabilization and permanent disposal. The viscosity of the borosilicate glass melt as a function of temperature is the single most important variable affecting the melt rate and pour ability of the glass. The viscosity determines the rate of melting of the raw feed, the rate of glass bubble release (foaming and fining), the rate of homogenization, the adequacy of heat transfer, the devitrification rate, and thus, the quality (in terms of glass homogeneity) of the final glass product. If the viscosity is too low, excessive convection currents can occur during melting, increasing corrosion/erosion of the melter materials of construction (refractory and electrodes) and making control of the melter more difficult. The lowest glass viscosities allowed in the DWPF melter have, therefore, been determined to be approximately 20 poise. DWPF glasses must pour continuously into a large steel canister for ultimate storage in a geologic repository, but glasses with a viscosity greater than or equal to 500 poise do not readily pour. Moreover, too high a viscosity can reduce product quality by causing voids in the final glass. A conservative range of 20-110 poise at a melt temperature, Tmelt or Tm, of 1150 degrees C was, therefore, established for DWPF production. In summary, a uranium term is not needed in the DWPF viscosity model as long as the U3O8 concentrations of the glasses being melted are less than or equal to 5.76 wt percent, the maximum value examined in this study. The fact that a U-plus-6 term is not needed in the DWPF viscosity model is consistent with the fact that U-plus-6 has four bridging and two non-bridging oxygen bonds. Therefore, the impact of the number of bridging and non-bridging oxygen is approximately equal at U3O8 concentrations of less than or equal to 5.76 wt percent. Uranium may not have an impact at higher U3O8 concentrations but this would have to be demonstrated since the effects of the 0.66:0.33 BO to NBO ratio may become more significant as the U3O8 content increases.
NTIS
Thorium; Uranium; Viscosity; Borosilicate Glass

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*.

20050242067 Lawrence Livermore National Lab., Livermore, CA USA
Drop Test Results for the Combustion Engineering Model No. ABB-2901 Fuel Pellet Package
Hafner, R. S.; Mok, G. C.; Apr. 27, 2004; 12 pp.; In English
Report No.(s): DE2005-15014142; UCRL-CONF-203811; No Copyright; Avail.: Department of Energy Information Bridge

The U.S. Nuclear Regulatory Commission (USNRC) contracted with the Packaging Review Group (PRG) at Lawrence Livermore National Laboratory (LLNL) to conduct a single, 30-ft shallow-angle drop test on the Combustion Engineering ABB-2901 drum-type shipping package. The purpose of the test was to determine if bolted-ring drum closures could fail during shallow-angle drops. The single test clearly demonstrated the vulnerability of the bolted-ring drum closure to shallow-angle drops-the test package's drum closure was easily and totally separated from the drum package.
NTIS
Combustion Physics; Drop Tests; Impact Tests; Pellets

20050243241 Pennsylvania State Univ., University Park, PA USA

Fundamental Understanding of Propellant/Nozzle Interaction for Rocket Nozzle Erosion Minimization Under Very High Pressure Conditions

Kuo, Kenneth K.; Brezinsky, Kenneth; Hanagud, Sathyanaraya; Irle, Stephan; Koo, Joseph H.; Lin, M. C.; Menon, Suresh; Morral, John; Musaev, Jamal; Seitzman, Jerry; Aug. 31, 2005; 108 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-1-0683

Report No.(s): AD-A439823; No Copyright; Avail.: CASI: A06, Hardcopy

To substantially increase the operating pressures of future missiles, this MURI project addresses scientific understanding and methods for mitigation of rocket nozzle erosion by solid-propellant combustion products. Several processes can affect the nozzle erosion rate at high pressure and temperature conditions. Three approaches have been used to reduce the thermochemical/mechanical erosion rates of nozzle materials, including improving the thermochemical resistance of the nozzle materials, modifying the solid propellant formulation, and/or introducing boundary-layer control methods. The experimental efforts of the program are guided by state-of-the-art theoretical calculations. During the past year, great progress has been made on the development of both numerical codes and new experimental test facilities. Test rigs have been designed for simulating ultra high-pressure rocket nozzle conditions; with X-ray radiography for erosion rate measurements. A vortex combustor was also designed to simulate propellant product species and to evaluate their effects on nozzle erosion process. A nozzle erosion code has been updated to include comprehensive heterogeneous surface reaction mechanism at high-pressure conditions. The reaction kinetics of nozzle materials has been studied and calculations have been performed using quantum-mechanical and molecular dynamics models. A micro-scale dynamics sub-grid model has been adopted in a parallel LES code to determine the effect of surface shear forces on physical erosion of nozzle throat. Phase diagrams of the W-O-C-H-Cl systems have been obtained to acquire insight into tungsten reaction mechanisms with gaseous mixtures at high-pressure conditions. From equilibrium calculations, tungsten-based nozzles are suitable for aluminized propellants since tungsten oxide and tungsten oxychloride formation are significantly reduced due to the strong affinity of oxygen for aluminum. DTIC

Corrosion Resistance; Erosion; High Pressure; High Temperature; Optimization; Propellants; Rocket Nozzles; Rocket Propellants

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*.

20050241891 National Inst. of Standards and Technology, Boulder, CO, USA

New Directions in Near-Field Antenna Metrology

Repjar, A. G.; Wittmann, R. C.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1310; In English; See also 20050241839; Copyright; Avail.: Other Sources

The contents of this paper focus on the near-field scanning methods which have gained wide acceptance as effective techniques for accurate measurement of microwave antenna parameters. Although the technology may be viewed as ‘mature,’ there has been a continued effort directed at improving measurement quality and at adapting near-field methods to related problems. Among these are: current interest in submillimeter wavelengths; requirements for on-site evaluation of large antennas; the need for efficient methods for production line evaluation; diagnostic test requirements for phased arrays and antenna range test zones; and satisfaction of ever increasing demands for better measurement accuracy. Topics include probe position error correction techniques, thermal imaging methods, quiet zone evaluations, and back transform techniques. Derived from text

Antennas; Metrology; Microwave Antennas; Near Fields

20050241905 Hull Univ., UK

A 64 Element Broad Band Volumetric Array Antenna

Tennant, A.; Fray, A. F.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1417-1420; In English; See also 20050241839; Copyright; Avail.: Other Sources

The defining feature of a volumetric array is that the elemental radiators occupy a region of three dimensional space rather

than conforming to a surface. Various volumetric array configurations may he considered but, probably the most useful form is the spherical volumetric array which can potentially provide full 360 deg coverage in both elevation and azimuth planes. Also, as the projected aperture of a spherical array is direction independent the beamwidth of the antenna remains constant for all scan angles. The elements of a volumetric array are usually randomly located, rather than positioned on a periodic lattice. This non-periodic element arrangement eliminates grating lobes and hence enables wide angle beam steering over a very large frequency bandwidth. In addition, the random nature of the array results in an average sidelobe level which is inversely proportional to the number of radiating elements. If the elements of a random spherical volumetric array are distributed with uniform probability, the projected aperture wig exhibit a natural amplitude taper which produces a first sidelobe level of -20.6 dB. Further reduction in the inner sidelobe levels may be obtained by employing amplitude weighting or, element spatial density tapering. Over the past two decades a number theoretical studies have been published which examine the fundamental characteristics of volumetric arrays, and, more recently, pattern synthesis techniques have been investigated. However, experimental investigation into volumetric arrays appears to have been limited to one research group. In this contribution we present experimental results obtained from a 64 element volumetric array designed for broadband frequency operation.
Derived from text
Antenna Arrays; Bandwidth; Beam Steering; Broadband

20050242956 Lawrence Livermore National Lab., Livermore, CA USA
Indirect Drive Warm-Loaded Ignition Target Design
Bernat, T. P.; Gibson, C. R.; Sep. 07, 2004; 16 pp.; In English
Report No.(s): DE2005-15014736; UCRL-TR-206424; No Copyright; Avail.: National Technical Information Service (NTIS)
This document summarizes the Indirect Drive Warm-Loaded Ignition Target design. These targets either use a fill tube or the capsule is strong enough to withstand the room temperature pressure of the DT fuel. Only features that affect the design of the NIF Cryogenic Target System (NCTS) are presented. The design presented is the current thinking and may evolve further.
NTIS
Fusion Reactors; Ignition; Laser Fusion; Design Analysis

20050243022 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site, Desert Extreme Scoring Record Number 211
Jul. 1, 2005; 60 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439448; ATC-8995; No Copyright; Avail.: CASI: A04, Hardcopy
This scoring record documents the efforts of Shaw Environmental, Inc., to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG standardized UXO Technology Demonstration Site Desert Extreme. The scoring record was coordinated by Larry Overbay and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Deserts; Field Tests; Scoring; Standardization

20050243023 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site, Woods Scoring Record Number 494
Overbay, Larry; Robitialle, George; Jul. 1, 2005; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439449; ATC-8961; No Copyright; Avail.: CASI: A05, Hardcopy
This scoring record documents the efforts of NAEVA Geophysics, Inc. to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG standardized UXO Technology Demonstration Site Woods. The scoring record was coordinated by Larry Overbay and by the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Field Tests; Scoring; Standardization

20050243024 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site, Open Field Scoring Record Number 657
Overbay, Larry; Robitaille, George; Jun. 1, 2005; 70 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439450; ATC-9035; No Copyright; Avail.: CASI: A04, Hardcopy

This scoring record documents the efforts of Blackhawk Geoservices to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG standardized UXO Technology Demonstration Site Open Field. Scoring Records have been coordinated by Larry Overbay and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include, the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Field Tests; Scoring; Standardization

20050243032 Naval Postgraduate School, Monterey, CA USA
Design and Validation of Improved Dynamic Cylinder Pressure Measurement for a Diesel Engine
Luebkert, Michael R.; Sep. 1, 2005; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439466; No Copyright; Avail.: CASI: A03, Hardcopy

An existing encoder system was analyzed to determine why the system had failed. This encoder system was found to have slipped off the crankshaft, resulting in the need for a new encoder mount system. A new encoder mount was designed and installed on a Detroit Diesel 3-53 engine. The encoder mount was designed to ensure positive contact with the crankshaft while not allowing the mechanism to have the same type of failure that was determined. During the validation of the encoder, the push rod connected to the fuel injector rocker arm failed, preventing further validation of the system. The failure of the push rods is described.
DTIC
Coders; Diesel Engines; Dynamic Pressure; Pressure Measurement

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*.

20050240869 Lawrence Livermore National Lab., Livermore, CA USA
Spotforming with an Array of Ultra-Wideband Radio Transmitters
Dowla, F.; Spiridon, A.; Feb. 17, 2004; 10 pp.; In English
Report No.(s): DE2005-15013959; UCRL-TR-202378; No Copyright; Avail.: National Technical Information Service (NTIS)

Ultra-wideband (UWB) array signal processing has the distinct advantage in that it is possible to illuminate or focus on ‘spots’ at distant points in space, as opposed to just illuminating or steering at certain directions for narrowband array processing. The term ‘spotforming’ is used to emphasize the property that point-focusing techniques with UWB waveforms can be viewed as a generalization of the well-known narrowband beamforming techniques. Because methods in spotforming can lead to powerful applications for UWB systems, in this paper we derive, simulate and experimentally verify UWB spot size as a function of frequency, bandwidth and array aperture.
NTIS
Broadband; Radio Transmitters; Signal Processing; Waveforms; Narrowband; Focusing

20050240923 Texas A&M Univ., College Station, TX USA
Development of a Wireline Communications Design Guidebook for Intelligent Transportation Systems
Brydia, R. E.; Brackin, B. E.; Johnson, J. D.; Thomas, G. B.; Balke, K. N.; Oct. 2005; 64 pp.; In English
Report No.(s): PB2006-100882; REPT-0-4969-1; No Copyright; Avail.: CASI: A04, Hardcopy

Texas Department of Transportation (TxDOT) engineers are responsible for the design, evaluation, and implementation of Intelligent Transportation System (ITS) solutions across the entire state. These installations occur with vast differences in requirements, expectations, and constraints. Many deployments require some type of communication system to complete the installation. This report details the development of a reference guidebook and training workshop for TxDOT engineers. The

purpose of these materials is to: Establish a fundamental level of understanding of wireline communication concepts and technologies; Convey and explain a comprehensive process for assessing communication needs for ITS deployments; and Create a set of workshop materials for future training program opportunities.
NTIS
Handbooks; Highways; Planning; Transportation

20050240971 Swedish Defence Research Establishment, Linkoeping, Sweden
AODV Routing in Ad Hoc Networks with Variable Data Rates (AODV Routing i Ad Hoc-Naet Variabel Datatakt)
Johansson, E.; Persson, K.; Skoeld, M.; Sterner, U.; Dec. 2004; 46 pp.; In English
Report No.(s): PB2006-100650; FOI-R-1430-SE; No Copyright; Avail.: CASI: A03, Hardcopy

In tactical operations, the capacity of a mobile radio network is of paramount importance. It is thus essential that the resources in the network are utilized as efficiently as possible. In a heterogeneous ad hoc network, where each link can have different possible data rates, a routing protocol should efficiently be able to take the data rate of each link into account when determining which route should be used. Reactive routing protocols, contrary to proactive routing protocols', usually do not compare different route options. Instead the 'first' found route is used. When choosing the most efficient route over links with variable data rates, comparing routes is necessary. In this report we show that it is possible to add a metric that takes this into account to a reactive routing protocol (AODV). However, the inherent properties of AODV made optimization of the routes problematic and maximum throughput is thus not achieved. Better results may be obtained but this will add more complexity to the routing protocol and cause more routing traffic. It is thus important to consider the total cost and gain of capacity in the network when evaluating the benefit of such an algorithm modification.
NTIS
Protocol (Computers); Rates (Per Time); Reactivity

20050241724 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
The Application of ESM and Radar Data to Predict Missile Threat Trajectories in a Task Group
Arciszewski, H. F. R.; Dam, F. A. M.; Liem, K. D.; Muhren, H. R.; June 2005; 35 pp.; In English; Original contains color illustrations
Report No.(s): TD04-0423; TNO-DV1 2004 A265; Copyright; Avail.: Other Sources; Abstract Only

Ln this study, a survey is made of typical (kill) assessment methods and an analysis is performed through simulation for two methods in particular: power monitoring and zero effort miss. The study concludes that the two methods are supplementary and can be used to determine the dispersion of threats over a group of ships. The methods are related to two different sensors: radar and ESM.
Author
Missile Trajectories; Radar Data; Electronic Countermeasures; Missile Defense

20050241731 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Depth Estimation by Means of Identification of Multipaths
van Moll, C. A. M.; Driesenaar, M. L.; April 2005; 33 pp.; In English; Original contains color illustrations
Report No.(s): TD2005-0297; TNO-DV1 2004 A261; Copyright; Avail.: Other Sources; Abstract Only

In sonar classification is often a difficult task. For example Low Frequency Active Sonar (LFAS) doesn't distinguish between a submarine and a rock. In this research project it is investigated how multipath arrival times can be used for estimating the depth of a sonar target. A method is developed that estimates target depth by finding the optimal assignment of propagation paths to multipath arrival times. The method is implemented and tested using simulated data in a shallow water, short distance LFAS scenario. In this scenario the method needs at least 5 multipad arrival times with a measurement error lower than 0.005 seconds. The estimated target position appears to be relatively robust to environmental mismatch. However due to the reduction of information, ambiguous solutions are inevitable.
Author
Depth Measurement; Depth; Estimating; Multipath Transmission; Sonar

20050241839 Georgia Inst. of Tech., Atlanta, GA, USA
IEEE Antennas and Propagation Society International Symposium, Volume 3, Volume 3
[1998]; 486 pp.; In English; IEEE Antennas and Propagation Society International Symposium; USNC/URSI National Radio Science Meeting, June 21-26, 1998, Atlanta, GA, USA; See also 20050241840 - 20050241955
Report No.(s): IEEE-Catalog-98CH36194-Vol-3; LC-90-640397; Copyright; Avail.: Other Sources

Contents include the following: New Directions in Near-field Antenna Metrology. Planar Near-field Measurement of Low Directivity Embedded Antennas using a Synthetic Array Probe Technique. The Planar Near-field Measurement of the Far Sidelobes of a Reflector Antenna. Back-to-back Method for Measuring Phased Array Antennas. Characterization of Indirectly Measurable Antenna Balun/lmpedance-matching Device. The Alignment of a Spherical Near-field Measurement System using Electrical Measurements. Thinned-grid Near-field Bi-polar Antenna Measurements. A Novel Approach to Near-field Far-field Transformation from Intensity Data. Correlation of Measurements in Different Test Sites using the GPOF Method. Antenna Diagnosis and Pattern Reconstruction using Near Field Amplitude Data and iterative Source Reconstruction.
CASI
Antenna Arrays; Antenna Radiation Patterns; Bipolarity; Electrical Measurement

20050241842 Wroclaw Univ., Poland
Thinned-grid Near-field Bi-polar Antenna Measurements
Kabacik, Pawel; Barylak, Marek; Maksimiuk, Dariusz; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1331-1334; In English; See also 20050241839; Copyright; Avail.: Other Sources

The invention of the planar bi-polar scanning method is one of the promising innovations in near-field antenna measurements of the scanner, which involves exclusively rotational movement [I]. However, during the operation of the bi-polar antenna laboratory (which we had developed) we found that it was the construction of the scanner arm and the redundancy of the ample points that created certain trouble. The constriction of the scanner arm required only several engineering efforts, but sample redundancy unnecessarily extended the duration of the measurements. As a result, the drift effects in the test setup, the file sizes and the computing time were increased,To overcome this drawback a thinning of the bi-polar grid was proposed,
Author
Antennas; Near Fields; Bipolarity

20050241850 Adelaide Univ., Australia
DESIGN of DIELECTRIC RESONATOR POWER COMBINED OSCILLATOR TYPE INTEGRATED APERTURE ARRAY ANTENNA
Sayyah, Ali Afkari; Griffin, Donald W.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1628-1631; In English; See also 20050241839; Copyright; Avail.: Other Sources

A detailed review of oscillator-type active integrated antenna identifies the commonly used antennas u either microstrip patches or slot elements with notch and Vivaldi antennas for broadband applications. Design issues that arc identified include, (a) surface wave excitation because most of these antennas are formed on dielectric slabs, (b) free space mutual coupling between elements forming an array, (c) unwanted radiation from the RF circuit that feeds the antenna element, and. (d) the antenna functioning as the resonator in the design of the oscillator. These design issues may be treated more accurately in a structure that exploits surface wave excitation and shields the antenna radiation field from the RF circuit and vice versa as detailed in the following sections.
Author
Dielectrics; Resonators; Oscillators; Apertures; Antenna Arrays; Design Analysis

20050241851 YRP Mobile Telecommunications Key Technology Research Labs. Co. Ltd., Yokohama, Japan
Difference of Path-loss Characteristics due to Reception Antenna Heights in an Urban LOS Environment
Massui, Hironari; Takahashi, Koichi; Kage, Kouzou; Yamada, Yoshihide; Takahashi, Satoshi; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1672-1675; In English; See also 20050241839; Copyright; Avail.: Other Sources

Propagation characteristics of frequencies less than 2 Gi|z and of microwave band have been studied by many authors, in these cases, vehicle-mount antennas were used for reception and the characteristics of break points were discussed. However, considering the remarkable growth of handy phone services+ handy mode is more practical. This paper discusses the line-of-sight (LOS) path-loss characteristics on break points by comparing handy mode and vehicle.mount mode of mobile stations (MS). Disappearance of break point in handy mode is clarified through experimental results.
Derived from text
Line of Sight; Antenna Arrays; Microwave Frequencies

20050241854 Aerospace Corp., El Segundo, CA, USA

The Planar Near-Field Measurement of the Far Sidelobes of a Reflector Antenna

Rousseau, Paul R.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1315-1318; In English; See also 20050241839; Copyright; Avail.: Other Sources

This paper addresses the feasibility of measuring the far sidelobes of an antenna in a planar near-field range. The most important error sources are identified and one significant error source is the scan plane truncation error. A near-field data window function, which has a smooth taper at the edges of the scan plane, is used to minimize the truncation error. Finally, an example is used to demonstrate the measurement of the far sidelobes of a reflector in a planar near-field range.

Author

Near Fields; Reflector Antennas; Reflectors; Sidelobes

20050241860 Yonsei Univ., Seoul, Korea, Republic of

Study on the Two-Dimensional Slotline Coupling Structure for Active Planar Array Antennas

Lee, Tae Yume; Yoon, Young Joong; Jang, Gyu Sang; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1398-1400; In English; See also 20050241839; Copyright; Avail.: Other Sources

IN this paper, a two-dimensional slotline coupling structure combined with E and H-plane slotlines is proposed for the oscillator-type phased array antenna. The proposed structure provides the two-dimensional scanning capability with smaller size and less spurious radiation than the conventional radiation or transmission line coupling structures. These operating characteristics are analyzed and experimentally demonstrated.

Derived from text

Two Dimensional Models; Planar Structures; Antenna Arrays

20050241862 Saitama Univ., Urawa, Japan

Dual-polarized Array Antenna Composed of Triplate-type Tapered Slot Antennas

Iizuka, H.; Haneishi, M.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1413-1416; In English; See also 20050241839; Copyright; Avail.: Other Sources

A tapered slot antenna (TSA) proposed by Gibson has several advantages such as high gain, wide bandwidth and simple configuration. In the past, the TSA element fed by a microctrip line or a coplanar waveguide has been mainly studied by many researchers. However, this type of TSA element shows high cross. polarization characteristics due to the influence of an unwanted radiation from its feeding system.

Derived from text

Polarization Characteristics; Antenna Arrays; Slot Antennas

20050241879 Georgia Tech Research Inst., Atlanta, GA, USA

Synthesis of Wideband Antenna Patterns from Narrowband Measurements

Mitchell, Mark A.; Howard, Robert L.; Hemphill, Robert G.; Mulcahey, Joseph K.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1642-1645; In English; See also 20050241839; Copyright; Avail.: Other Sources

Although many antennas are designed to operate with wide instantaneous bandwidths, it is often impractical to measure antenna patterns over wide instantaneous bandwidths. Primarily this is due to limitations in the measurement range. A feasible approach to overcoming this problem is to measure a number of single-frequency antenna patterns and synthesize the wideband antenna pattern from these components. This paper describes a simple approach to this synthesis, derives rule of thumb for the required number of component antenna patterns as a function of several antenna parameters, and shows the results of simulated wideband antenna pattern synthesis.

Author

Antenna Radiation Patterns; Narrowband; Broadband; Frequency Response

20050241882 Pennsylvania State Univ., University Park, PA, USA

Using FDTD to Evaluate Ray-Tracing Models for Propagation Prediction in Urban Microcells

Schuster, Joseph W.; Luebbers, Raymond J.; IEEE Antennas and Propagation Society International Symposium 1998 Digest.

Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1676-1679; In English; See also 20050241839; Copyright; Avail.: Other Sources

In recent years a number of ray-tracing based models have been developed for making site-specific propagation predictions in urban microcells. These models have usually been validated by comparison with path loss and delay spread measurements. Because of the complexity of the environments in which the measurements are made it is often not clear from the comparisons why the predictions are inaccurate in some areas and how the models can be improved. The purpose of this paper is to introduce some simple techniques by which the finite difference time domain (FDTD) method can be used to evaluate the accuracy of ray-tracing based propagation models.

Derived from text

Finite Difference Time Domain Method; Ray Tracing; Antenna Arrays

20050241883 Paderborn Univ., Germany

Results of Extensive 800 Mb/s, 30 GHz Channel Sounding Experiments

Karthaus, U.; Noe, R.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1688-1691; In English; See also 20050241839; Copyright; Avail.: Other Sources

We have recorded more than 1000 channel CIRs (complex impulse responses) at -30 GHz with temporal resolutions down to 1.25 ns and distances up to 3.8 km. Scenarios include 11 straight streets with different traffic loads, distances and building environments, some NLOS (non-line-of-sight) scenarios, residential areas fed from base stations with 25 m and 45 m antenna heights, and 3 squares. We have investigated the influences of polarization, antenna mounting position, traffic and antenna gain on fading and delay spread. Our results suggest that ATM transmission over distances of more than 200 m should be possible.

Author

Antenna Gain; Distance; Fading; Line of Sight

20050241885 Bremen Univ., Germany

FE/Mode-Matching/Moment Method Analysis of Horn Antennas

Bunger, Rainer; Arndt, Fritz; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1710-1713; In English; See also 20050241839; Copyright; Avail.: Other Sources

A hybrid method is presented for the rigorous analysis of horn antenna. The interior horn taper structure of arbitrary cross-section is described by the fast FE/mode-matching method combined with the generalized scattering matrix technique. For the exterior horn problem including the radiating aperture, an EFIE formulation is used where the eigenvectors of the waveguide taper and the basic functions of Rao are chosen as basic functions. Results for a conical horn show good agreement with measurements. The flexibility of tile presented method is demonstrated at the example of a conical ridged waveguide horn.

Author

Horn Antennas; Waveguides; Mathematical Models; Modes (Standing Waves)

20050241892 Lockheed Martin Corp., USA

Planar Near-Field Measurement of Low Directivity Embedded Antennas Using a Synthetic Array Probe Technique

Al-Mahdawi, Tareef; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1311-1314; In English; See also 20050241839; Copyright; Avail.: Other Sources

The technique presented here reduces the near-field level at the edges of plane of measurement by combining near-field data points to form a directive synthetic array of probes. This will allow using the planar measurements for measuring antennas embedded in a large structure without rotating these structures or collecting excessively large scan data point. The deconvolution of the array factor in the spectral domain will be independent from the probe correction. The disadvantage of this processing is the limited measurement angular range in which the processed data are valid.

Author

Directivity; Embedding; Near Fields; Synthetic Arrays

20050241893 Massachusetts Univ., Amherst, MA, USA

Back-to-back Method for Measuring Phased Array Antennas

Chang, WeiChun; Wunsch, Greg J,.; Schaubert, Daniel H.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1319-1322; In English; See also 20050241839; Copyright; Avail.: Other Sources

When designing large phased array antennas, sophisticated computer codes can be used to estimate the array performance including mutual coupling. However, to verify the design, large test antennas containing hundreds or even thousands of radiators must be built. The cost of a phased array system rises sharply when the number of radiators becomes large, in many cases, this is due to the power dividers and phase shifters in the feed network. Feed networks, although essential for the operation of the phased array system, are not necessary for the design of the radiating elements. There are various ways to characterize phased array antennas without feed networks. Among them are: waveguide simulators, and active element patterns. But neither of those methods can yield complex impedance of the radiators at arbitrary frequency and scan angle, in the next section, a back-to-back method is described. This method enables designers to test arrays containing a large number of radiators with relatively low cost and minimal modification of existing measurement facilities.

Author

Antenna Arrays; Antennas; Large Space Structures; Phased Arrays

20050241906 Tokyo Inst. of Tech., Tokyo, Japan

Conical Beam Radial Line Slot Antennas for 60GHz Band Wireless LAN

Akiyama, A.; Yamamoto, T.; Ando, M.; Takeda, E.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1421-1424; In English; See also 20050241839; Copyright; Avail.: Other Sources

There are strong demands for high-gain and high-efficiency planar antennas in millimeter frequency. These includes high speed wireless LAN, automotive collision avoidance radar and various types of millimeter-wave subscriber systems such as entrance radio link between base stations in mobile communications etc. Many works have been reported to this end, using microstrip and triplate line patch antennas+ However, the conducting loss becomes notable in high gain and frequency range. On the other hand, waveguide antennas are free from conductor loss in principle and are attractive candidate of high-efficiency planar antennas. Radial line slot antenna (RLSA) is one of single-layer waveguide antennas proposed for DBS reception in 12GHz.SIots are cut on the top plate of a multi mode parallel plate waveguide operating in TEM wave. The waveguide has no side-walls and assures the lowest transmission loss. Therefore extremely high efficiency can be obtained in high gain range where other types of planar structure suffers serious degradation due to conductor loss. Moreover its simple structure is suitable for low cost mass production. We have proposed the millimeter wave RLSA for wireless LAN. In this paper, we fabricate

Derived from text

Conical Flow; Radar Beams; Slot Antennas; Wireless Communication; Local Area Networks

20050241927 Nagasaki Univ., Japan

Analysis of Circular Microstrip Antenna with Perturbation Segments

Fujimoto, Takafumi; Tanaka, Kazumasa; Taguchi, Mitsuo; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1594-1597; In English; See also 20050241839

Contract(s)/Grant(s): MOE-09750429; Copyright; Avail.: Other Sources

The cavity model is a simple and efficient analytical method on the microstrip antenna (MSA). In the cavity model the wall admittance at the aperture has to the determined in advance. The accuracy of the wall admittance influences the input impedance and resonant frequency of antenna. Authors have proposed the formulation method on the wall admittance of arbitrarily shaped MSA and applied it to the circular MSA, elliptical MSA and rectangular MSA. The wall admittance is defined in terms of the magnetic field due to the equivalent magnetic current on the aperture. The magnetic field is derived by using Green's functions in the spectral domain in order to consider the influence of dielectric substrate. In this paper, the wall admittance of circular MSA with perturbation segments is calculated by our proposed method and the antenna is analyzed by the cavity model. Although the wall susceptance was formulated by the capacitance of fringe field around the aperture in previous studies, the susceptance given by our method consists of capacitance and inductance. The numerical results are presented which show that the susceptance of the primary mode in the neighborhood of the resonant frequency in inductive

at the aperture of the perturbation segment and capacitive at the aperture except the perturbation segment.
Author
Microstrip Antennas; Circular Plates; Perturbation; Magnetic Fields

20050241930 Calabria Univ., Arcavacta di Rende, Italy
Analysis of the Elliptic-Cylindrical-Rectangular Patch Antenna
Amendola, G.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1586-1589; In English; See also 20050241839; Copyright; Avail.: Other Sources

One of the most interesting characteristic of microstrip patch antennas is that they can be printed on curved substrates. Infact they have found many applications in the aero-space industry where antennas conformal to the aerodynamic surface of the aircrafts are needed. In the last years, patch antennas printed on cylindrical, spherical and conical substrates have been studied but, to the best knowledge of the author, antennas printed on elliptic cylindrical substrates have never been considered. In this paper the cavity model analysis of the elliptic-cylindrical rectangular patch antenna is reported. In what follows, a short account of the theory is given and expressions of the radiated electric field are presented. Plots of far-field and input impedance fi)r a probe fed patch are also shown. The effects of the eccentricity of the elliptic cylinder on the characteristics of the antenna are discussed.
Author
Microstrip Antennas; Patch Antennas; Electric Fields; Cylindrical Antennas

20050241931 Yokohama National Univ., Japan
Active Antenna Using Parasitic Elements
Mori, Kouhei; Uchida, Kazuskl; Aral Hiroyuki; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1636-1640; In English; See also 20050241839; Copyright; Avail.: Other Sources

In recent years, integrated active antennas become very popular in microwave and millimeter-wave applications. The integrated active antennas have very small losses in feed lines, that is significant advantage in millimeter-wave frequency range, because high gain antenna require a lot of element for array configuration. One of active antenna researches is the oscillating active integrated antenna that uses Gunn Diode or FET oscillator and the patch antennas and sh_ antennas for the radiating element. They are not only the output loads of oscillators, but also work as the resonators determining oscillation frequencies. In general, the quality factor of these active antennas is decreased by loading the radiating antenna element, and degrades the frequency stability of the oscillate.
Derived from text
Antenna Components; Parasitic Elements (Antennas); Patch Antennas; Oscillators

20050241932 Birmingham Univ., UK
Cavity-backed active slot loop antenna
Zheng, M.; Hall, P. S.; Chen, Q.; Fusco, V. F.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1620-1623; In English; See also 20050241839
Contract(s)/Grant(s): GR/K-75675; GR/K-75682; Copyright; Avail.: Other Sources

There has been a growing interest of integrating active three terminal devices to passive planar antennas in recent years. The applications of these active antennas are numerous and include spatial power combiners, distributed oscillator beam steering, low cost Doppler sensors and non-contact identification. However, because of their inherent radiation characteristics, active antennas normally have a relatively low Q factor and high single side-band (SSB) phase noise. Several approaches can be taken to stabilize them; for example, inject locking or cavity backing the active antennas. In this paper an air-filed cavity is employed to back an active slot loop antenna. The cavity has two functions: one is to stabilize the active antenna and the other is to increase tim radiation directivity. It has been experimentally proved that the phase noise of the active antenna can he reduced by 30 dB at an offset frequency of 40 kHz and radiation power at the broad side can be increased by approximately 3 dB by attaching the cavity to the back of the active slot loop antenna.
Author
Loop Antennas; Q Factors; Cavities; Beam Steering

20050241933 Georgia Tech Research Inst., Atlanta, GA, USA

A SYSTEM FOR UNOBTRUSIVE MEASUREMENT of SURFACE CURRENTS

Harms, Paul H.; Maloney, James G.; Kesler, Morris P.; Kuster, Eric J.; Smith, Glenn S.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1646-1650; In English; See also 20050241839

Contract(s)/Grant(s): N00014-97-1-0209; Copyright; Avail.: Other Sources

A knowledge of surface currents is useful for determining radiation sources or hot spots for EMI in circuits, antenna (phased array antennas, etc.) operation, or RCS characteristics of complex scatterers. In making measurements, it is desirable to obtain the surface currents without perturbing the currents/fields being measured or damaging the object under test. One traditional method for measuring surface currents of large objects is to attach small loop probes to the surface to sense the currents. This approach can give a good indication of the surface currents, but it has drawbacks: it takes time to attach the probes and calibrate them, the probes can perturb the currents being measured, and sometimes it can be difficult to attach the probes if the surface has a coating.

Derived from text

Antenna Arrays; Surfaces; Currents

20050241936 Waterloo Univ., Ontario, Canada

A Combined Ray Tracing and FDTD Method for Modeling Indoor Radio Wave Propagation

Wang, Ying; Safavi-Naeini, Safieddin; Chaudhuri, Sujeet K.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1668-1671; In English; See also 20050241839; Copyright; Avail.: Other Sources

Ray tracing technique based on geometrical optics has been demonstrated to be promising for indoor radio propagation modelling. It can give accurate results if the size of the obstacle is much larger than a wavelength, and the observation point is many wavelengths away from the scatterers. For complex lossy structures with finite dimensions, such as wall corners and edges, and isolated scatterers comparable in size to a wavelength, geometrical optics fails to predict correctly the scattering fields. However, it is quite possible that the transmitter or receiver is installed close to wall corners and other objects, It is thus desirable to have models to study these effects. Furthermore, by comparing the results obtained by ray tracing method and those by more accurate method, we will bc able to assess the accuracy of the ray model for radio channel simulations.

Derived from text

Ray Tracing; Finite Difference Time Domain Method; Radio Waves; Scattering; Transmitter Receivers

20050241939 ANSOFT Corp., Boulder, CO, USA

Novel Fabrication Methods for Slotted Waveguide Antennas

Thomas, W.; Hall, R\g C.; Wu, F.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1694-1697; In English; See also 20050241839; Copyright; Avail.: Other Sources

Leaky-wave slot waveguide antennas have a low profile with high gain and power handling capabilities but are typically expensive to fabricate. High fabrication expenses often result in the elimination of this design method from consideration in cost sensitive applications. This paper discusses a novel method of fabrication that reduces the medium to high volume production costs of slotted waveguide antennas to the point that more extensive applications in the civilian sector can be considered. A leaky-wave slot antenna is shown. This type of antenna, first developed in the 1950s, consist of a ridged waveguide fed at one end with a coaxial connector, a longitudinal slot in the broad wall of the waveguide, and a waveguide load at the opposite end. The radiated electric field is nominally broadside to the waveguide and is polarized transverse to the slot. The offset of the longitudinal slot from the center line determines the amount of energy radiated and this allows the designer to control the amplitude taper along the length of the antenna.

Derived from text

Fabrication; Slot Antennas; Waveguide Antennas

20050241940 Tokyo Inst. of Tech., Tokyo, Japan

40GHz Parallel Plate Slot Array Fed by Single-layer Waveguide Consisting of Posts in a Dielectric Substrate

Hirokawa, Jiro; Ando, Makoto; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1698-1701; In English; See also 20050241839; Copyright; Avail.: Other Sources

A parallel plate slot array is an attractive candidate of high-efficiency and mass-producable planar antennas for millimeter-wave applications since the transmission loss in a parallel plate waveguide is generally small in comparison with other feed lines such as a microstrip or a suspended line. The radiating part has a simple structure that consists of slots etched on the upper plate. There are various ways to feed a plane TEM wave in a parallel plate. Feed structures using a horn or a parabolic reflector are simple but need relatively large areas. We introduced a novel single-layer structure of a feed waveguide as shown. Densely arrayed posts equivalently compose the waveguide walls, We make many through-holes in a metal-grounded dielectric substrate and metalizing them as posts, The structure is advantageous for fabricating planar antennas for millimeter-wave applications with low costs. In this paper, we make a 40GHz model of the parallel plate slot array with the feed waveguide. We have confirmed the uniform dividing of the feed waveguide in amplitude and phase at 40.2GHz. The antenna gain of 30,6 dBl with 29% efficiency is obtained.
Author
Antenna Gain; Parallel Plates; Slots; Waveguides; Flat Layers

20050241943 Manitoba Univ., Winnipeg, Manitoba, Canada
Gain Enhancement of Conical Horn by Introducing Bodies of Revolution inside the Horn
IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1718-1721; In English; See also 20050241839; Copyright; Avail.: Other Sources

Horn antennas, pyramidal and conical, are extremely popular antennas at microwave and millimeter-wave frequencies. They provide high gain, low VSWR, relatively wide bandwidth and are rather easy to fabricate. Nevertheless they suffer from losses due to phenomena like spillover, phase error in the aperture field distribution or cross-polarization, resulting in reduced aperture efficiency of about 50% to 60% for optimum gain horn. Corrugated horn, dielectric loaded horn and lens-corrected horn have been used to correct a specific deficiency. ‘l’be latter case, i.e. the lens-corrected horn, is the special case that improves the horn aperture phase distribution and consequently, enhances its gain. However, for large flare angles, the lens becomes bulky and requires high dielectric permittivities with increased cost and difficulties in impedance matching. Koerner and Rogers have shown that the performances of wide-flare pyramidal horn antennas can be improved by loading horns with small, planar, metal baffles. These baffles alter aperture fields resulting in enhanced gain, beam-patterns and aperture efficiency. We extended this idea to improve the performance of conical horn antennas by introducing bodies of revolution, not necessarily planar, inside the horn. The investigations are carried out by simulations using a numerical code based on the method of moments for bodies of revolution.
Author
Antenna Design; Horn Antennas; Bodies of Revolution; Radiation Distribution

20050241944 Waterloo Univ., Ontario, Canada
Input Impedance of a Monopole over a Circular Ground-Plane of Finite Thickness
Shen, Zhongxiang; MacPhie, Robert H.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1726-1729; In English; See also 20050241839
Contract(s)/Grant(s): NSERC-A-2176; Copyright; Avail.: Other Sources

A considerable amount of theoretical and experimental work has been devoted to the problem of a monopole antenna fed through n finite or infinite ground-plane by a co8.zial transmission line. Monopole antennas have been widely used in airborne and ground-based communication systems. Monopole antennas on portable telephones can he observed in daily life. A monopole with an infinite ground plane can be easily characterized by the method of images as a dipole. In reality, however, the ground plane of the monopole antenna can not be of infinite extent. It is important and of practical value to understand the effect of the finite ground plane on the monopole’s performance. Unlike all the previously reported works, this paper describes a waveguide modal-expansion method for obtaining the input impedance of &monopole antenna fed through a circular ground plane of finite diameter and finite thickness by a costal line. The open-region antenna problem is initially transformed into n coaxial-circular waveguide junction cascading problem by properly introducing a large cylindrical wall to enclose the monopole and ground plane. The resulting waveguide cascading problem is then solved by the conservation of complex power technique (CCPT). Numerical results for the input impedance of a monopole over a finite circular ground plane are compared with experimental data. Very good agreement is observed.
Author
Monopole Antennas; Aircraft Communication; Telecommunication; Transmission Lines

20050241950 Naples Univ., Italy
A Novel Approach to Near-field Far-field Transformation from Intensity Data
D’Elia, G.; Pierri, R.; Soldovieri, F.; IEEE Antennas and Propagation Society International Symposium 1998 Digest.

Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1335-1338; In English; See also 20050241839; Copyright; Avail.: Other Sources

The diagnostic of the antenna from the measurement of the radiated (complex) near-field is a well established technique which now becomes of increasing interest also in the millimeter range [I]. However, many factors such as probe-positioning errors, temperature changes and the mechanical movements of the cables connecting the probe to the receiver, make more and more inaccurate the measurement of the phase of the near-field when the working frequency increases. In order to overcome this problem, various near-field far-field transformation techniques, exploiting only intensity data, have been recently proposed, the most promising ones being the microwave holography [21 and the phase retrieval technique [3]. The Gabor holography is based on the measurement of the intensity of the interference signal between the antenna under test (AUT) and a reference antenna and allows to evaluate the far-field of the AUT by numerically processing the interference data and exploiting the known behaviour of the reference antenna. However. the accuracy of the technique is strictly related to the accuracy of the modelling of the reference antenna, and, in order to make it possible a sampling rate ensuring an affordable measurement time, unacceptable size of the anechoic chamber can he required at millimeter frequencies for electrically large AUT. F.i., in the case of a planar scanning, a 2 meter diameter antenna working at 1000 Ghz, would require a measurement plane 15 meter far from the source. The second approach is based on the phase retrieval of the near-field from intensity data, usually exploits more than one measurement surface and involves the minimisation of a non quadratic objective functional exhibiting a number of local minima which can trap the minimisation algorithm. In order to control and to reduce the trapping problem, a new approach solving the phase retrieval problem in the space of the square amplitude of the field and involving a quartic functional has been recently introduced [3]. A comparison between various approaches has shown the advantages of this technique in finding the global minimum of the objective functional [41. However, a serious drawback of the approach is related to the large measurement time (at least twice the one required by standard NF-FF techniques) which can make it impossible to attain the stability of the measurement set up needed to ensure the required measurement accuracy [I]. Furthermore, due to the sensitivity of the technique to the distance between the scanning surfaces, a minimum distance is required between such surfaces so that, for electrically large antennas at millimeter frequencies, a large anechoic chamber can be required, with an increased cost of the overall measurement facility. Aim of this paper is to present a new antenna diagnostic technique from only near-field amplitude measurements which overcomes the aforementioned drawbacks while retaining the positive features of the square amplitude based approach. The presented technique is based on two independent intensity data obtained by exploiting two different probes on a single scanning surface and thus does not require to increase the measurement time and the anechoic chamber size. A planar scanning geometry, a planar source and a scalar case. will be considered in the following, although the approach can be applied to a vectorial case and a different geometry.

Author

Near Fields; Antennas; Algorithms; Far Fields; Theorem Proving

20050241973 Missouri Univ., Rolla, MO, USA

Pipelines as Communication Network Links. (Final Report, October 1, 2002-November 30, 2004)

Erickson, K. T.; Miller, A.; Stanek, E. K.; Wu, C. H.; Mar. 14, 2005; 54 pp.; In English

Report No.(s): DE2005-839987; No Copyright; Avail.: National Technical Information Service (NTIS)

This report presents the results of an investigation into two methods of using the natural gas pipeline as a communication medium. The work addressed the need to develop secure system monitoring and control techniques between the field and control centers and to robotic devices in the pipeline. In the first method, the pipeline was treated as a microwave waveguide. In the second method, the pipe was treated as a leaky feeder or a multi-ground neutral and the signal was directly injected onto the metal pipe. These methods were tested on existing pipeline loops at UMR and Batelle. The results reported in this report indicate the feasibility of both methods. In addition, a few suitable communication link protocols for this network were analyzed.

NTIS

Communication Networks; Natural Gas; Pipelines

20050242978 Naval Postgraduate School, Monterey, CA USA

A Study of the IEEE 802.16 MAC Layer and its Utility in Augmenting the ADNS Architecture to Provide Adaptable Intra-Strike Group High-Speed Packet Switched Data, Imagery, and Voice Communications

Johnson, Ballard V.; Sep. 1, 2005; 85 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439348; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research evaluates the Medium Access Control Layer (MAC) of the IEEE 802.16 Wireless standard and its utility in augmenting the IP (Internet Protocol) router based Automated Digital Network System (ADNS). This research explores the

need for a high throughput, high speed network for use in a network centric wartime environment and how commercial off-the-shelf (COTS) technologies that take advantage of the IEEE 802.16 wireless protocol can satisfy these requirements. The intent of this research is to prove that IEEE 802.16 systems can provide the ADNS with a viable alternative in order to enhance its capabilities and mitigate its limitations. This research includes a discussion on the current configuration of the ADNS architecture and its uses in the Carrier Strike Group (CSG). This research also analyzes the IEEE 802.16 MAC layer and identifies and tests its unique quality attributes that make it a viable high speed, high throughput communication link for point-to-point and point-to-multipoint naval applications.
DTIC
Communication Networks; Data Transmission; High Speed; Imagery; Switching; Voice Communication

20050242983 Naval Postgraduate School, Monterey, CA USA
Airborne Tactical Data Network Gateways: Evaluating EPLRS' Ability to Integrate With Wireless Meshed Networks
Bey, Christopher S.; Sep. 1, 2005; 114 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439366; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis assesses the feasibility, suitability, efficacy, and military potential of utilizing the Enhanced Position Location Reporting System (EPLRS) from airborne communications nodes with emergent commercialbased wireless technologies. Such integration would offer highly mobile maneuver units with over-the-horizon (OTH) tactical data connectivity. Specifically, this work examines tactical data requirements intrinsic to military operations with current OTH tactical data solutions. It also explores current EPLRS architectures and use and then compares the functional capabilities and limitations of EPLRS with those of IEEE 802.11x and 802.16 standards and prevalent developing meshed network routing protocols. Finally, this thesis evaluates fielded and emergent technologies to see if they are suitable to build and to sustain (collectively or independently) interconnected, ubiquitous, and routable tactical data networks by capitalizing on the advantages of EPLRS and by exploiting the inherent advantages of airborne assets in overcoming line-of-sight (LOS) limitations.
DTIC
Communication Networks; Computer Networks; Telecommunication

20050242993 Naval Postgraduate School, Monterey, CA USA
Data Set Simulation and RF Path Modeling of a QPSK Radio Communication System
Fang, Ting-Kuo; Sun, Wei-Long; Sep. 1, 2005; 78 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439409; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project simulates QPSK modulation signals and uses a laboratory environment to create deteriorating effects of real-world high frequency (HF) transmissions that may modify the ideal QPSK waveform. These modifications may be identifiable in order to 'fingerprint' the source of the modifications. To simulate the transmission path in the real world a signal generator is used to create the QPSK I/Q signal at the HF operating frequencies and a digital sampling oscilloscope acts as a receiver and records the data for analysis. A computer with MATLAB Instrument-control Toolbox is used to generate a random-input data stream as an input to the signal generator, which modulates the RF signal. The RF signal was chosen to be at HF (5-15 MHz) and the QPSK modulation was at 9600 baud. The deterioration effects of a real-world transmitter site were chosen to be associated with the output amplifier linearity.
DTIC
Data Simulation; Phase Shift; Phase Shift Keying; Radio Communication; Radio Frequencies

20050242998 Naval Postgraduate School, Monterey, CA USA
Performance Analysis of IEEE 802.11G Signals Under Different Operational Environments
Filtikakis, Stefanos; Sep. 1, 2005; 123 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439415; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A modern military environment requires flexible, capable and robust communications systems. Wireless communications infrastructures can provide all these services that are absolutely necessary to the soldiers on the battlefield or to the mission planners. The IEEE 802.11g wireless LAN seems to fit the military needs since it can provide data rates up to 54 Mbps and it is backward compatible with the earlier 802.11b specification. The purpose of this thesis was to implement, analyze and evaluate the performance of an outdoor point-to-point 802.11g WLAN under different operational environments. The implementation was achieved using two low-cost commercially available wireless bridges and directional external antennas from a well-known manufacturer, Cisco. As part of the analysis, the effective throughput of this standard, the packet error rate and the received signal strength were measured in each of the following three environments: suburban area, medium density

vegetation, and coastal. The signal path loss was then calculated from the recorded results and was compared to theoretical results from common outdoor propagation models. A new path loss exponent, n, was also estimated for each case. Based on this exponent, the free space path loss model was properly modified in order to fit the measured path loss results.
DTIC
Local Area Networks; Reliability Analysis; Wireless Communication

20050243030 Naval Postgraduate School, Monterey, CA USA
Proof of Concept: Iraqi Enrollment via Voice Authentication Project
Lee, Samuel K.; Sep. 1, 2005; 292 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439464; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis documents the findings of the Naval Postgraduate School (NPS) research team's efforts on the initial phase of the Iraqi Enrollment via Voice Authentication Project (IEVAP). The IEVAP is an Office of the Secretary of Defense sponsored research project commissioned to study the feasibility of speaker verification technology in support of the Global War on Terrorism security requirements. The intent of this project is to contribute toward the future employment of speech technologies in a variety of coalition military operations by developing a pilot proof-of-concept system that integrates speaker verification and automated speech recognition technology into a mobile platform to enhance warfighting capabilities. In this first phase of the IEVAP, NPS developed with the assistance of Nuance Communications, Inc. and the Defense Language Institute, a bilingual (English and Jordanian-Arabic) speech application that demonstrates the viability of speaker verification technology for use in operations in Iraq. Additionally, NPS conducted a test to assess the accuracy claim of Nuance's packaged speaker verification application, Nuance Caller Authentication 1.0 (for North American English). The NPS test consisted of 68 speaker enrollments and 411 speaker verification attempts. Upon completion of the test, NPS conducted a single data-point analysis yielding a system accuracy of 95.87%.
DTIC
Computer Information Security; Iraq; Military Operations; Proving; Speech; Speech Recognition; Voice Communication

20050243045 Naval Postgraduate School, Monterey, CA USA
Model to Calculate the Effectiveness of an Airborne Jammer on Analog Communications
Vingson, Narciso A., Jr.; Muhammad, Vaqar; Sep. 1, 2005; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439490; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this study is to develop a statistical model to calculate the effectiveness of an airborne jammer on analog communication and broadcast receivers, such as AM and FM Broadcast Radio and Television receivers. During the development the required power margin in dB, or equivalently, the required linear ratio, between the jammer power and the carrier power at the target receiver input was first determined. Subsequently, using probabilities that the jammer power will exceed the target signal's carrier power, the required power margin was calculated. This power margin was determined by statistical techniques to predict the propagation characteristics of communication and broadcast signals, such as Log-Normal Shadowing, and Small-Scale Fading. From the model, it was determined that it is difficult to achieve high probabilities of exceeding the required jamming margins with a single jammer. Hence, the use of spatial diversity jamming is recommended, that is, using two or more jammers spaced sufficiently far apart from each other, such that their jamming signals at the targeted area are de-correlated due to the differences in their respective angles of arrival.
DTIC
Airborne Equipment; Aircraft Communication; Jammers; Jamming; Telecommunication

20050243078 Naval Postgraduate School, Monterey, CA USA
Shipboard Radio Frequency and Free Space Optics Communications System using an Airborne Relay
St. Germain, Kenneth; Sep. 1, 2005; 101 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439542; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis explores the possible gains and discusses the constraints of a communications system that uses a ship to unmanned aerial vehicle (UAV) radio frequency (RF) link paired with a UAV to satellite free space optic (FSO) link to accomplish satellite communications. Analysis shows that a data rate of 2 gigabits per second (Gbps) with a 1 . 10(-6) probability of bit error can be attained by a shipboard system with a relatively small antenna and power supply if an FSO-enabled UAV is used. An experiment demonstrated that the addition of an FSO link and additional routing does not reduce the performance of a slower data rate RF link. The findings indicate that a composite RF and FSO ship-UAV-satellite

system can be used within the Transformational Communications Architecture (TCA) and with the Navy's FORCEnet to enable network-centric operations (NCO).
DTIC
Communication Networks; Radio Frequencies; Space Communication

20050243079 Naval Postgraduate School, Monterey, CA USA
Modeling, Simulation and Implementation of a Non-Coherent Binary-Frequency-Shift-Keying (BFSK) Receiver-Transmitter into a Field Programmable Gate Array (FPGA)
Svenningsen, Juan P.; Sep. 1, 2005; 108 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439543; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis presents the use of a field programmable gate array (FPGA) to implement a non-coherent binary-frequency-shift-keyed receiver-transmitter (BFSK-RT) that simulates the modulation of the SINCGARS radio, the RT-1523C. An FPGA successfully, and with very few resources, implemented the desired modulation and demodulation. Topics covered include FPGA history, the hardware and software utilized, a summary of the SINCGARS RT-1523C characteristics, the BFSK-RT on FPGA design procedure and the design results.
DTIC
Field-Programmable Gate Arrays; Frequency Shift; Frequency Shift Keying; Receivers; Simulation; Transmitters

20050243087 Naval Postgraduate School, Monterey, CA USA
High Throughput Tactical Wireless Networking for Surveillance and Targeting in a Coalition Environment: An Analysis of the Next Generation IEEE 802.11n Equipment and Standard
Thomason, Gary W.; Sep. 1, 2005; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439555; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis presents a technology review of the emerging IEEE 802.11n standard. A wireless local area network (WLAN) based on state-of-the-art equipment supporting the 802.11n protocol is evaluated in the Coalition Operating Area Surveillance and Targeting System (COASTS). This thesis also provides a brief introduction to COASTS, its support for testing various networking schemes, and their effectiveness in supplying information necessary to reach a decision maker's desired end-state. Also provided is a summary of the current state of the 802.11n proposed standard, the hardware and software used to evaluate the equipment, and the testing methodology. In general, the methodology was to conduct field tests with private vendors and coalition partners to evaluate the capabilities of 802.11n networks that promise large throughput benefits for WLANs. The specific goal of this research focused on testing equipment and network configurations in an IP network. The ultimate goal of this research is to evaluate an evolutionary improvement for our forces to transfer large amounts of data and to maintain the mobility and flexibility to deploy rapidly to areas with little or no infrastructure. With this capability our forces may can gain control of the environment, dramatically improve tactical situational awareness, and attain information superiority.
DTIC
Local Area Networks; Surveillance

20050243097 Naval Postgraduate School, Monterey, CA USA
Tactical Wireless Networking in Coalition Environments: Implementing an IEEE 802.20 Wireless End-User Network Utilizing FLASH-OFDM to Provide a Secure Mobile Extension to Existing WAN
Parrish, William J.; Tovar, Daniel R.; Sep. 1, 2005; 139 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439567; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis will focus on the area of 802.20 wireless networking as a feasible 'last mile' solution to wireless access in a tactical coalition environment and will be implemented into a series of experiments. Implementation will primarily utilize Flarion s FLASH OFDM (Fast, Low-Latency Access with Seamless Handoff Orthogonal Frequency Division Multiplexing). Current and future military and homeland security forces, conducting operations in a tactical environment, require instant access to data. Wireless data requires a reliable air-link resource anchored to a viable service platform. Flarion's FLASH-OFDM wireless air-link mimics the performance of a high-speed wireline environment. Through Flarion's Radio Router base station and mobile data terminal, a Radio Access Network is created. It connects directly to a standard IP Packet Data Network forming a wireless data network. Utilizing this network environment, this thesis intends to document the implementation of a limited objective experiment (LOE) in support of homeland security and the War on Terrorism (WOT); specifically, the testing of an IEEE 802.20 network enabling US and key foreign partners to integrate mobile wireless local

area network (WLAN) technologies into a surveillance and target acquisition network program.
DTIC
Communication Networks; Data Processing Terminals; Radiotelephones; Target Acquisition; Warfare; Wide Area Networks

20050243100 Naval Postgraduate School, Monterey, CA USA
Feasibility Study of VoIP Integration into the MYSEA Environment
Tse, Lily; Sep. 1, 2005; 204 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439571; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Voice over Internet Protocol (VoIP) is becoming popular due to its low cost and the management advantages it offers over traditional PSTN phone systems. VoIP is widely implemented with H.323 and Session Initiation Protocol (SIP) standards. However, both protocols are poorly designed for networks with common security solutions such as firewalls and Network Address Translation (NAT). This project is a feasibility study of SIP-based VoIP integration into the Monterey Security Architecture (MYSEA), a multilevel secure environment that uses NAT as a security mechanism. A gathering of comparative studies on VoIP protocols was performed to guide the selection of SIP as the test protocol. A set of experiments was devised and conducted using SIP-based softphones for this study. The insights gained from the experiment provide useful insights to the MYSEA project concerning VoIP security.
DTIC
Feasibility; Voice Communication

20050243106 Naval Postgraduate School, Monterey, CA USA
Command Resiliency: An Adaptive Response Strategy for Complex Incidents
Pfeifer, Joseph W.; Sep. 1, 2005; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439581; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many organizations believe they are prepared for the next terrorist event by wrongly assuming there is a predictable threat that can be managed with the purchase of new equipment. Unless organizations develop a resilient response strategy that can adapt organizational and operational elements to respond to new terrorist incidents, they will find themselves with the same difficulties emergency responders did on 9/11. As terrorist attacks unfold, organizations are pushed beyond their normal capabilities. How quickly organizations adapt to the uncertainty of a new crisis is critical. Organizations that cannot adapt to new threats of large, complex terrorist vents will be less likely to respond effectively to future attacks. This paper recommends a resilient response strategy that is flexible enough to adapt to complex incidents. It proposes policy recommendations that address organizational strategy and operational crisis management to deal with the initial critical hours of a terrorist attack. Organizational strategy defines core competencies and what happens when competencies are pushed beyond their capacity. Operational crisis management will examine situational awareness requirements, flexible decision-making and innovation. Command resiliency is achieved by overcoming organizational bias and integrating organizational preparedness and operational adaptability into a synergistic response network.
DTIC
Command and Control; Decision Making; Emergencies; Management Methods; Military Operations; Strategy; Terrorism

20050243110 Naval Postgraduate School, Monterey, CA USA
Frequency and Polarization Diversity Jamming of Communications in Urban Environments
Ulama, Tuncay; Sep. 1, 2005; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439586; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research is to investigate how to exploit frequency and polarization techniques in reducing the effects of jamming against UAV relay communication links in an urban warfare environment. There have been early studies investigating the diversity techniques against multipath and fading problems in urban environments. A medium without any jamming issues seems almost impossible to exist in today's warfare. Basically, noise jamming issues were taken into consideration. Urbana Wireless Toolset was used as the computer simulation. Even though it is a powerful tool to predict the radio wave propagation in urban environments, due to the problems about modeling the cities (lack of detail, like the shapes of the buildings, objects and vehicles that could be found in the streets, and other details that would contribute to the propagation mechanisms), it can only give us a trend with some guidelines instead of an exact mapping of propagation.
DTIC
Cities; Communication Networks; Frequency Shift; Jamming; Reception Diversity

20050243119 Naval Postgraduate School, Monterey, CA USA
Object Tracking Using Wireless Sensor Networks
Salatas, Vlasios; Sep. 1, 2005; 297 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439599; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wireless sensor network (WSN) is a promising new technology. It could be a way to achieve ubiquitous computing and embedded Internet. WSNs are an efficient solution for applications that involve deep monitoring of a deployment environment. The objective of this thesis is to explore the use of WSNs for object tracking and motion estimation. It introduces the WSN technology, their theoretical characteristics, system constraints, WSN architectures, deployment topologies and standards. The object-tracking system that this thesis introduces, demonstrates a real-world application that uses a WSN to track objects and communicate their information. It is an event-driven application implemented in Java, built on top of the Crossbow MSP 410 wireless sensor system. The algorithm process the data returned from the WSN detection signals and tracks the object's motion. Deployment scenarios are proposed that demonstrate suitable node topologies for the system. The evaluation of the object-tracking system is performed by conducting a number of indoor and outdoor experiments..
DTIC
Communication Networks; Radiotelephones

20050243200 Maryland Univ., College Park, MD USA
Joint Detection and Decoding of High-Order Modulation Schemes for CDMA and OFDM Wireless Communicaitons
Xu, Yingjiu; Jan. 1, 2003; 200 pp.; In English
Report No.(s): AD-A439734; No Copyright; Avail.: CASI: A09, Hardcopy

Wireless communications call for high data rate, power and bandwidth efficient transmissions. High-order modulation schemes are suitable candidates for this purpose as the potential to reduce the symbol period is often limited by the multipath-induced intersymbol interference. In order to reduce the power consumption, and at the same time, to estimate time-variant wireless channels, we propose low-complexity, joint detection and decoding schemes for high-order modulation signals in this dissertation. We start with the iterative demodulation and decoding of high-order CPM signals for mobile communications. A low complexity, pilot symbol-assisted coherent modulation scheme is proposed that can significantly improve the bit error rate performance by efficiency exploiting the inherent memory structure of the CPM modulation. A noncoherent scheme based on multiple symbol differential detection is also proposed and the performances of the two schemes are simulated and compared.
DTIC
Code Division Multiple Access; Decoding; Detection; Modulation; Radiotelephones

20050243207 Humansystems, Inc., Guelph, Ontario Canada
Network Enabled Operations: A Canadian Perspective
Thomson, Michael H.; Adams, Barbara D.; May 13, 2005; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W7711-3-7893-01-TOR
Report No.(s): AD-A439749; DRDC-TORONTO-CR-2005-162; No Copyright; Avail.: CASI: A03, Hardcopy

This report outlines the concept of Network Enabled Operations (NEOps), both as a whole, and from a uniquely Canadian perspective. This report is the culmination of an extensive literature survey, and of two think tanks convened on 1 March 2005 and 30 March 2005 with Canadian subject matter experts (SMEs), both military and non-military, who are currently working to define and drive forward the Canadian concept of NEOps. Results showed that the Canadian conception of NEOps must be interpreted in light of the new security environment and what role the Canadian Forces (CF) is likely to play. As such, NEOps must be understood within emerging concepts in defense policy, such as the JIMP framework (joint, interagency, multinational, public) and the 3-D (defense, diplomacy, development) approach to international affairs. SMEs questioned how the stated benefits of NEOps would actually manifest themselves in operations, such as warfighting, peacekeeping, humanitarian, nation building, etc., without fully appreciating the cognitive and socialization processes that underlie them. Moreover, SMEs pointed to a number of challenges that require greater attention prior to full implementation of NEOps. These include: trust; ensuring common mental models cognitive processes, and understanding information overload; authority (including common intent) and accountability; attempts to implement NEOps universally, across the three arms of the CF; CF structure and culture (e. g., distributed decision making and information sharing); education and training; and affordability.
DTIC
Canada; Communication Networks; Military Operations

20050243213 Naval Postgraduate School, Monterey, CA USA
U.S. Democracy Promotion and Al Jazeera: A View into Arab Reactions and Opposing Movements
Smith, Marie E.; Sep. 1, 2005; 131 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439758; No Copyright; Avail.: CASI: A07, Hardcopy

The promotion of democracy in the Arab world, an area to date resistant to effective political liberalization, has become a central pillar in American Middle East foreign policy as well as an integral element in the Global War on Terrorism (GWOT). How will this advocacy of democracy be received, given our theoretical and historical knowledge? The underlying assumption of U.S. policy is that democracy will moderate some of the anti-American sentiments from the region as well as undermine terrorist activities and support. Will overt American promotion of democracy cause these states to democratize? Using aspects of social movement theory, this thesis examines Arab reactions to public American promotion of democracy. I argue that America's campaign is counterproductive because it has polarized the political discourse, a result which weakens potential sources of internal pressure and distorts understandings of democracy, thus facilitating states maintenance of the status quo. It does this through framing the message as inherently American and spurring opposing movements. Using al-Jazeera data derived from the Foreign Broadcast Information Service (FBIS), I recorded the connotations associated with each articulation of the word 'democracy' to create a sample of competing frames to observe opposing movement developments and frame contest trends.
DTIC
Broadcasting; Foreign Policy; International Relations; Terrorism; Warfare

20050243219 Maryland Univ., College Park, MD USA
Spectro-Temporal Modulation Transfer Functions and Speech Intelligibility
Chi, Taishih; Gao, Yujie; Guyton, Matthew C.; Ru, Powen; Shamma, Shihab; Jan. 1, 1999; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439776; CAAR-TR-99-2; ISR-TR-99-61; No Copyright; Avail.: CASI: A03, Hardcopy

The most obvious feature of a speech spectrogram is the energy modulations, both in time in any given frequency channel, and along the spectral axis at any instant, due to formant peaks and their transitions, spectral edges, and rapid amplitude modulations at onsets/offsets. These modulations occur at relatively slow temporal rates (few Hz) reflecting the speed of the articulatory gestures, and hence the phonetic and syllabic rates of speech. Speech intelligibility is critically dependent on the clarity of these spectro-temporal modulations. Thus speech reconstructed from smoothed spectrograms along either dimension suffers from progressive loss of intelligibility.
DTIC
Intelligibility; Modulation Transfer Function; Speech Recognition

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*.

20050240863 Lawrence Livermore National Lab., Livermore, CA USA
Preconditioned MoM Solutions for Complex Planar Arrays
Fasenfest, B. J.; Capolino, F.; Wilton, D. R.; Jackson, D. R.; Mar. 30, 2004; 10 pp.; In English
Report No.(s): DE2005-15013928; UCRL-CONF-203260; No Copyright; Avail.: Department of Energy Information Bridge

The numerical analysis of large arrays is a complex problem. There are several techniques currently under development in this area. One such technique is the FAIM (Faster Adaptive Integral Method). This method uses a modification of the standard AIM approach which takes into account the reusability properties of matrices that arise from identical array elements. If the array consists of planar conducting bodies, the array elements are meshed using standard subdomain basis functions, such as the RWG basis. These bases are then projected onto a regular grid of interpolating polynomials. This grid can then be used in a 2D or 3D FFT to accelerate the matrix-vector product used in an iterative solver. The method has been proven to greatly reduce solve time by speeding the matrix-vector product computation. The FAIM approach also reduces fill time and memory requirements, since only the near element interactions need to be calculated exactly. The present work extends FAIM by modifying it to allow for layered material Green's Functions and dielectrics. In addition, a preconditioner is implemented to greatly reduce the number of iterations required for a solution. The general scheme of the FAIM method is

reported in ‘General MoM Solutions for Large Arrays;’ this contribution is limited to presenting new results.
NTIS
Method of Moments; Fast Fourier Transformations; Matrices (Mathematics); Planar Structures

20050240885 Lawrence Livermore National Lab., Livermore, CA USA
Model-Based Processing of Micro-Cantilever Sensor Arrays
Clague, D. S.; Candy, J. V.; Lee, C. L.; Nov. 23, 2004; 62 pp.; In English
Report No.(s): DE2005-15011800; UCRL-TR-208164; No Copyright; Avail.: National Technical Information Service (NTIS)

We develop a model-based processor (MBP) for a micro-cantilever array sensor to detect target species in solution. After discussing the generalized framework for this problem, we develop the specific model used in this study. We perform a proof-of-concept experiment, fit the model parameters to the measured data and use them to develop a Gauss-Markov simulation. We then investigate two cases of interest: (1) averaged deflection data, and (2) multi-channel data. In both cases the evaluation proceeds by first performing a model-based parameter estimation to extract the model parameters, next performing a Gauss-Markov simulation, designing the optimal MBP and finally applying it to measured experimental data. The simulation is used to evaluate the performance of the MBP in the multi-channel case and compare it to a smoother (averager) typically used in this application. It was shown that the MBP not only provides a significant gain (approx. 80dB) in signal-to-noise ratio (SNR), but also consistently outperforms the smoother by 40-60 dB. Finally, we apply the processor to the smoothed experimental data and demonstrate its capability for chemical detection. The MBP performs quite well, though it includes a correctable systematic bias error.
NTIS
Algorithms; Signal Processing

20050240956 Commerce Dept., Washington, DC, USA
Technology Recycling: Achieving Consensus for Stakeholders. Roundtable Electronics Recycling. Held in Washington, DC. on September 21, 2004
January 2004; 136 pp.; In English; Technology Recycling: Achieving Consensus for Stakeholders. Roundtable Electronics Recycling., September 21, 2004, Washington, DC.
Report No.(s): PB2006-101144; No Copyright; Avail.: CASI: A07, Hardcopy

Phil Bond is privileged to serve as the Under Secretary here for Technology, and he is happy to welcome you here to the building for an important discussion, and one of the great, great stories of the USA in the last 20 years has been the growth of the high tech sector, especially Information Technology (IT). In particular, its contribution to economic growth, standard of living, giving rise to the ubiquitous consumer electronics products that we see, improving the quality of life, and contributing much. At the same time, we now are faced with more and more of these products reaching the end of their life cycles, and that is requiring political institutions everywhere to begin to discuss and deal with a looming issue, an issue that could really affect the very competitiveness in this increasingly competitive world of the same technology companies that have helped to drive our economy. Here is the state of play. By some estimates, about two million tons per year of scrap, 20 to 50 million PCs per year, requiring management of electronic waste. And, of course, this is, as he mentioned receiving greater focus from political institutions. State and local governments in this country are considering a number of actions, searching for ways as responsibly manage the waste and protect our environment.
NTIS
Electronic Equipment; Recycling

20050240964 Lawrence Livermore National Lab., Livermore, CA USA
Heterodyning Time Resolution Boosting for Velocimetry and Reflectivity Measurements
Erskine, D. J.; Aug. 22, 2004; 16 pp.; In English
Report No.(s): DE2005-15014558; UCRL-PROC-205680; No Copyright; Avail.: Department of Energy Information Bridge

A theoretical technique is described for boosting the temporal resolving power by several times, of detectors such as streak cameras in experiments that measure light reflected from or transmitted through a target, including velocity interferometer (VISAR) measurements. This is a means of effectively increasing the number of resolvable time bins in a streak camera record past the limit imposed by input slit width and blur on the output phosphor screen. The illumination intensity is modulated sinusoidally at a frequency similar to the limiting time response of the detector. A heterodyning effect beats the high frequency science signal down a lower frequency beat signal, which is recorded together with the conventional science signal. Using 3 separate illuminating channels having different phases, the beat term is separated algebraically from the conventional signal.

By numerically reversing the heterodyning, and combining with the ordinary signal, the science signal can be reconstructed to better effective time resolution than the detector used alone. The effective time resolution can be approximately halved for a single modulation frequency, and further decreased inversely proportional to the number of independent modulation frequencies employed.
NTIS
Heterodyning; Reflectance; Temporal Resolution; Velocity Measurement

20050241685 Lawrence Livermore National Lab., Livermore, CA USA
Dual-Mode Actinic EUV Mask Inspection Tool
Liu, Y.; Barty, A.; Gullikson, E.; Taylor, J. S.; Liddle, J. A.; Mar. 23, 2005; 16 pp.; In English
Report No.(s): DE2005-15015933; UCRL-PROC-210747; No Copyright; Avail.: Department of Energy Information Bridge

To qualify the performance of non-actinic inspection tools, a novel EUV mask inspection system has been installed at the Advanced Light Source (ALS) synchrotron facility at Lawrence Berkeley National Laboratory. Similar to the older generation actinic mask inspection tool, the new system can operate in scanning mode, when mask blanks are scanned for defects using 13.5-nm in-band radiation to identify and map all locations on the mask that scatter a significant amount of EUV light. By modifying and optimizing beamline optics (11.3.2 at ALS) and replacing K-B focusing mirrors with a high quality Schwarzschild illuminator, the new system achieves an order of magnitude improvement on in-band EUV flux density at the mask, enabling faster scanning speed and higher sensitivity to smaller defects. Moreover, the system can also operate in imaging mode, when it becomes a zone-plate-based full-field EUV microscope with spatial resolution better than 100 nm. The microscope utilizes an off-axis setup, making it possible to obtain bright field images over a field-of-view of 5x5 m2.
NTIS
Extreme Ultraviolet Radiation; Inspection; Masks; Microscopes; Microscopy

20050241840 Northrop Grumman Corp., Pico Rivera, CA, USA
High Frequency Analysis of Interior Wedge/Horn Scatterings
Ling, R. T.; Ufimtsev, P.-Ya.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1557; In English; See also 20050241839; Copyright; Avail.: Other Sources

Many scattering objects contain concave elements with planar facets where the incident wave undergoes multiple reflections. The number of multiple reflections increases in inverse proportion to the internal angle between facets and becomes very large for small wedge angles. This makes the solution of the scattering problem difficult. We study this problem for an appropriate model, shaped like the capital letter Z, which consists of junctions of three planar faces (two half-planes joined by a strip). Actually, such a geometry can be considered as an interior wedge/horn structure. A comprehensive analysis of multiple reflections inside this structure is presented. All possible horn shapes which create beams reflected directly back to the monostatic radar are identified. Radiation of the last reflected beams from the horn is studied in the Kirchhoff-Kottler and Physical Optics approximations. The Kirchhoff-Kottler approximation does not take into account the transverse diffusion of the wave field in the region between the reflecting faces and the radiating aperture. This phenomenon is described by the Physical Optics. Numerical data for the radiated field illustrate the effect of transverse diffusion. The field radiated by the reflected beams is only a part of the total scattered field. Edge waves radiated by nonuniform (fringe) currents represent additional contributions. They are studied in the framework of the Physical Theory of Diffraction. A version of this theory based on a modified definition of nonuniform currents near the interior edge is developed. It allows the simplification of the scattered field computation.
Author
Diffusion Waves; Wave Reflection; Scattering; High Frequencies; Transverse Waves; Wedges; Diffraction; Half Planes; Physical Optics

20050241841 Siena Univ., Italy
Evolution of the Equivalent Currents in High-Frequency Diffraction
Tiberio, R.; Maci, S.; Toccafondi, A.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1562-1565; In English; See also 20050241839; Copyright; Avail.: Other Sources

The development and applications of high-frequency techniques have mainly been based on two leading theories; namely the Geometrical Theory of Diffraction (GTD)[I] and the Physical Theory of Diffraction (PTD) [2]. Both of them make use of

solutions of local canonical problems, that in most practical instances, have an infinite, uniform cylindrical configuration. These canonical problems are used by GTD to provide an estimate of a diffracted ray field contribution and by PTD to find an estimate of the currents that should be introduced to correct those predicted by the Physical Optics (PO). The GTD leads to a very attractive picture of the scattering from a complex object, in terms of rays emanating from isolated 'flash points'. The singularities that occur in the original GTD formulation at the shadow boundaries (SB) of the Geometrical Optics (GO) field have been removed by its uniform versions, such as the Uniform Geometrical Theory of Diffraction (UTD) [3]. However, serious difficulties occur in applying this ray method close to and at caustics. Nevertheless, when applicable, GTD techniques have been demonstrated to provide a very powerful method. Therefore, it would be desirable, if not imperative, for any alternative or even more general method, to be able to recover this ray field description when it is appropriate.
Derived from text
Geometrical Theory of Diffraction; Cylindrical Bodies; Problem Solving; Geometrical Optics; Diffraction

20050241843 National Kaohsiung Inst. of Tech., Kaohsiung, Taiwan, Province of China
A Circular Polarized Annular Ring Microstrip Antennas
Chen, Hua-Ming; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1352-1355; In English; See also 20050241839; Copyright; Avail.: Other Sources

new and simple circular polarization (CP) design of annular ring microstrip antennas using a pair of tuning stubs or a pair of slits are proposed. This design allows easy adjustment, by trimming the stub length or slit length, to excite good circularly polarized waves. A typical design with the antenna size reduction about 52% is demonstrated, and experimented results are presented and discussed.
Author
Circular Polarization; Microstrip Antennas

20050241844 Waterloo Univ., Ontario, Canada
Study of Effects of HTSC Nonlinearity on Current Distribution over a Microstrip Line
Tang, H. Z.; Safavi-Naeini, S.; Chow, Y. L.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1376-1379; In English; See also 20050241839; Copyright; Avail.: Other Sources

So far the applications of high temperature superconductive (HTSC) microwave circuits are limited to low power levels. The surface resistance of HTSC materials increases significantly with the power. For some applications, such as the transmitters in the base station of wireless communication systems, we have to push the input power level high enough to meet practical requirements. It is necessary to investigate the nonlinear effects of HTSC planar microwave integrated circuits at these high power levels. In this paper, a HTSC microstrip transmission line is analysed to investigate the nonlinear effects on the current distribution due to high applied powers. The current density distribution and the power handling capability of the HTSC planar microstrip line are studied, and the conductor loss as a function of the applied power will be obtained.
Derived from text
High Temperature Superconductors; Microwave Circuits; Current Distribution; Integrated Circuits; Losses

20050241845 Ferdinand-Braun-Inst. fuer Hoechstfrequenztechnik, Berlin, Germany
Design Considerations for Bi-conical Multibeam Antennas
Demmerle, Frank; Wiesbeck, Werner; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1446-1449; In English; See also 20050241839; Copyright; Avail.: Other Sources

Bi-conical multibeam antennas allow a simple and inexpensive implementation of multiple radiated beams, without the need for cost intensive beamforming networks [1]. They can be used as smart antennas in order to increase capacity and efficiency of microwave communication networks, but also for intelligent microwave sensors. The horizontal beamwidth of multimode bi-conical antennas is mainly determined by the number of propagating TEM- and TE(sub nl)-modes in the feeding overmoded coaxial waveguide. Increasing the number of modes however decreases the bandwidth because of the mode dispersion. The antenna gain can be increased by shaping the elevation characteristic. This can be realized almost independently from the horizontal pattern by simply changing the flare angle and length of the bi-conical waveguide. In this paper typical results for bi-conical multibeam antennas with respect to gain, bandwidth, elevation and azimuth characteristics

are presented. These have been determined by measurements and are compared with calculations.
Derived from text
Antenna Design; Conical Bodies; Multibeam Antennas; Microwave Circuits; Antenna Gain; Beamforming; Communication Networks

20050241846 National Chung Hsing Univ., Taichung, Taiwan, Province of China
Cylindrical Microstrip Lines in a Cylindrical Layered Medium
Kiang, Jean-Fu; Ching-Her, Lee; Chung-I G. Hsu; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1476-1479; In English; See also 20050241839; Copyright; Avail.: Other Sources

In this research, a rigorous full-wave analysis is applied to study the dispersion characteristics of a cylindrical microstrip line with a multilayered medium. The spectral dyadic Green's function needed in the electric field integral equation formulation is derived to deal with four different cases of the background layered media: with or without the presence of the center and/or the outer ground conductors.
Author
Cylindrical Bodies; Electric Fields; Microstrip Transmission Lines; Integral Equations; Conductors

20050241847 Politecnico di Turin, Turin, Italy
On the Spectral Evaluation of Mutual Coupling Between Planar Antennas
Sereno-Garino, Massimo; Vecchi, Giuseppe; Orefice, Mario; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1522-1525; In English; See also 20050241839; Copyright; Avail.: Other Sources

We describe a numerics/integration technique to efficiently evaluate the spectral traction integrals between two arbitrary functions on separated domains, in a general stratified dielectric medium, that employs a novel scheme of contour deformation. An application example is presented.
Author
Integrals; Dielectrics; Contours; Deformation; Planar Structures; Antenna Design

20050241848 Delaware Univ., Newark, DE, USA
Low Frequency Scattering From Dielectric Objects-A Simplified Approach
Kleinman, R. E.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1574-1576; In English; See also 20050241839
Contract(s)/Grant(s): F49620-96-1-0039; Copyright; Avail.: Other Sources

This paper presents a simplified method for determining the coefficients in a low frequency expansion of the electric and magnetic fields for the problem of scattering by penetrable homogeneous dielectric (both lossy and lossless) bodies.
Author
Low Frequencies; Scattering; Dielectrics; Electric Fields; Magnetic Fields

20050241849 Amirkabir Univ. of Technology, Tehran, Iran (Islamic Republic of)
Analysis of a Thick Finite Microstrip Antenna Using Surface Equivalence Principle and Multiple Network Theory (SEMN)
Tavakkol-Hamedani, Farzad; Tavakoli, Ahad; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1606-1609; In English; See also 20050241839; Copyright; Avail.: Other Sources

SEMN method is previously introduced and general formulas and derivations for analysis of complex structures and closed-form expressions for electromagnetic fields in the source region were presented [1]. A thick microstrip antenna with finite size substrate is analyzed by SEMN method and its return loss and radiation patterns are calculated. It is shown that the method is a powerful tool for analyzing such structures and theoretical results are in very good agreement with measurements.
Author
Antenna Radiation Patterns; Microstrip Antennas; Structural Analysis; Electromagnetic Fields; Thickness

20050241852 Public Univ. of Navarre, Pamplona, Spain

MEASUREMENTS of A NEW GAUSSIAN PROFILE CORRUGATED HORN ANTENNA FOR MILLIMETER WAVE APPLICATIONS

Gonzalo, R.; Canales, J. Martf; Teniente, J.; delRio, C.; Sorolla, M.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1722-1725; In English; See also 20050241839; Copyright; Avail.: Other Sources

The measurements results of a new design of corrugated horn antennas [1, 2, 3] following the gaussian expansion are presented in this paper. The performance of two corrugated horn antennas of this kind was verified in the ESTEC Compact Antenna Test Range (CATR) [4]. Very high agreement between measured and predicted results is found.

Author

Horn Antennas; Corrugated Waveguides; Millimeter Waves

20050241856 Universidad Politecnica de Madrid, Madrid, Spain

Antenna Diagnosis and Pattern Reconstruction using Near Field Amplitude Data and Iterative Source Reconstruction

Las-Heras, Fernando; Ortiz-Valbuena, Cesar; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1343-1346; In English; See also 20050241839

Contract(s)/Grant(s): TIC95-0123; Copyright; Avail.: Other Sources

In this paper an iterative technique for antenna diagnosis and pattern reconstruction from amplitude field data at two distances is presented. At each iteration, phase correction is accomplished using a source reconstruction optimization method. Results from synthesized data, even in the case of typical measurement errors, illustrate the validity of the technique.

Author

Antenna Radiation Patterns; Diagnosis; Near Fields

20050241857 Army Communications-Electronics Command, Fort Monmouth, NJ, USA

Planar, Single Feed, Circularly Polarized Microstrip Antenna with Enhanced Bandwidth

Nalbandian, Vahakn; Lee, Choon Sae; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1368-1371; In English; See also 20050241839; Copyright; Avail.: Other Sources

The most common Circularly Polarized (CP) microstrip antennas are made by using a splitting network that feeds the two adjacent sides of a square patch with signals of equal magnitude and 90deg phase difference. This splitting networks become cumbersome especially in large arrays. Single-feed CP microstrip antennas have been investigated by a number of authors eliminating the need for a complex splitting network[l]. Unfortunately these antennas have very narrow CP bandwidth. In the proposed antenna, a double-layer microstrip will be used. The two orthogonal modes occupy different cavities and the 90 phase difference between the modes is achieved by coupling holes between the two resonant cavities. The coupling hole concept was first introduced by Bethel2], and further refined by Collins[3]. In an earlier paper by the anthors[4] each cavity had two side walls in order to suppress any unwanted modes. Unfortunately, side walls make fabrication difficult, especially in array structures. In this paper the side walls are eliminated and the CP bandwidth is substantially increased. In addition, the CP axial ratio does not degrade near the horizon.

Derived from text

Microstrip Antennas; Bandwidth; Cavity Resonators; Cavities

20050241858 Tatung Inst. of Tech., Taipei, Taiwan, Province of China

Microstripline-fed Circularly-polarized Aperture Antenna

Chang, Nan; Wu, Chung Pei; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1372-1375; In English; See also 20050241839; Copyright; Avail.: Other Sources

A technique to generate circularly polarized aperture antenna is presented in this paper. This antenna uses a microstrip line to feed a truncated square aperture. A tuning metal strip is placed across the diagonal line of the aperture. Experiment shows that the metal strip will improve both input V.S.W.R. and axial ratio of this antenna. It is found that 20% bandwidth for 10dB return loss and 5% bandwidth for less than 3dB bore sight axial ratio can easily be achieved.

Author

Microstrip Transmission Lines; Circular Polarization; Bandwidth; Apertures

20050241859 Texas A&M Univ., College Station, TX, USA

Analysis of Line-fed Antenna Coupler

Yang, Yao-Chou; Chang, Kai; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1384-1388; In English; See also 20050241839; Copyright; Avail.: Other Sources

As power is fed into the transmission line of the line-fed antenna coupler, energy is coupled from the transmission line to the patch. Two resonant modes are excited at two different frequencies with orthogonal linear polarizations if the patch is rectangular. Theoretical analysis with experimental verification has been conducted to study the characteristics of this configuration. The antenna can transmit and receive two independent, orthogonal, and linear polarized signals.

Author

Coupling Circuits; Antenna Couplers; Transmission Lines; Resonant Frequencies

20050241861 Manitoba Univ., Winnipeg, Manitoba, Canada

Characterization of an NRD Slot for the Design of an NRD Based Slot Array

Ghosh, B.; Simons, N.; Shafai, L.; Ittipiboon, A.; Petosa, A.; Cuhaci, M.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1405-1408; In English; See also 20050241839; Copyright; Avail.: Other Sources

The non-radiating dielectric waveguide (NRD) has been receiving considerable attention lately due to its low loss nature and the ability to suppress radiation at bends and discontinuities, it is proposed to exploit the above properties to design a NRD based slot array. Previous work relied on measured data for the admittance of a single slot in the ground plane of the NRD. In the following, a single slot in the NRD ground plane is characterized using the TLM method. The perfectly matched layer (PML) Absorbing Boundary Condition was used to ensure minimal reflection from the exterior boundaries of the computational domain. It is also shown that an sin less than -40 dB is achieved when the PML is used to terminate the NRD.

Author

Dielectric Waveguides; Electrical Impedance

20050241863 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA

Predictions and Measurements of Double-Vee Dipoles

Patwari, Neal; Safaai-Jazi, Ahmad; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1426-1429; In English; See also 20050241839; Copyright; Avail.: Other Sources

A novel variation of the vee dipole is introduced. This new geometry, called a double-vee dipole, has more directive gain in the mainlobe and has significantly smaller sidelobes than the conventional vee-dipole. The antenna is modeled and the results are formulated for design of double-vee dipoles of different lengths and angles. A double-vee dipole was fabricated and measurements are shown to match predictions.

Author

Sidelobes; Dipole Antennas; Dipoles; Predictions

20050241864 Ministry of Posts and Telecommunications, Tokyo, Japan

A Slot-array Antenna on a Coaxial Cylinder

IIgusa, Kyoichi; Yamamoto, Shinichi; Tanaka, Masato; Teshirogi, Tasuku; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1434-1437; In English; See also 20050241839; Copyright; Avail.: Other Sources

In mobile communication, omnidirectional directivity and circular polarization are convenient properties because when they are used, acquisition and track operations for direction and polarization are not needed. As an antenna which has such properties, we developed a slot-array antenna on an oversize coaxial cylinder, as shown in Fig. 1. This array antenna has less loss than microstrip arrays because energy is transported to each slot in the oversize coaxial waveguide. Also we can shape the beam in the vertical plane by controlling the size and position of slots. We developed cosecant and conical beam antennas. They are scale model antennas for respectively indoor communication by millimeter waves and mobile satellite communications. In this conference we show the performance of these antennas.

Derived from text

Slot Antennas; Circular Polarization; Directivity; Antenna Arrays; Communication Satellites; Mobile Communication Systems; Cylindrical Antennas

20050241865 Institute of Microwave Techniques and Electronics, Belgrade, Yugoslavia

New Circularly Polarized Planar Printed Antenna with Conical Radiation Pattern

Nesic, Aleksandar; Brankovic, Veselin; Radnovic, Ivana; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1438-1441; In English; See also 20050241839; Copyright; Avail.: Other Sources

The new circularly polarized planar printed antenna concept with conical antenna pattern is presented. The proposed concept features a simple printed structure with omnidirectional pattern end maximum gain of about 6 dBi at the elevation angle from 30deg to 60deg, showing features for various commercial applications. Operational bandwidth of more than 20% for VSWR less than 2 as well as satisfactory axial ratio is obtained. The concept is verified by measurements.

Author

Antenna Radiation Patterns; Circular Polarization; Bandwidth; Antenna Design; Conical Bodies

20050241866 Saga Univ., Japan

Determination Method of the Loading Impedances of Loaded Antenna: Realizing Desired Beam Tilting and Low Sidelobe Level

Tanaka, Takayaki; Egashira, Shigeru; Sakitani, Akibide; Aikawa, Masayoshi; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1450-1453; In English; See also 20050241839

Contract(s)/Grant(s): MOE-09750428; Copyright; Avail.: Other Sources

For the base station antenna of cellular mobile telephone systems, a beam tilting antenna is desired[1]. Such a beam tilting is realized easily by a loaded wire antenna.If we can obtain the leading impedances from desired characteristics such as tilt angle and sidelobe level in a straightforward manner, in the design it is practically useful. In this paper, determination method of the impedances loaded on the antenna for the desired tilt angle and low sidelobe is described.

Derived from text

Antenna Design; Sidelobes; Attitude (Inclination)

20050241867 Defence Science and Technology Organisation, Salisbury, Australia

The Effect of Inhomogeneous Ground Upon HF Antennas

Coleman, C. J.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1462-1466; In English; See also 20050241839; Copyright; Avail.: Other Sources

A technique is developed for estimating the impact of inhomogeneous ground upon the performance of an HF antenna. In this technique, the antenna currents are calculated for a representative homogeneous ground and the effects of inhomogeneities are found from the solution to an integral equation. An approximate solution procedure is developed and is used to investigate the impact of a variety of ground screens upon antenna performance.

Author

High Frequencies; Integral Equations; Antennas

20050241868 Manitoba Univ., Winnipeg, Manitoba, Canada

Grooved Suspended Microstrip Line

Gupta, N.; Shafai, L.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1468-1471; In English; See also 20050241839; Copyright; Avail.: Other Sources

This paper presents a new type of a grooved suspended microstrip line configuration. The groove dimensions provide an extra degree of freedom in design to increase the impedance control capability of the line. The method of lines has been employed for this purpose. Finally, the dispersion characteristics of this new type of grooved suspended microstrip line is computed and compared with the simple and suspended microstrip configurations.

Author

Grooves; Microstrip Transmission Lines; Degrees of Freedom; Impedance

20050241869 Hong Kong Polytechnic, Kowloon, Hong Kong

An Efficient Non-Uniform FDTD Method for Analysis of Propagation Characteristics of Optical Fiber Waveguides

Shen, Guoqiang; Chen, inchao; Mittra, Raj; IEEE Antennas and Propagation Society International Symposium 1998 Digest.

Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1488-1491; In English; See also 20050241839; Copyright; Avail.: Other Sources

The development of modern optical fiber technologies has spurred many advances in communication systems, including component miniaturization, energy reduction, increase in data-handling capacity, and the introduction of new signal processing techniques [1]. A crucial step in the design of optical fiber communication systems is the prediction of their propagation characteristics in an efficient and accurate manner. The conventional modal analysis of optical fiber cables requires both tedious mathematical manipulations and numerical root searching, which can be computer-intensive. In a recent publication [2]. the present authors have introduced a highly efficient, one-dimensional, cylindrical finite difference time domain (1D-CFDTD) algorithm for analyzing axisymmetric cylindrical waveguides. In this paper we extend this work to a nun-uniform version of the above FDTD that is useful for analyzing optical fiber waveguides. Figs. 1 and 2 show the geometry of an optical fiber waveguide and its index-of-refraction distributions for the three most commonly-used optical fiber cables, including the step-index multimode, graded-index multimode, and single-mode step index structures. To analyze these structures we employ the 1D-CFDTD algorithm in conjunction with the unsplit, anisotropic perfectly matched layer (APML) [3] technique to truncate the mesh along the radial direction. The primary advantages of the algorithm are its simplicity from the point of view of mathematical manipulation, computational efficiency, low computer memory requirement, and potential for application to a wide variety of fiber optical waveguide problems,

Derived from text

Optical Waveguides; Optical Fibers; Finite Difference Time Domain Method; Cylindrical Bodies; Memory (Computers); Miniaturization

20050241870 McMaster Univ., Hamilton, Ontario, Canada

The Analysis of Higher-Order Modes and Cutoff Frequencies in Circular-Rectangular Coaxial Waveguides Using SVD Technique

Haiyin, Wang; Litva, John; Ke-Li, Wu; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1500-1503; In English; See also 20050241839; Copyright; Avail.: Other Sources

The singular value decomposition technique combined with orthogonal mode expansion and Galerkin method are applied to analyze the field distribution and cutoff frequencies of higher-order modes in circular-rectangular (C-R) coaxial waveguides. The mathematical expressions of the TE modes are presented. The results can be used for design of waveguide components with C-R coaxial structures.

Author

Circular Waveguides; Rectangular Waveguides; Decomposition

20050241872 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA

SDFMM-Based Fast Analysis of Radiation and Scattering from Finite Microstrip Structures

Jandhyala, Vikram; Michielssen, Eric; Shanker, Balasubramaniam; Chew, Weng C.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1530-1533; In English; See also 20050241839; Copyright; Avail.: Other Sources

The prediction of radiation and scattering from microwave circuits and multilayered patch antenna is essential in the design of many communication systems. The analysis of electromagnetic phenomena involving large-scale quasi-planar structures requires efficient and accurate numerical techniques. The most popular approach for analyzing scattering and radiation from such structures relies on surface integral equation formulations and method of moments (MoM) based solution techniques.

Derived from text

Planar Structures; Integral Equations; Scattering; Patch Antennas; Microwave Circuits

20050241874 Commissariat a l'Energie Atomique, Bruyeres-le-Chatel, France

A NEW CLASS of CANONICAL CASES FOR the DIFFRACTION BY AN ANISOTROPIC IMPEDANCE WEDGE

Bernard, J. M. L.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1558-1561; In English; See also 20050241839; Copyright; Avail.: Other Sources

We study the diffraction of a skew incident plane wave by a passive anisotropic wedge of any angle, whose principal axes of anisotropy are along and normal to the edge. We present here a new class of canonical cases, which is derived by employing

the factorization technique for coupled equations, developed by the author [1]-[2].
Derived from text
Plane Waves; Wedges; Impedance; Diffraction

20050241875 Pennsylvania State Univ., State College, PA, USA
A RECIPROCITY APPROACH FOR DETERMINING RADIATION PATTERNS of PATCH ANTENNAS ON CIRCULARLY-CYLINDRICAL PLATFORMS
Werner, D.H.; Mouyis, G.D.; Millra, A.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1582-1585; In English; See also 20050241839; Copyright; Avail.: Other Sources

Over the past few years there has been a rapidly growing interest in conformal patch antennas that can be mounted on arbitrarily curved surfaces [1-6]. One of the major factors influencing the popularity of these antennas is their potentially useful application in mobile communication systems. This has also fueled a need for more powerful and versatile computational modeling techniques for this class of antennas. In this paper we present an efficient method, based on the Reciprocity theorem, for calculating the radiation patterns of patch antennas mounted on circularly-cylindrical platforms when the current distribution on the patches is available from previous computations. The major advantages of this approach are that it does not require the evaluation of complicated layered media Green's functions for curved geometries and circumvents the need to calculate time-consuming Sommerfeld integrals. The technique also has the highly desirable feature that it is easily generalizable to patch antennas of arbitrary shape.
Derived from text
Reciprocity Theorem; Antenna Radiation Patterns; Cylindrical Bodies; Green's Functions; Current Distribution

20050241876 National Taiwan Inst. of Tech., Taipei, Taiwan, Province of China
Transmission Line Analysis of a Rectangular Microstrip Patch Antenna Coupled to an Open-Ended Microstrip Line
Cheng-Chef, Yu; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1598-1601; In English; See also 20050241839; Copyright; Avail.: Other Sources

A highly-flexible and computation-efficient transmission line method is presented to model a rectangular patch antenna coupled to a microstrip line. Using this transmission line approach, the input impedance, resonant frequency, return loss, coupled and radiated power can be determined simultaneously. From the analysis results, it is shown that the resonant frequency and input impedance have strong connection to the coupled line. Both the coupled and radiated powers can be increased to useful levels when the matching section is properly designed after the resonant input impedance has been determined as the antenna feeding port.
Author
Microstrip Transmission Lines; Resonant Frequencies; Patch Antennas; Coupling Circuits; Impedance; Microstrip Antennas

20050241877 Shanghai Univ., Shanghai, China
Analysis of Aperture-Coupled Gridded Patch Antenna
Shun-Shi, Zhong; Shi-Chang, Gao; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1610-1613; In English; See also 20050241839; Copyright; Avail.: Other Sources

An analysis of the aperture-coupled 8ridded patch antenna is described by using the spectral domain Green function approach. Effects of various antenna parameters on the input impedance and resonant frequency are studied. These results arc useful for antenna design applications.The theory is confirmed by comparisons with available results.
Author
Antenna Design; Apertures; Patch Antennas; Resonant Frequencies; Impedance

20050241878 Institute of Microwave Techniques and Electronics, Belgrade, Yugoslavia
ACTIVE SLOT ANTENNAS AS INTEGRATED UNIPLANAR MICROWAVE PART of TRANSMITTER-RECEIVER
Nesic, Aleksandar; Jovanovic, Sinisa; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1624-1627; In English; See also 20050241839; Copyright; Avail.: Other Sources

A new concept, design and realization of active slot antennas as simple integrated uniplanar part of transmitter-receiver

is presented in this paper. All circuits era realized in coplanar waveguide techniques (CPW) The common oscillator with one low-cost FET (NE76084) works like transmitter and local oscillator for the receiver and has electrically controlled frequency. The model is realized at transmitting frequency of 5.25 GHz, Transmitter radiating power is about 22 dBm end mixer isotropic conversion gain is 2.7 dB. The concept end design can be applied to microwave as well as to millimeter-wave frequencies. Author

Transmitter Receivers; Slot Antennas; Field Effect Transistors; Radio Transmitters; Planar Structures

20050241880 Universidad de Cantabria, Santander, Spain

FAST RAY-TRACING METHOD FOR CALCULATING the PROPAGATION IN INDOOR ENVIRONMENTS

Catedra, M. F.; Perez, J.; deAdana, F. Saez; Gutierrez, Oscar; Cantalapiedra, Javier; Gonzalez, Ivan; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1656-1659; In English; See also 20050241839; Copyright; Avail.: Other Sources

A method for calculating the propagation for mobile communications in indoor environments is presented. It is an extremely efficient fully three-dimensional method based on ray-tracing. This method is characterized by his high computation speed by using the angular Z-Buffer algorithm for the ray-tracing.

Author

Computation; Ray Tracing; Algorithms; Mobile Communication Systems

20050241881 Waterloo Univ., Ontario, Canada

FDTD Analysis of Indoor Radio Propagation

Wang, Ying; Safavi-Naeini, Safieddin; Chaudhuri, Sujeet K.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1664-1667; In English; See also 20050241839

Contract(s)/Grant(s): CUHK-506/95E; Copyright; Avail.: Other Sources

A Modified Two Dimensional Finite Difference Time Domain formulation was used to simulate indoor radio wave propagation for base located indoors. Good agreement between calculation and measurement as well as UTD/Ray tracing results confirmed its accuracy. This method required 800 times less memory than 3-Dimensional FDTD for a 3 meter ceiling/floor separation with the signal at 1.8 GHz, making it possible to model the effect of furniture on wave propagation inside a building.

Author

Radio Transmission; Ray Tracing; Finite Difference Time Domain Method; Wave Propagation; Radio Waves

20050241884 Tsinghua Univ., Bejing, China

Analysis of an offset cross slot in the broadwall of a rectangular waveguide using the Galerkin method

Hongyu, Liang; Zhenghe, Feng; Qiji, Yang; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1702-1705; In English; See also 20050241839; Copyright; Avail.: Other Sources

A novel type of radiating elements for slotted-waveguide arrays: offset cross slots in the broadwall of a rectangular waveguide is put forward. Scattering and resonant properties of a single offset cross slot are analyzed using the Galerkin method with global sinusoidal basis Numerical results reveal that such an element can be represented by an admittance in a transmission line, just as an offset longitudinal slot does. However, it possesses a shorter resonant length and a broader bandwidth, compared with the offset longitudinal slot. The agreement between theory and experiment is found to be good, which verifies the accuracy of our method.

Author

Slots; Galerkin Method; Rectangular Waveguides; Transmission Lines; Bandwidth; Electrical Impedance

20050241887 Ghent Univ., Belgium

CONVERGENCE ANALYSIS and OPERATION COUNT of THE CONJUGATE GRADIENT FAST MULTIPOLE METHOD

VandenAbeele, Piet; Knockaert, Luc; DeZutter, Daniel; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1750-1753; In English; See also 20050241839; Copyright; Avail.: Other Sources

The fast multipole method in combination with a conjugate gradient technique has been used to speed up solution of

two-dimensional scattering problems. We focus on a convergence analysis of the conjugate gradient method for the problem of TM scattering by a perfectly conducting cylinder. Results for rectangular cylinders with different aspect ratios are presented. Author

Conjugate Gradient Method; Convergence; Multipoles; Scattering; Integral Equations; Electric Fields

20050241888 Illinois Univ., Urbana, IL, USA

Error Analysis for the Multilevel Fast Multipole Algorithm

Koc, S.; Song, J. M.; Chew, W. C.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1758-1761; In English; See also 20050241839; Copyright; Avail.: Other Sources

The matrix-vector multiplication encountered in the iterative solution of scattering problems can be performed in O(N) operations by using a multilevel fast multipole algorithm (MLFMA). This paper presents estimates for the errors introduced by MLFMA. The details of the algorithm is described in [1]. An analysis of the errors in the FMM algorithm for the monopole and dipole terms is given in [2]. The analysis is extended to higher order multipole terms, and integration and interpolation errors are alto included. The basic mathematical tool in FMM is the addition theorem. The notation used here is as defined in [1]. The matrix representations of the spherical translation operators are full matrices. However, these operators have diagonal representations when expressed in terms of their plane wave spectra [3, 4, 5].

Derived from text

Algorithms; Error Analysis; Multipoles; Iterative Solution; Interpolation; Plane Waves; Vectors (Mathematics)

20050241889 Illinois Univ., Urbana-Champaign, IL, USA

Parallel Fast Multipole Capacitance Solver

Dull, J.; Gallivan, K.; Song, J. M.; Chew, W. C.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1766-1769; In English; See also 20050241839; Copyright; Avail.: Other Sources

Computing the interactions between N-bodies is a scientific problem encountered in many engineering disciplines. Some common N-body problems include gravitational interactions and electrostatic interactions. These problems surface in electromagnetics, fluid dynamics, and physics, as well as other scientific fields. The N-body problem consists of computing the interactions among all objects in the system. Computing the interactions directly takes O(N(sup 2)) operations. However, as the size of the problem exceeds about 7,000, using an O(N(sup 2)) algorithm to solve the problem is unacceptable. The two most popular fast algorithms for the N-body problem are the Fast Multipole Algorithm [1] and the Barnes Hut Algorithm [2], whose complexity can he reduced to O(N log N) or even O N). This paper describes a parallel implementation of the static Fast Multipole Algorithm, which can solve the capacitance between an arbitrary number of objects. Some results for common capacitance problems will be discussed.

Derived from text

Electrostatics; Multipoles; Gravitational Effects; Fluid Dynamics; Algorithms; Capacitance

20050241895 France Telecom International, Issy-les-Moulineaux, France

Correlation of Measurements in Different Test Sites using the GPOF Method

Fourestie, Benoit; Altman, Zwi; Wiart, Joe; Azoulay, Alain; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1339-1342; In English; See also 20050241839; Copyright; Avail.: Other Sources

Measurement test sites fall into two main categories: sites which are ideally free of reflections, such as anechoic chambers, and sites with a reflecting ground. Semi anechoic chambers and Open Area Test Sites (OATS) belong to the second category. Measurements of Site Attenuation (SA) or transmission loss on a test site in case of site validation [I] or antenna testing are strongly influenced by the nature of the test site. Standards of measurements are therefore specific to each type of site. It is of primary interest to be able to correlate measured results on these different sites. Theoretical studies of measurement of SA have been carried out using the geometrical-optics approximation and the assumption that the ground is a perfect reflector. Using these assumptions entails errors in measurement modelling thus making the correlation process more difficult. The aim of this work is to put forward a new method for systematic retrieval of results obtained in an anechoic chamber from results measured in a semi anechoic chamber. The strategy employed is to identify the different propagating components, viz., the

direct and the reflected wave components using the Generalised Pencil of Function method (GPOF) [21. Once identified, the reflected component can be removed.
Derived from text
Geometrical Optics; Correlation; Attenuation; Reflected Waves; Reflectors; Transmission Loss

20050241896 Israel Aircraft Industries Ltd., Yehud, Israel
Manufacturing Tolerances Impact on Millimeter Wave Enhanced Gain Patched Antenna Performance
Rojansky, Vladimir; Winebrand, Mark; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1348-1351; In English; See also 20050241839; Copyright; Avail.: Other Sources

The Ref. [1] paper validated the feasibility of a Ka-band rectangular patch antenna gain enhancement method, based on substrate-superstrate resonance. Substantial consonance between theoretical and sample antenna measurement results was observed. A thorough study of the manufacturing tolerances impact on the antenna performance is presented in this paper. The following factors affecting the gain of the antenna operating at upper Ka frequency band are covered: a) substrate-superstrate distance deviation from the nominal one; b) superstrate tilt relative to substrate and c) superstrate surface roughness. Allowable ranges of the manufacturing tolerances considering the above parameters axe established. These tolerances axe well inside the limits of the modem manufacturing capabilities. Therefore, the enhanced gain patch antenna operating at millimeter waves (Ka-frequency band) can be easily manufactured and happens to be a comprehensive and cost effective solution for various applications.
Author
Patch Antennas; Millimeter Waves; Substrates; Antenna Gain; Extremely High Frequencies; Manufacturing; Microwave Antennas

20050241897 Chinese Military Academy, Fong-Shan, Taiwan
Compact Circular Microstrip Antenna with Embedded Chip Resistor and Capacitor
Chen, Hong-Twu; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1356-1359; In English; See also 20050241839; Copyright; Avail.: Other Sources

It has been reported that, by loading a shorting pin at the edge of a microstrip patch, the antenna size for operating at a fixed frequency can be significantly reduced [1]-[4]. However. such short-circuited patch antennas also result in a narrower bandwidth, as compared to the conventional microstrip patch antenna. To overcome this disadvantage, we present in this paper a new configuration of the compact microstrip antenna with chip-resistor and chip capacitor loadings. When the microstrip patch is loaded with a chip resistor [5], it is found that the compactness of the microstrip patch antenna can still be achieved. That is the reduction in the resonant frequency of the microstrip patch is similar for using either the shorting-pin or chip-resistor loading technique. Moreover, since the microstrip patch antenna is a resonant structure and, when at resonance, it can roughly he modeled as a parallel RLC lumped-element equivalent circuit, it is expected that, with the loading of an external chip resistor, the quality factor of the microstrip patch will be decreased. That is, a wider antenna bandwidth can he achieved by using a chip-resistor loading. Also, since it is known that the resonant frequency of the equivalent RLC circuit will be decreased when an external capacitor is loaded in parallel with the circuit, it is expected that the chip-resistor and chip-capacitor loadings will have constructive effects in lowering the resonant frequency of the microstrip patch. To verify such predictions, the respective effects of the chip-resistor loading and chip-capacitor loading on the characteristics of a microstrip patch antenna will first be studied. Although the present loading technique can be applied to microstrip antennas of various patch shapes such as rectangular, circular, and triangular patches, we present in this paper the studies for a circular microstrip patch antenna. The effects of loading the chip resistor and chip capacitor on the circular microstrip patch antenna will be analyzed experimentally. The optimal loading positions of the chip resistor and chip capacitor in the circular microstrip patch will also be discussed. Simulated results generated by a full-wave CAD tool [6], which is based on a mixed-potential integral-equation approach and is capable of analyzing the microstrip patch with resistive and reactive lumped loads, are also given for comparison.
Derived from text
Microstrip Antennas; Capacitors; Chips; Resistors; Equivalent Circuits; Dipole Antennas

20050241898 Cheng-Shiu Coll. of Technology and Commerce, Kaohsiung, Taiwan, Province of China
Single-feed Circularly Polarized Square-ring Microstrip Antennas with a Slit
Chen, Wen-Shyang; Chen, Horng-Dean; IEEE Antennas and Propagation Society International Symposium 1998 Digest.

Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1360-1363; In English; See also 20050241839; Copyright; Avail.: Other Sources

Circular polarization (CP) design using single-feed microstrip patch antennas has been performed by nearly square ring. and nearly square patch [1,2]. As refer these CP design techniques, due to the aspect ratio of the rectangular patch to be near unity, trial-and-error methods are usually applied to fabricate the perturbation segment for CP radiation, in this article, we present a new and simple technique by cutting a narrow slit to the edge of a square-ring patch instead of such a perturbation segment. Thus. a CP design technique of a single-feed square-ring microstrip antenna with a narrow slit is relatively easier and simple to be implemented, as compared to the other CP design methods using perturbation segment [1,2]. The present proposed design have been experimentally studied. By properly choosing the length of the inlaying slit to the edge of square-ring patch (see Fig. 1), a 90deg phase difference can be easily achieved. And, by cutting a square slot in the center of the square patch to become a square-ring case, this makes it possible to lengthen the excited surface current paths of both the degenerate TM(sub 01), and TM(sub 10) modes, which effectively lowers the first two dominant resonant frequencies of the square microstrip antenna. With the lowering of the two operating frequencies, the required antenna size for a fixed CP operation can be reduced; that is, the design of a reduced-size CP microstrip antenna can be achieved. In this design, the two operating frequencies are the resonant frequencies of the orthogonal near-degenerate modes of the square-ring patch, which are of equal amplitude and 90 phase difference, and can be excited using a single coax feed. Typical results of the proposed design are discussed in the Symposium.

Derived from text

Microstrip Antennas; Circular Polarization; Resonant Frequencies; Slits; Perturbation; Patch Antennas

20050241899 Cheng-Shiu Coll. of Technology and Commerce, Kaohsiung, Taiwan, Province of China

Single Feed Circularly Polarized Microstrip Ring Antenna and Arrays

Chen, Wen-Shyang; Chen, Horng-Dean; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1360-1363; In English; See also 20050241839; Copyright; Avail.: Other Sources

Single feed circularly polarized antennas are currently receiving much attention within tire antenna community. Circular polarization is beneficial because current and future commercial and military applications (e.g. satellite, terrestrial communications) require tile additional design freedom of not requiring alignment of the electric field vector at the receiving and transmitting locations. A single feed allows a reduction in the complexity, weight, and RF loss of aa array feed. Circularly polarized microstrip antennas, CP-MSA, have the additional advantage of small size and produce a co]npletely planar antenna which is compatible with microwave and millimeter, MIC, and monolithic, MMIC, integrated circuits. Previous works have demonstrated single feed microstrip and aperture square and circular patches with perturbations. Excitation is either a coaxial or a stripline feed. This paper introduces a simple and robust design of a single feed antenna system; namely a stub ring antenna fed by proximity coupling, PC, from an embedded microstrip line. We present an analysis of a single element and two and four element arrays.

Derived from text

Antenna Arrays; Microstrip Antennas; Perturbation; Circular Polarization; Integrated Circuits

20050241900 Michigan Univ., Ann Arbor, MI, USA

Characterization of a CPW/MS Transition for Antenna Applications

Robertson, R.; Tentzeria, E. M.; Ellis, T. J.; Katchi, L. P. B.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1380-1383; In English; See also 20050241839

Contract(s)/Grant(s): QJ8820; DAAH04-95-1-0321; Copyright; Avail.: Other Sources

A full-wave analysis of a Coplanar Waveguide (CPW) to Microstrip (MS) Transition is performed using Finite Difference Time Domain (FDTD) and the High Frequency Structure Simulator (HFSS). The effects from truncating the dielectric substrate around the CPW and microstrip are characterized . Results indicate that decreasing the size of the dielectric substrate does not significantly affect performance.

Author

Finite Difference Time Domain Method; Planar Structures; High Frequencies; Substrates; Dielectrics

20050241901 Chan Technologies, Inc., Kirkland, Quebec, Canada

A Broadband End Launched Coaxial-to-Waveguide Transition for Waveguide Phased Arrays

Chan, K. K.; Martin, R.; Chadwick, K.; IEEE Antennas and Propagation Society International Symposium 1998 Digest.

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To achieve wide scan over a broad bandwidth, the elements in a waveguide phased array are usually of reduced height and width to keep grating lobes out of the field of view. In active arrays, these waveguide elements are fed by T/P. modules through end launched coaxial-to-waveguide transitions because of the severe space restriction brought about by the dense packaging and the cooling requirements. A frequently used end-launcher is the L-shaped loop or the loop plus probe type. Approximate loop coupling and probe coupling analytical models have been offered by Sand [2] and Deshpande et al [1] to predict the performance of this type of transition. A wider band design approach for the end launched transition has been reported by Dix [3]. It involves using four sections - a circular coaxial guide section, the protrusion of the center conductor into a ridged waveguide and two thin ridged steps, in addition to the input circular coaxial and the output rectangular waveguides. This empirically designed transition has a reported 48% bandwidth with a return loss of -20,6 dB, In this paper, we are offering both improved modifications to Dix's approach to produce a better performing transition as well as a formally exact field analysis procedure for end launched transitions,

Derived from text

Waveguides; Broadband; Phased Arrays; Bandwidth; Rectangular Waveguides; Field of View

20050241902 Netherlands Foundation for Radio Astronomy, Dwingelo, Netherlands

Wide-band Antenna Element with Integrated Balun

Smolders, A. B.; Arts, M. J.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 13941397; In English; See also 20050241839; Copyright; Avail.: Other Sources

The international radio-astronomy community is currently making detailed plans for the development of a new radio telescope: the Square Kilometer Array Interferometer (SKAI) [1]. This instrument will be a hundred times more sensitive than telescopes currently in use. One of the options for this new telescope is to use phased arrays with wore than 10(exp 6) receiving elements with a mixed RF/digital adaptive beamformer. At this moment a demonstrator is being developed at NFRA, the One Square Metre Array (OSMA). This is a scaled model with 144 receiving elements and with a 16 channel digital adaptive beamformer. For this demonstrator a wide-band antenna element was developed [2], which was optimized for the scan behaviour in an array environment. In this paper, an optimized design of the balanced-to-unbalanced transition (balun) from the antenna element to the first LNA stage is presented. In addition, results are shown of a wide-band printed antenna element with integrated balun. Two theoretical models were developed to optimize and analyse the balun, i.e. a transmission line model based on the work of Knorr [3] and a model based on the method of moments. Several experiments were done to test the balun and to check the corresponding models. Furthermore, the performance of an antenna element with integrated balun was also tested experimentally.

Derived from text

Antenna Components; Broadband; Interferometers; Transmission Lines; Phased Arrays; Method of Moments; Design Analysis; Couplers

20050241903 Wang Electro-Opto Corp., Marietta, GA, USA

Low-cost Wideband 3-bit Phased Array Module using Integrated Antenna/Phase-Shifter

Wang, J. J. H.; Thompson, G. T.; Tillery, J. K.; Bohannan, K. E.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1401-1404; In English; See also 20050241839

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A low-cost wideband 3-bit integrated antenna/phase-shifter array module using the Spiral-Mode Microstrip (SMM) antenna has been developed, achieving a 10:! frequency bandwidth with good, robust measured performance. The estimated cost for the array modules is about $300 each in production quantities of over 20,000 units.

Author

Broadband; Antenna Arrays; Microstrip Antennas; Phase Shift Circuits; Phased Arrays

20050241904 Raytheon Systems Co., Los Angeles, CA, USA

Photonic Wideband Beamformer for Multibeam Arrays

Lee, J. J.; Stephens, R. R.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas:

Gateways to the Global Network, Volume 3; [1998], pp. 1409-1412; In English; See also 20050241839; Copyright; Avail.: Other Sources

A new multibeam feed system has been developed which will significantly reduce the complexity of the beamformer by eliminating multiple sets of discrete phase shifters, drivers, multiplexers, and control lines at the array element level. The feed 'engine' can be used for both transmit and receive operations. On receive, the signal across the aperture is conjugatedly matched at the front end by the phase gradient produced by the transmit network. The received signal does not go through the entire manifold in the reverse direction, which ensures that the system noise figure is not degraded by losses in the receive path. The technique can be extended to 2-D scan.

Author

Beamforming; Multiplexing; Broadband; Feed Systems

20050241907 Yokohama National Univ., Japan

6-Sector Antenna Using Proximity Coupled Taper Slot for Multi-Media Mobile System

Arai, Hiroyuki; Ebine, Yoshio; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1430-1433; In English; See also 20050241839; Copyright; Avail.: Other Sources

The next generation mobile telephone service is planning to be on service after 2,000. This service gives high speed data transmission of 2Mbps for local area and 384kbps for global area. After the next generation, data speed is required to be up to 20Mbps. The issue for high speed data transmission is how to eliminate delayed signal caused by multi-path propagation. Smart or intelligent antenna is investigated to increase the C/N (carrier to noise) ratio, however, the sector beam antenna is effective to eliminate the delayed signal. For the sector beam antenna, thin horn antenna [1] and monopole Yagi-Uda array [2] have been proposed. In order to obtain low cost and simple manufacturing process for the sector beam antenna, this paper presents novel 6-sector antenna using proximity coupled taper slot. This antenna will be installed on the vehicle roof, and also used for micro or pico cell indoor/outdoor base station. This paper presents the characteristics of electromagenetically coupled taper slot antenna and demonstrates 6-sector antenna using this taper slot.

Derived from text

Monopoles; Data Transmission; Slot Antennas; Yagi Antennas; Horn Antennas; High Speed; Carrier to Noise Ratios

20050241908 Japan Radio Co. Ltd., Japan

Mobile Communication Higher-order-mode Microstrip Antennas for VICS

Kazama, Yasuhiro; Morita, Nagayoshi; Tokumaru, Shinobu; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1442-1445; In English; See also 20050241839; Copyright; Avail.: Other Sources

Vehicle Information and Communication System (VICS) is one of the Intelligent Transport Systems (ITS) in Japan. The system was commenced in Tokyo area and Tohmei and Meishin highways in 1995. The VICS consists of radio beacon system, light beacon system and FM broadcasting system. Radio beacon system antennas installed on cars are desired to have ability to receive sufficient level signals in the area ranging from just below the beacon antenna to a great distance along the road. Our purpose is to develope car installation microstrip antennas as conformable as possible to such particular receiving ability. To evaluate the receiving characteristics, we define and use 'effective directivity', which can evaluate real relative receiving power depending upon the distance between beacon antenna and car antenna and relative inclination of both antennas. As a result of investigation, we point out that conventional microstrip antennas using the dominant mode do not have suitable property for this system and that those using higher order modes are preferable.

Author

Microstrip Antennas; Radio Beacons; Information Systems; Beacons; Broadcasting

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Dielectric-Loaded Slotted-Cylinder Antennas Offering Reduced Base Station Interference for Personal Communication Services

Ando, Atsuya; Cho, Keizo; Hori, Toshikazu; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1454-1457; In English; See also 20050241839; Copyright; Avail.: Other Sources

Personal communication services (PCS) based on micro- and macro-cells have been developed and launched successfully, and the subscriber number and service areas continue to expand at a tremendous rate [1]-[2]. In PCS that use macro-cells, the

base station antennas are usually mounted on high places, such as building rooftops, to cover a wide area with circular radio zones [3]. Such a base station antenna (macro-cell) experiences severe base station interference (co-channel interference) from other base station antennas that are in line-of-sight to the antenna. In addition, PCS base station antennas mostly transmit vertically polarized waves. The beam tilt-down technique [4], which puts nulls on the horizontal plane is the technique most commonly used to reduce this base station interference and has been adopted by many base station antennas of both cellular and micro cellular systems throughout the world. Unfortunately, this technique offers only limited success and a more efficient approach is needed. To reduce the interference level more effectively, horizontally polarized wave antennas are very effective. However, the rod-shape horizontally polarized omnidirectional antennas have not been developed in land mobile communication systems. This paper proposes dielectric-loaded slotted-cylinder antennas (DSCA) that have, for PCS, horizontally-polarize d omnidirectional radiation pattern to reduce the base station interference. These rod-shape array antennas are achieved by modifying a slotted-cylinder antenna (SCA) [5]-[7] to include dielectric loading. The structure of DSCA and the fundamental characteristics, such as input impedance and radiation pattern of the DSCA array, are shown. The reduction in the base station antenna interference level and the radio zone length of the DSCA array are confirmed by measurer results on an urban street.

Derived from text

Antenna Radiation Patterns; Electromagnetic Interference; Mobile Communication Systems; Omnidirectional Antennas; Slot Antennas; Antenna Arrays; Dielectrics; Impedance

20050241910 McMaster Univ., Hamilton, Ontario, Canada

Smart Antenna Calibration For Beamforming

Xue, Hao; Kezys, Vytas; Litva, John; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1458-1461; In English; See also 20050241839; Copyright; Avail.: Other Sources

There are three basic techniques for carrying out DOA estimation. These are: (i) scanning the region of interest with a high-gain directional antenna and measuring the power received from each singular direction (ii)using a small antenna array to receive the signals and carrying out the estimation using high resolution algorithms and (iii) measuring DOA using a multibeam antenna array. The first method is simple, but one has to remove the antenna pattern effect from the results. For the second method, the number of impinging signals should be smaller than the number of antenna elements. It is not applicable to wireless communications. It will be shown that the third technique can be used to estimate the DOA of signals. There are two main issues that need to be addressed. First, the resolution of this technique is limited by the aperture size. Second, the array needs to be calibrated, which is the subject of this paper. The array needs to be calibrated because of the discrepancies in the receiver channels associated with each antenna element. There is also mutual coupling between the elements of the array. If these errors or discrepancies are not taken into account during the beamforming, they can seriously degrade the accuracy of DOA estimation. The technique used in this paper is based on generation of a weight matrix used for DOA distribution estimation, which compensates for the above errors. The weight matrix is calculated based on using optimization method to convert the measured array response to the desired array response. The measured array response is obtained by carrying out measurements in an anechoic chamber with a known distribution of test signals. The DOA distribution can then be estimated by multiplying the incoming signal vector by the weight matrix.

Derived from text

Antenna Arrays; Directional Antennas; Wireless Communication; Multibeam Antennas; Beamforming; Calibrating; Estimating; Accuracy

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Microstrip Lines on an Indented Cylinder

Kiang, Jean-Fu; Lee, Ching-Her; Hsu, Chung-I. G.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1472-1475; In English; See also 20050241839; Copyright; Avail.: Other Sources

The transmission properties of cylindrical microstrip lines and striplines have been studied by using both the static and the dynamic approaches [1]-[5]. In [1], a variational approach was developed to calculate the capacitance matrix of coupled cylindrical striplines and microstrip lines on which the charge distribution is presumed. In [2], a conformal mapping technique is applied to calculate the characteristic impedance of striplines and coupled slots on a tubular dielectric cylinder. In [3], an iterative approach is developed to analyze the multiconductor cylindrical transmission line where the charge distribution is

refined in each iteration step. In the full wave approach, method of moments can be applied to solve for the current distribution on the strips [4], [5].
Derived from text
Transmission Lines; Microstrip Transmission Lines; Current Distribution; Charge Distribution; Dielectrics; Electrical Impedance; Cylindrical Bodies

20050241912 Toosi Univ. of Technology, Tehran, Iran (Islamic Republic of)
Analysis of a Coplanar Waveguide with Finite Metallization Thickness on an Anisotropic Multilayer Substrate using Method Of Lines
Haghlani, N.; Safavi-Naeini, S.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1480-1483; In English; See also 20050241839; Copyright;
Avail.: Other Sources

Coplanar waveguides (CPW) have been proposed and used for the external modulation and control of the lightwaves at microwave range of frequencies. To achieve GHz modulation bandwidth, travelling wave configurations are more convenient. Design and optimization of such structures require accurate microwave characterization of CPW in terms of phase velocity, characteristic impedance, and the attenuation. The appropriate analytical or numerical method for this purpose should take the finite metallization thickness and loss as well as the anisotropy of the substrates with high electro-optic sensitivities into account. Finite Element and Finite Difference Time Domain techniques require considerable amount of computational resources whereas the Method of Moment, although more numerically efficient, is not suitable for anisotropic media. Taking advantage of the uniformity of the structure in lateral directions (perpendicular to the lamination) we chose the Method Of Lines (MOL) [1] as an optimum approach to analyze this structure. Numerical stability, computational efficiency, and the possibility of the modeling of realistic geometries are the main advantages of this method compared to other techniques for our problem. An extension of this method to anisotropic dielectric waveguide has been described in 12l. In this work we apply this method to a thick CPW line on an anisotropic multilayer substrate.
Derived from text
Dielectric Waveguides; Planar Structures; Traveling Waves; Microwave Frequencies; Finite Difference Time Domain Method; Anisotropy

20050241913 King Fahd Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia
Modal Analysis of Multilayers Conductors in Multilayers Dielectric Strip Line
Hassan, Essam; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1484-1487; In English; See also 20050241839; Copyright; Avail.: Other Sources

The analysis of multiconductors strip line embedded in a multilayer dielectric media has received considerable attention due to their use in different microwave integrated circuits. Most of the work done in this area is based on the Quasi-TEM analysis employing Green's function or field modal expansion and a suitable numerical technique such as the moment method or the finite element method [1-6]. This obtains an approximate solution to the strip line parameters such as the characteristic impedance and the propagation constant valid only at low frequencies. To the best of this author's knowledge, no complete modal analysis for all hybrid modes valid for all frequencies for the multilayer conductors in multilayer dielectric strip line has been published. It is the objective of this paper to present a general technique which could apply to various types of structures both symmetric and non-symmetric. Further, the technique could also determine the field distribution within the structure which allows for the determination of the characteristic impedance for quite a large number of different microstrip lines structures. The technique is based on employing the reciprocity theorem for traveling waves inside the strip line and have been used earlier [7] in solving a similar problem which was limited to a single layer of conductors. The expression used is variational with respect to the propagation constant , and upon the application of the Rayleigh-Ritz optimization technique, both the propagation constant and the fields components are readily obtained to a high degree of confidence. In the following, a short account of the technique is given followed by presenting some of the results obtained compared to corresponding published data.
Derived from text
Microstrip Transmission Lines; Conductors; Integrated Circuits; Traveling Waves; Microwave Circuits; Method of Moments; Electrical Impedance; Dielectrics

20050241914 Illinois Univ., Urbana, IL, USA

An Efficient Iterative Solver for the Modes in a Dielectric Waveguide

Radhakhisnan, Kaladhar; Chew, Weng Cho; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1492-1495; In English; See also 20050241839

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In recent years, advances in optical waveguide technology have spurred the need for numerical algorithms for the modal analysis of dielectric waveguides. Dielectric waveguides used in integrated optics consist primarily of rectangular dielectric cores. Since waveguides of rectangular cross-section have no closed form solution, the eigenmodes of the waveguide have to be found numerically, Several numerical methods are available to solve for the modes of dielectric waveguides. They were first analyzed using the mode-matching technique [1] Goell [2] analyzed the same problem by expanding the field using circular harmonics. Marcatili [3] tried approximate analysis of rectangular waveguides by assuming a simple field distribution. More recently, with the increase in tide computational power, finite-element [4] and finite-difference [5] techniques have become popular. In this paper, the finite difference method is used to formulate the problem using the transverse field components, to ensure the absence of spurious modes. The resulting eigenvalue problem is solved using the Bi-Lanczos algorithm [6]. Once the governing matrix is reduced to a tri-diagonal matrix, two methods are available to obtain the desired eigenpairs. The first method solves for all the eigenpairs of the tridiagonal matrix. The memory requirements for thin method ii O(N(sup 1.5). 'the second method solves for just the first few dominant modes in the waveguide but the memory requirement scales as O(N). The computational complexity for both methods is O(N(sup 1.5).

Derived from text

Approximation; Dielectric Waveguides; Rectangular Waveguides

20050241915 New Mexico State Univ., Las Cruces, NM, USA

The 2.5D Pseudospectral Time-Domain (PSTD) Algorithm With PML Absorbing Boundary Condition

Tang, Zi Bin; Liu, Qing Huo; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1496-1499; In English; See also 20050241839

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In many applications, such as geophysical subsurface sensing, microwave and optical waveguides, one can reduce three-dimensional problems into 2.5-dimensional ones because the inhomogeneity is two-dimensional and one of the spatial derivatives in Maxwell's equation can be simplified by using the Fourier transform. Most previous 2.5-D algorithms [e.g., 1, 2] were based on the FDTD method and used non-PML absorbing boundary condition. Very recently, the pseudospectral time-domain (PSTD) method [3, 4] has been proposed for multidimensional problem. The key point of PSTD method is that it uses the fast Fourier transform (FFT) other than finite differences to calculate spatial derivatives and uses Berenger's perfectly matched layers [5] to remove wraparound effect caused by the periodicity assumed in the FFT. In this work we use the PSTD method to solve 2.5-dimensional problems. The theoretical analysis and numerical examples are presented.

Derived from text

Finite Difference Time Domain Method; Boundary Conditions; Geophysics; Optical Waveguides; Periodic Variations; Spectral Methods; Algorithms

20050241916 Manitoba Univ., Winnipeg, Manitoba, Canada

Performances of Projection Iterative Method on Electromagnetic Scattering by Spheres

Ye, Qiubo; Shafai, L.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1526-1529; In English; See also 20050241839; Copyright; Avail.: Other Sources

In order to solve large electromagnetic scattering problems with less computer memory and less executive time, some iterative based numerical methods have been sought for the matrix equation obtained by the Method of Moment (MOM). Basic iterative techniques, such as, Jacobi, Gauss-Seidel, and Successive Overrelaxation Iterative methods, usually can not result in a convergent solution. A Progressive Numerical Method (PNM), which is based on the spatial decomposition of the scatterer and incorporated with the iterative procedure, can yield accurate solution only for two-dimensional case. The Spatial Decomposition Technique (SDT) faces the similar difficulty as the PNM. Conjugate Gradient Method (CGM) is widely used, but its numerical instability sometimes slows down the convergent rate. This becomes a severe problem especially when the matrix is ill-posed. A Projection Iterative Method (PIM) is a convenient guaranteed method which is not widely introduced and applied in electromagnetics. In this method, the solution is improved by means of an orthographic projection procedure. The decomposition technique is that the unknowns are not decomposed in space. A series of sub-equations defined on subdomains are solved in each iterative step. The computer memory is much less than that of the direct method for the original

equation when the sub-equation size is small. Therefore it is potentially applicable to the large electromagnetic problems.
Derived from text
Electromagnetic Scattering; Conjugate Gradient Method; Iterative Solution; Decomposition; Convergence; Spheres

20050241917 New Mexico State Univ., Las Cruces, NM, USA
Dyadic Green's Functions for Curved Waveguides and Cavities and Their Reformulation
Guo-Xin, Fan; Qing Huo, Liu; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1504-1507; In English; See also 20050241839; Copyright; Avail.: Other Sources

Continuously curved waveguides are used not only for waveguide bends but also for fielding or radiating guides for cylindrical conformal slot arrays [1]. In solving the curved waveguide junction problems and the coupling slot and radiating slot problems, one often uses the dyadic Green's functions (DGFs) for curved waveguides and cavities. Although many expressions of DGFs have been derived for various straight waveguides and cavities, no expressions of DGFs for curved waveguides and cavities are available. The difficulty is in that there only exist the longitudinal-section electric modes (LSE) and longitudinal-section magnetic modes (LSM) in curved waveguides. But these two kinds of modes do not have the complete orthogonality in the terms of the dot product. Therefore, the usual Ohm- Rayleigh method in not applicable to the curved waveguides problems. Moreover, unlike common rectangular wave;guides, the complete expression of DGFs for curved guides cannot be constructed from the potential DGFs. On the other hand, when applied to boundary integral equations, the usual expressions of the DGFs is not convenient for numerical computation because of their higher singularity and discontinuity. In this paper, the DGFs for curved waveguides and cavities are constructed by the fields excited by a unit electric or magnetic source. The field expressions are derived with the help of the Lorentz reciprocity theorem and the mode orthogonality, and by adding the source-point term. The common form of DGFs is reformulated into a form convenient for numerical computation. Finally, a general procedure for reformulation of DGFs for waveguides in proposed.
Derived from text
Green's Functions; Boundary Integral Method; Computation; Cylindrical Bodies; Discontinuity; Integral Equations

20050241918 Universidad de Cantabria, Santander, Spain
EXTENSION of A CG-FFT BOR FORMULATION to MODEL SLOTS IN CIRCULAR WAVEGUIDE ANTENNAS
Piedra, S.; Basterrechea, J.; Catedra, M. F.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1514-1517; In English; See also 20050241839; Copyright; Avail.: Other Sources

CG-FFT method is presented which allows the analysis of antennas with symmetry of revolution with slots in their waveguide walls. Results are successfully compared with measurements and demonstrates the need of including an appropriate model of slots and wall thickness when open ended waveguides are considered.
Author
Dipole Antennas; Fast Fourier Transformations; Conjugate Gradient Method; Waveguide Antennas; Symmetry; Walls

20050241921 Ohio State Univ., Columbus, OH, USA
Control of Surface Waves in Planar Printed Antennas
Rojas, R. G.; Lee, K. W.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1566-1573; In English; See also 20050241839
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Printed antennas such as the microstrip antenna have become popular because of their low-cost, low weight, low profile, conformability, and ease of manufacture [1]. However, they also have some negative characteristics such as low power capacity and narrow bandwidth. Furthermore, the dielectric substrate can support guided waves (surface waves) which can become stronger when the thickness of the substrate is large. These surface waves contribute to the mutual coupling between printed antennas on the same substrate and can reach the edges of the substrate and radiate to free-space. The radiated surface-wave will contribute, often in a negative way, to the radiation pattern of the antenna along the main beam and back-lobe directions, as well in the direction of the substrate surface where it is stronger.
Derived from text
Microstrip Antennas; Control Surfaces; Surface Waves; Antenna Radiation Patterns; Bandwidth; Dielectrics; Substrates

20050241922 Siena Univ., Italy

EQUIVALENT NETWORK FOR A SLOT-COUPLED ELLIPTICAL INTEGRATED LENS ANTENNA

Neto, A.; Borselli, L.; Maci, S.; DeMaagi, P. J. I.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1590-1593; In English; See also 20050241839; Copyright; Avail.: Other Sources

In this paper, a method is presented for the design and the analysis of a. dielectric elliptical lens antenna slot fed by a microstrip. The elliptical shape of the lens gives a focusing property provided that the eccentricity is properly related to the dielectric constant. In particular, under this condition, all the rays outgoing from the source are refracted in the boresight direction, thus providing the focusing phenomenon. On the other hand the lens interface gives rise to reflections. Indeed, as pointed out in [3], the geometrical properties of the lens itself are such that all the doubly reflected rays launched by a focal source return in phase at the original focus. In view of this property, the availability of tools for the accurate prediction of the input impedance of the antenna including multiple reflections effects is particularly important owing to the limited tuning possibilities intrinsic with integrated technology. Regarding the feed arrangement, we propose the same as that typically used in patch antenna [4], namely a slot which is excited by a microstrip printed on a back substrate. This structure presents several advantages, primarily due to the physical separation between the radiating elements sad the feeding network. Furthermore, with respect to alternative slot feed arrangement such as coplanar waveguides (CPW) the present solution provides radiation pattern regularity and polarization purity, which are important features in quasi-optical receiver front-ends [1-2].

Derived from text

Dielectrics; Design Analysis; Antenna Radiation Patterns; Lens Antennas; Slot Antennas; Reflected Waves; Planar Structures; Lenses; Eccentricity

20050241923 Illinois Univ., Urbana, IL, USA

An Improved Fast Steepest Descent Path Algorithm

Bin, Hu; Weng, Cho Chew; Michielssen, Eric; Junsheng, Zhao; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1542-1545; In English; See also 20050241839; Copyright; Avail.: Other Sources

Recently, a number of techniques have been proposed which permit fast matrix-vector multiplications of matrices which arise in the method of moments (MoM) solution of very large scattering problems. The Fast Steepest Descent Path Algorithm (FASDPA), proposed by Michielssen and Chew [1], is only one of them. The basic ideas of this algorithm are similar to those of the well-known Fast Multipole Method (FMM), which relies on a multilevel geometrical partitioning of the scatterer and an expansion of scattered fields in terms of plane waves. In this paper, we propose a modified FASDPA, which, unlike the original FASDPA, directly interpolates the far-field pattern of the source group and match it along a modified steepest descent path. The cost of a standard MoM matrix-vector multiplication for an N unknown problem scales as O(N(sup 2)). A two-level application of the improved FASDPA reduces this cost to O(N(sup 4/3)), and, in a multi-level implementation, the cost is O(NlogN). It is shown that the modified FASDPA is more efficient than the previously developed FMM and RPFMA.

Derived from text

Algorithms; Method of Moments; Far Fields; Plane Waves; Scattering; Vectors (Mathematics); Descent

20050241924 United Arab Emirates Univ., Al-Ain, United Arab Emirates

Efficient Analysis of a U-Slot Patch Antenna using Contour Integral Method with Complex Images

Omar, Amjad A.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1602-1605; In English; See also 20050241839; Copyright; Avail.: Other Sources

This paper attempts to analyze a general shaped patch antenna excited using either probe feed or microstrip feed (Fig.1). The technique used is a combination of the 2-D contour integral method and the 3-D complex image method. This technique has been successfully applied for microstrip fed patch antennas (without slot) of arbitrary shape [4]. The method used is highly convergent because it performs only a 2-D discretization of the contour (peripheral) of the patch and not a 3-D discretization of the patch itself. It is also accurate because it includes the effect of the fringe field at the edges of the patch through the 3-D complex images, the method is also versatile in the sense that it can solve arbitrarily shaped patch antennas with any slot shape. The contour integral method with complex images in [4] is extended here to include the effect of a U-slot etched on the surface of the patch. The performance of the antenna with different patch shapes, slot sizes, locations and orientations will be investigated.

Derived from text

Microstrip Antennas; Contours; Etching; Slot Antennas; Slots; Edges

20050241925 Illinois Univ., Urbana, IL, USA

Approximate Inverse Preconditioner for Near Resonant Scattering Problems

Ahn, C. H.; Chew, W.C.; Zhao, J.S.; Michielssen, E.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1546-1549; In English; See also 20050241839; Copyright; Avail.: Other Sources

To solve the method of moments (MOM) matrix equation, iterative methods are becoming popular as a solution technique for such problems. These methods require one or two matrix-vector multiplications per iteration. To speed up the matrix-vector multiplications in the iterative solvers, the fast multipole method (FMM) [1] and its multilevel extension, multilevel fast multipole algorithm (MLFMA) [2] are developed to obtain fast solution for scattering problems. But they are more advantageous if the number of iterations for convergence is much smaller than the number of unknowns. However, for strongly resonant problem and/or strong multiple reflection problems, these methods require a very large number of iterations for convergence. In this paper, to account for these near interactions, the approximate inverse of the block banded coefficient matrix is introduced as a preconditioner [3],[4]. By means of the matrix partitioning method, the computing time requited to set up this preconditioner is O(N), which is indispensable for applying to O(N log N) fast algorithms.

Derived from text

Multipoles; Iterative Solution; Scattering; Vectors (Mathematics); Convergence; Coefficients; Method of Moments

20050241926 Politecnico di Turin, Turin, Italy

FUNCTIONAL METHODS IN the STUDY of DIFFRACTION BY PENETRABLE THICK HALF-PLANES and WEDGES

Daniele, Vito G.; Uslenghi, Piergiorgio L. E.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1552; In English; See also 20050241839; Copyright; Avail.: Other Sources

In this work, we apply the first technique to the scattering by a thick half-plane made of isorefractive material. An analytical solution is obtained by solving modified Wiener-Hupf equations. In the case of infinite thickness, one has a right-angle isorefractive wedge, and the solution is obtained in closed form by factorization.

Derived from text

Half Planes; Diffraction; Wedges; Factorization

20050241928 Pisa Univ., Italy

EM Scattering by a Interior Right-Angled Anisotropic Impedance Wedge Illuminated at Oblique Incidence

Manara, G.; Nepa, P.; Pelosi, G.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1553-1556; In English; See also 20050241839; Copyright; Avail.: Other Sources

The impedance boundary condition (IBC) constitutes a very useful approximation for many physical problems since it allows us to account for material effects without involving the fields within the material [1] Despite the simplifications introduced by IBCs, rigorous solutions for plane wave scattering by non-perfectly conducting wedges illuminated at oblique incidence have been derived only for some specific geometrical and electrical wedge configurations [1, Ch. 4], [2]. Among unsolved cases, a configuration of remarkable importance for applications is that of an interior right-angled wedge, characterized by tensor surface impedance faces with their principal anisotropy axes parallel and perpendicular to the edge. It has been shown [3] that, when the tensor surface impedances on both wedge faces satisfy the compatibility relation introduced by Dybdal et al. in [4], the exact solution of the above problem can be written in terms of just Geometrical Optics (GO) contributions. It is worth observing that the work in [4] is relevant to the analysis of propagation in a rectangular waveguide with anisotropic impedance walls. The aim of this paper is to derive an approximate analytical solution for skew incidence scattering from an interior right-angled anisotropic impedance wedge. This is obtained by resorting to a perturbation

Derived from text

Boundary Conditions; Approximation; Wave Scattering; Plane Waves; Surface Properties; Electrical Impedance; Rectangular Waveguides

20050241929 Polytechnic Univ., Farmingdale, NY, USA, Sikorsky Aircraft, Stratford, CT, USA

Analytical Extraction of Mutual Coupling in Spectral-Domain Modeling of Planar Elements

McCabe, Brian L.; Das, Nirod K.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas:

Gateways to the Global Network, Volume 3; [1998], pp. 1578-1581; In English; See also 20050241839; Copyright; Avail.: Other Sources

The spectral-domain moment method approach is commonly used for analysis of microstrip antennas and arrays [1,2]. However, the method is not efficient for computation of mutual coupling in electrically large structures, due to poor convergence of the resulting Fourier integrals as the separation between elements increases. In this paper, we present closed-form asymptotic expressions for mutual coupling between two elements that are shown to be valid for relatively close distances. The method consists of analytically extracting contributions from the critical points (stationary-phase points, simple Pole singularities, or combinations) of the spectral integrals that account for coupling due to space waves as well as surface waves. Depending on the particular geometry involved, different levels of accuracy can be achieved by using specialized techniques. It may be noted that in addition to simplifying mutual coupling calculations, the method can be extended to other problems of practical interest involving non-planar surroundings, by employing a hybrid ray-tracing moment method technique [3]. Results are presented for several planar structures to demonstrate the validity of the method.
Derived from text
Microstrip Antennas; Antenna Arrays; Method of Moments; Planar Structures; Extraction; Asymptotic Series; Surface Waves

20050241934 Hongik Univ., Seoul, Korea, Republic of
Simulation and Measurement of Microwave Propagation in a Simple Urban Area
Oh, Yisok; Koo, Yeon-Geon; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. --; In English; See also 20050241839
Contract(s)/Grant(s): 96-186-RT-12; Copyright; Avail.: Other Sources

As the demands for wireless mobile communication services were rapidly increasing. commercial personal communication serviccs(PCS) were started in recent years In order to design an appropriate cell structure in urban area for the PCS system, the characteristics of microwave propagation in urban area should he analyzed accurately In earlier papers for this purpose, a ray tracing technique with the uniform theory of diffraclion(UTD) has been usually employed to compute wave path loss approximately. The simulated results of the ray tracing technique have been compared with experimental data measured in real streets, for example, in Kyoto[1] and in New York and Tokyo[2,3]. However, because of the complex wall structures, those comparisons are based on arbitrary values for the dielectric constant and conductivity (or complex permittivity) of ground and wall surfaces, which were chosen for best data-fit. In this work, a down-scaled simple urban structure was constructed using concrete bricks, and the path losses between a transmitter and a receiver at various line-of-sight(LOS) and out-of-sight(OOS) positions were measured using a signal generator, an amplifier, a spectrum analyzer and two dipole antennas, The complex permittivities of concrete walls and ground measured accurately by a ring-resonator-type dielectric probe. The measured path losses are compared with the simulated results of the ray tracing technique, which include the effects of the antenna patterns and the surface roughness of the walls.
Derived from text
Antenna Radiation Patterns; Dipole Antennas; Transmitter Receivers; Ray Tracing; Permittivity; Spectrum Analysis; Dielectrics

20050241935 Southeast Univ., Nanjing, China
PROPAGATION PATH-LOSS PREDICATION FOR URBAN MICROCELLULAR PLANNING
Jin, Zhen Rong; Zhang, Wen Xun; Yung, Zheng Qing; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1660-1663; In English; See also 20050241839
Contract(s)/Grant(s): JNSF-BK95044503; Copyright; Avail.: Other Sources

In this paper, a large amount of field distribution data calculated by using the software developed in Southeast University[I] are utilized to summarize some conclusions: 1. On the main street where the transmitting antenna stands, the field distribution is mostly due to the effect of the direct incident ray. It is affected considerably by the width of the main street, but affected neglectfully by the distance from transmitting or receiving antenna to the wall and the width and position of every branch street if exists. 2. On the side street which intersects the main street, a yielding point exits where the path-loss slumps below -110dB behind it the field intensity is mostly due to the effect of the diffracted ray. 3. The position of the yielding point mainly depends on the distance from transmitting antenna to the side street; it is affected by the widths of both the main and side streets, and the distance from transmitting or receiving antenna to the wall. 4. The path-loss on the side street is affected by both the widths of the main and side sheets. 5. The additional path-loss caused by the crossed branch streets depends on the widths and positions of these streets. 6. The additional path-loss caused by parallel branch streets may be roughly approximated by only one branch street whose width is the sum of all branch widths . These data, produced by calculating with different positions of the transmitting and receiving antennas, different widths and locations of each street assumed, are

fitted for formulating a simple engineering model to predict the path-loss on main or side street. In the above calculation, the operation frequency of 2 GHz; the heights of 10m and 1.7m, respectively, for omnidirectional transmitting and receiving antennas with vertical polarization and 0dB gain; the relative permittivity of 15 and the conductivity of 2 S/m for both the ground and the walls are assumed.
Derived from text
Antenna Radiation Patterns; Diffraction; Field Strength; Omnidirectional Antennas; Permittivity; Losses

20050241937 ADVANTEST Labs. Ltd., Sendai, Japan
Visualization Technique of Radiowave Propagation Environments by Using a New Holography Method
Kitayoshi, Hitoshi; Sawaya, Kunio; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1680-1683; In English; See also 20050241839; Copyright; Avail.: Other Sources

A new method for evaluating radiowave propagation environments is proposed. The technique yields accurate estimation of 3-D scattering path by using dual-frequency holography method and amplitude compensation based on the exact Green's function. Some results of the computer simulation and the experiment are presented to demonstrate the validity and the accuracy of the proposed method.
Author
Radio Transmission; Holography; Radio Waves; Computerized Simulation; Green's Functions

20050241938 Ben Gurion Univ. of the Negev, Beersheva, Israel
PARAMETRIC MODEL of UHF/L-WAVE PROPAGATION IN CITY WITH RANDOMLY DISTRIBUTED BUILDINGS
Blaunstein, N.; Levin, M.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1684-1687; In English; See also 20050241839; Copyright; Avail.: Other Sources

Modern cities in the point of view of radio wave propagation are the complicated areas and the analytical description of this process cannot be presented without some simplifications for the concrete radio link situation. For UHF/L-band radio waves the most large city buildings practically are nontransparent and their sizes more larger than the wavelength, lambda. Moreover, in the cases when buildings are randomly distributed at the rough ground surface all specific properties of city topography form the specific conditions of wave propagation inside the street level. In t such situation of urban environment we cannot use well known deterministic models and must use the statistical description of the real building pattern inside the city and need to derive the field strength on its base. To obtain the statistical description of the city topography map, we need 8 detailed information about the spatial distribution of city buildings and natural obstacles, the sizes and ranges of reflected and diffracted surface sections of the ground relief and the spatial distribution of scattered points of each building placed in areas surrounding the receiver and transmitter antenna.
Derived from text
Ultrahigh Frequencies; Wave Propagation; Buildings; Radio Transmission; Radio Waves; Diffraction; Spatial Distribution

20050241941 Tokyo Inst. of Tech., Japan
Reflection-Canceling of Slotted Waveguide Antenna by Using a Circular Pit
Sato, Junji; Hirokawa, Jiro; Ando, Makoto; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1706-1709; In English; See also 20050241839; Copyright; Avail.: Other Sources

A slot cut on a metal waveguide produces scattered fields in the internal region as well as the external region. It causes reflection in the waveguides and deteriorates the VSWR of the antenna. In the TEM mode waveguide arrays, such as radial line slot antennas[ll and the parallel plate waveguide arraysl21 which are all oversized, the scattering causes fatal perturbation to desired TEM mode operation. So, the suppression or the control of the .scattering is a key technique in the slotted waveguide array design. There are two well known techniques to suppress overall reflections in slotted waveguide arrays. One is to set the slot spacing different from half the guide wavelength so that the reflection from slots effectively cancels with each other at the I II. This technique is widely used in rectangular waveguide arrays. The main beam is slightly tilted to this end. The other technique is to place an additional element to cancel reflection from the original slot[sakakibara]. This can also be applied for the TEM mode waveguide arrays', a reflection-canceling slot set used in a linearly polarized radial line slot antenna[3] and a slot pair in the parallel plate waveguide array are the examples. One slot set in the former consists of four

slots that is two original and two additional slots. The beam tilting or the additional slot technique stated above generally results in the restriction in the antenna design; the realization of normal boresite beam is difficult and the dense slot arrangement including additional ones necessitates the careful assessment of the strong mutual slot coupling in the design. This paper proposes a novel technique to cancel the reflection by placing a pit on the bottom of a waveguide. Only the original slots exist on the aperture and the pit is in the waveguide. So the radiation pattern design by the slots and the pit design for reflection cancelling can he conducted independently. We design a circular pit for a transverse slot in a rectangular waveguide. The analysis and design are validated by experiments. These results are applicable for parallel plates such as radial line as well.
Derived from text
Rectangular Waveguides; Standing Wave Ratios; Waveguide Antennas; Antenna Radiation Patterns; Parallel Plates; Slot Antennas; Slots

20050241942 Ben Gurion Univ. of the Negev, Israel
WAVE PATTERN of A BURIED LEAKY COAXIAL CABLE IN A GUIDING RADAR SYSTEM
Blaunshiein, N.; Dank, Z.; Zilbershtein, M.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1714-1717; In English; See also 20050241839; Copyright; Avail.: Other Sources

During the recent decades, leaky coaxial cables are generating increasing interest as a tools of intrusion detection in guided radar systems [1-3]. As it is known, a buried leaky coaxial cable can support two TEM-like modes [4-7]. The first, internal mode, is the perturbed transmission line mode which has the main part of its energy confined under the cable shield but with some leakage outside it. The second mode is the external mode which uses the cable shield and the earth as conductors. Such construction enables the signals to be coupled into immediately adjacent objects and the temporal variations of these signals can be used in the intrusion detection systems. The radiation properties of leaky coaxial cables were investigated in a number of works, see e.g. a review in [4], but in most of them, with exception of [2,3], only the open installation of the cable was considered. At the same time, it is known that the radiation pattern of the buried cable differs essentially from that in the open installation. This is caused mainly by the losses in the earth, inhomogeneities, and the presence of the earth-air interface. In such situation the exact theoretical analysis of, the radiation properties of the cable is very complicated. That is why in this work we report some results of experimental investigations of the near field radiation pattern.
Derived from text
Antenna Radiation Patterns; Coaxial Cables; Radar Detection; Warning Systems; Leakage; Temporal Distribution

20050241945 Tsukuba Univ., Japan
Characterisation of Probe-Fed Dielectric Resonator between Parallel Grounded Plates
Chen, Z. N.; Leung, K. W.; Luk, K. M.; Yung, E. K. N.; Hirasawa, K.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1730-1734; In English; See also 20050241839; Copyright; Avail.: Other Sources

To many engineering applications, using a probe as a feed is a simple and practical mean. For example, a probe can be easily used to excite the fields in a waveguide or to adapt a coaxial line to a waveguide or to feed a cavity antenna, etc. As an important feature, the characterisation of a probe radiating in a parallel plate waveguide has been analysed[1,2]. Instead of bare conducting probe, the probe with thin dielectric coat has been studied [3-6]. As one knows, a dielectric resonator (DR) can be considered as a good radiator operating in the free space. Recently, many kinds of DR antennas have been investigated theoretically and experimentally[7]. At meanwhile, as an resonator, a cy!indfica! homogeneous dielectric short-circuited at both ends by parallel grounded planes has been discussed well[8]. However, the consideration of the feature, that a probe-fed dielectric resonator is short-circuited at its both ends by two parallel conducting plates, has not been conducted. In this Summary, the characterisation of this structure is investigated experimentally and theoretically. The cylindrical mode matching method (MMM) is applied to find the input impedance of this structure[9,10]. The trapped and leaky modes of the resonator are considered. The study shows that as expected, the consideration of the effect of a probe length on the characteristics of a resonator is very important and necessary. Tim effect of DR dielectric constant and DR radius/height ratio on the input impedance are studied as well.
Derived from text
Resonators; Parallel Plates; Waveguides; Cylindrical Bodies; Dielectrics; Impedance

20050241946 Texas Univ., Austin, TX, USA

Application of Adaptive Wavelet Packet Basis to Solving Electromagnetic Integral Equations

Deng, Hai; Ling, Hao; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1740-1743; In English; See also 20050241839

Contract(s)/Grant(s): F49620-95-C-0045; F49620-96-1-0025; Copyright; Avail.: Other Sources

Moment method is a standard technique to calculate the induced current distribution on a scattering object by solving a linear matrix equation. However, the direct solution of the resulting dense matrix equations becomes prohibitively expensive for electrically large scatterers. Recently, wavelet-like basis has being used to sparsify the dense moment matrix, leading to reduced solution time for the resulting sparse system [1-6]. It has been found that the application of wavelet basis functions in electrodynamic problems can result in a very sparse moment matrix, but the number of above-threshold elements still grows nearly as O(N(sup 2)). As a result, the computational complexity of solving electromagnetic integral equations using wavelet basis is not reduced. In this work, we apply the adaptive wavelet packet transform (AWPT) to the sparsification of moment matrix. Instead of following the rigid decomposition structure in the conventional wavelet transform (CWT), we adaptively select the wavelet packet basis functions based on an additive cost function so that the sparsity of transformed moment matrix is maximized. Our numerical results show that the number of above-threshold elements grows at the rate of O(N(sup 1.4)) in the AWPT transformed moment matrices.

Derived from text

Integral Equations; Method of Moments; Wavelet Analysis; Linear Equations; Rigid Structures; Scattering

20050241947 Illinois Univ., Urbana, IL, USA

MLFMA for Solving Boundary Integral Equations of 2D Electromagnetic Scattering at Low Frequencies

Zhao, J. S.; Chew, W. C.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1762-1765; In English; See also 20050241839; Copyright; Avail.: Other Sources

The near- and far-field response of two-dimensional (2D) conducting cylinders have been extensively studied. An elegant and straightforward approach is to use the method of moments (MOM) numerical technique to solve the integral or integro-differential equation derived from Maxwell's equations where the current density or the charge density distribution are unknowns. MOM generates a system of linear equations corresponding to a full matrix. For a conventional matrix solution, the required computer storage is O(N(sup 2)), where N is the number of unknowns, and the number of floating-point operations is O(N(sup 3)) for Gaussian elimination method or O(N(sup 2)) per iteration for the plain conjugate gradient (CG) method. To expedite the matrix-vector multiplication, which is the most time-consuming part in the plain CG method, a fast multipole method (FMM) is developed. The FMM was first proposed for acoustic waves and then applied to electromagnetic scattering. Combining the FMM and multilevel method with interpolation and anterpolation, a more efficient method called the multilevel fast multipole algorithm (MLFMA) is developed [1] to further reduce the computational complexity to O(N log N).

Derived from text

Method of Moments; Multipoles; Algorithms; Boundary Integral Method; Conjugate Gradient Method; Electric Charge; Electromagnetic Scattering; Integral Equations

20050241949 Illinois Univ., Urbana-Champaign, IL, USA

Application of Adaptive Integral Method to Scattering and Radiation Analysis of Arbitrarily Shaped Planar Structures

Feng, Ling; Chao-Fu, Wang; Jian-Ming, Jin; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1778-1781; In English; See also 20050241839; Copyright; Avail.: Other Sources

The method of moments (MoM) is one of the most popular numerical methods for solving boundary-value problems in electromagnetics. For large-scale problems, the conjugate gradient (CG) method is preferred for solving the MoM matrix equation, which requires O(N (sup 2)) operations per iteration for the matrix-vector multiplication. To make the iterative method more efficient, it is necessary to speed up the matrix-vector multiplication. This is possible since integral describing the electromagnetic problems have a form of convolution. Therefore, when these equations are discretized on the uniform rectangular grids, the resulting matrix-vector product can be evaluated with the aid of the fast fourier transform (FFT). The resulting technique is usually called the CGFFT method [1]. However, modeling an arbitrary geometry with uniform rectangular grids necessitates a stair-case approximation, which makes the final solution inaccurate. This is often considered as the most serious drawback of the rectangular subdomain based CGFFT method. This drawback can be alleviated with the use of discretization based on Rao-Wilton-Glisson (RWG) functions [2]. However, in this case the FFT cannot be applied

directly to speed up the matrix-vector multiplication. One approach to accomplish it is to project the triangular subdomain basis functions onto a rectangular grid, then apply FFT to carry out the matrix-vector multiplication [3]. This approach is called the adaptive integral method (AIM). In this paper, we apply AIM to the scattering and radiation analysis of arbitrarily shaped planar structures in both the free space and the microstrip environment.
Derived from text
Fast Fourier Transformations; Conjugate Gradient Method; Boundary Value Problems; Computational Grids; Planar Structures; Scattering; Method of Moments; Electromagnetism

20050241952 Chinese Univ. of Hong Kong, Hong Kong
Optimization of a Center-slotted Active Patch Antenna
Lai, A. K. Y.; John H. H., Ng; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1632-1635; In English; See also 20050241839
Contract(s)/Grant(s): CUHK506/95E; Copyright; Avail.: Other Sources

This paper represents the optimization of a center-slotted active patch antenna. The antenna was optimized theoretically using an FDTD analysis of its near field standing wave pattern; and experimentally using its bias voltage, injection voltage, and component values to achieve a harmonic level of -20dBc, SSB phase noise level of -99 dBc/Hz at 10 KHz, sensitivity of -97 dBm and a gain of 4.5 dB. The transceiver has low component count with only two BJTs and one FET and is therefore well suited for low cost and low power application.
Author
Field Effect Transistors; Finite Difference Time Domain Method; Slot Antennas; Transmitter Receivers; Patch Antennas; Electric Potential

20050242990 Naval Postgraduate School, Monterey, CA USA
Design and Analysis of a Multicolor Quantum Well Infrared Photodetector
Alves, Fabio D. P.; Sep. 1, 2005; 117 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent military applications have demanded photodetectors with high sensitivity, high selectivity and multispectral capability for detection and identification of the target. These characteristics have been found in quantum well infrared photodetectors (QWIP). Driven by these applications, a QWIP photodetector capable of detecting simultaneously infrared emissions within near infrared (NIR), mid wavelength infrared (MWIR) and long wavelength infrared (LWIR) was studied, modeled, designed and characterized. Using the envelope function approximation, the mathematical model of the quantum phenomena in semiconductor heterostructures was derived. A computational tool was developed to solve self-consistently the Schodinger-Poisson equation using the shooting method, allowing the theoretical evaluation of the absorption coefficient. A three-color (NIR, MWIR and LWIR) GaAs-based QWIP sample and a two-color (NIR and MWIR) InP-based QWIP sample were designed, both comprised of stacks of uncoupled wells for each band detection. The 67 layers of the GaAs sample was grown using molecular beam epitaxy (MBE). Intersubband absorption in the sample was measured for the MWIR and LWIR using Fourier transform spectroscopy (FTIR) and the measured peak positions, found at 5.3 m , 8.7 m , and 13.8 m are within 0.3 m of the theoretical values, indicating that the model accurately predicts the absorption wavelengths. A twodimensional ordered grating pattern was selected and optimized separately for both MWIR and LWIR desired peaks. Finally the photodetector device configurations were designed to permit to the measurement of the NIR band through photocurrent spectroscopy and performance analysis. The fabrication and characterization of the prototypes are a matter for future work.
DTIC
Design Analysis; Infrared Detectors; Infrared Radiation; Photometers; Quantum Wells

20050243031 Naval Postgraduate School, Monterey, CA USA
Direct Imaging of Minority Charge Carrier Transport in Luminescent Semiconductors
Luber, David R.; Sep. 1, 2005; 74 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439465; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A quantitative method for extracting minority carrier diffusion and drift lengths is developed and demonstrated in a heavily-doped semiconductor heterostructure. This method advances the high resolution transport imaging technique yielding key material parameters with a single non-destructive measurement. This is the first demonstration of an SEM-based contact-free non-destructive technique for high-resolution minority carrier lifetime measurement. The measured values are in excellent agreement with theoretical calculations. The imaging transport technique is also employed to image the nature of the

generation region as a function of beam energy probe current and sample atomic number. These types of images should be useful to allow for experimental verification of resolution limits in CL and EBIC associated with interaction volume effects in bulk materials and can be obtained without additional sample preparation. Finally several suggestions for further research are offered including mapping of radiation damage in solar cells near-contact E field mapping and studies of low-dimensional structures such as superlattices and quantum wires. These nanoscale structures are poised to usher-in the next revolution in solid-state electronic devices.
DTIC
Carrier Mobility; Charge Carriers; Imaging Techniques; Luminescence; Minority Carriers; Semiconductors (Materials)

20050243037 Minnesota Univ., Minneapolis, MN USA
Scalable Partitioning Algorithms for FPGAs With Heterogeneous Resources
Selvakkumaran, Navaratnasothie; Ranjan, Abhishek; Raje, Salil; Karypis, George; Sep. 29, 2004; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439474; TR-04-037; No Copyright; Avail.: CASI: A03, Hardcopy

As FPGA densities increase, partitioning-based FPGA placement approaches are becoming increasingly important as they can be used to provide high-quality and computationally scalable placement solutions. However, modern FPGA architectures incorporate heterogeneous resources, which place additional requirements on the partitioning algorithms because they now need to not only minimize the cut and balance the partitions, but also they must ensure that none of the resources in each partition is over-subscribed. In this paper, we present a number of multilevel multiresource hypergraph partitioning algorithms that are guaranteed to produce solutions that balance the utilization of the different resources across the partitions. We evaluate our algorithms on twelve industrial benchmarks ranging in size from 5,236 to 140,118 cells and show that they achieve minimal degradation in the min-cut while balancing the various resources. Comparing the quality of the solution produced by some of our algorithms against that produced by hMETIS, we show that our algorithms are capable of balancing the different resources while incurring only a 3.3%-5.7% higher cut.
DTIC
Algorithms; Field-Programmable Gate Arrays; Heterogeneity; Pulse Rate; Resources; Scalers; Semiconductors (Materials)

20050243063 Maryland Univ., College Park, MD USA
Washout Filters in Feedback Control: Benefits, Limitations and Extensions
Hassouneh, Munther A.; Lee, Hsien-Chiarn; Abed, Eyad H.; Jan. 1, 2004; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439515; ISR-TR-2004-16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Advantages and limitations of washout filters in feedback control of both continuous-time and discrete time systems are discussed and generalizations that alleviate the limitations are presented. Some previously unpublished results in the Ph.D. dissertation of one of the authors (Lee, 1991) are presented in the context of their relation to the generalized results and to recent publications on delayed feedback control. We show that delayed feedback control (for discrete time systems) extensively used in control of chaos is a special case of washout filter-aided feedback. Moreover, the limitations of delayed feedback control can be overcome by the use of washout filter-aided feedback, which gives rise to the possibility of stabilizing a much larger class of systems.
DTIC
Control; Feedback; High Pass Filters

20050243127 California Inst. of Tech., Pasadena, CA USA
Fabrication and Characterization of Nano-Optic Devices
Scherer,; Apr. 1, 2001; 7 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0447
Report No.(s): AD-A439615; AFRL-SR-AR-TR-05-0484; No Copyright; Avail.: CASI: A02, Hardcopy

In this program, we have developed the ability to microfabricate optical devices with feature sizes significantly smaller than the wavelength of light, and use these to control light within very small geometries. Although structures with similar lateral dimensions have been made by electron beam lithography for over 20 years now, it has only recently become possible to transfer such patterns into semiconductors with a high enough quality to produce photonic nanostructures' in materials

systems with a large refractive index contrast. Through our improved processing capabilities, it is now possible to efficiently localize light and thereby miniaturize the lateral sizes of optical devices.
DTIC
Fabrication; Optical Equipment

20050243164 Naval Postgraduate School, Monterey, CA USA
Theory of Multirate Signal Processing with Application to Signal and Image Reconstruction
Scrofani, James W.; Sep. 1, 2005; 155 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439675; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Signal processing methods for signals sampled at different rates are investigated and applied to the problem of signal and image reconstruction or super-resolution reconstruction. The problem is approached from the viewpoint of linear mean-square estimation theory and multirate signal processing for one-and two-dimensional signals. A new look is taken at multirate system theory in one and two dimensions which provides the framework for these methodologies. A careful analysis of linear optimal filtering for problems involving different input and output sampling rates is conducted. This results in the development of index mapping techniques that simplify the formulation of Wiener-Hopf equations whose solution determine the optimal filters. The required filters exhibit periodicity in both one and two dimensions, due to the difference in sampling rates. The reconstruction algorithms developed are applied to one- and two-dimensional reconstruction problems.
DTIC
Image Reconstruction; Interpolation; Signal Processing

20050243228 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Using Multiple MEMS IMUs to form a Distributed Inertial Measurement Unit
Hanson, Rayn; Mar. 1, 2005; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439789; AFIT/GE/ENG/05-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

MEMS IMUs are readily available in quantity and have extraordinary advantages over conventional IMUs in size, weight, cost, and power consumption. However, the poor performance of MEMS IMUs limits their use in more demanding military applications. It is desired to use multiple distributed MEMS IMUs to simulate the performance of a single, more costly IMU, using the theory behind Gyro-Free IMUs. A Gyro-Free IMU (GF-IMU) uses a configuration of accelerometers only to measure the three accelerations and three angular rotations of a rigid body in 3-D space. Theoretically, almost any configuration of six distributed accelerometers yields sufficient measurements to solve for the translational and angular acceleration. In reality, however, sensor noise corrupts the measurements and good sensor geometry is necessary to obtain an accurate estimate of the translational and angular accelerations. Determining the optimal configuration of accelerometers is an exercise in geometry. This thesis investigates the optimal geometry of an INS constructed of multiple networked IMUs and develops the accompanying mechanization and error equations. Simple simulations are run to test and validate the basic design principles.
DTIC
Inertial Platforms; Microelectromechanical Systems

20050243236 Minnesota Univ., Minneapolis, MN USA
Multilevel Algorithms for Multi-Constraint Hypergraph Partitioning
Karypis, George; Nov. 11, 1999; 12 pp.; In English
Contract(s)/Grant(s): DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439813; TR-99-034; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Traditional hypergraph partitioning algorithms compute a bisection of a graph such that the number of hyperedges that are cut by the partitioning is minimized and each partition has an equal number of vertices. The task of minimizing the cut can be considered as the objective, and the requirement that the partitions will be of the same size can be considered as the constraint. In this paper, the author extends the partitioning problem by incorporating an arbitrary number of balancing constraints. In this formulation, a vector of weights is assigned to each vertex, and the goal is to produce a bisection such that the partitioning satisfies a balancing constraint associated with each weight, while attempting to minimize the cut. The author presents new multi-constraint hypergraph partitioning algorithms that are based on the multilevel partitioning paradigm. He experimentally evaluates the effectiveness of the multi-constraint partitioners on a variety of synthetically generated problems.
DTIC
Algorithms; Computer Aided Design; Computer Networks; Very Large Scale Integration

20050243239 Naval Postgraduate School, Monterey, CA USA

Performance Analysis of Variable Code Rate Signals Transmitted over Frequency-Nonselective, Slowly Fading Channels in a Pulse-Interference Environment

Shih, Wan-Chun; Sep. 1, 2005; 117 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439820; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wireless systems, including wireless local area networks (WLAN) and cellular networks, are increasingly being used for both commercial and military applications. For military applications, it is important to analyze the effect of interference on wireless communications systems. The objective of this research is to investigate the performance of variable code rate signals transmitted over frequency-nonselective, slowly fading channels in a worst case, pulse-noise interference environment. Both binary phase-shift keying (BPSK) and noncoherently detected binary frequency-shift keying (NCBFSK) are considered. System performance with both Viterbi hard decision decoding (HDD) and soft decision decoding (SDD) is analyzed for additive white Gaussian noise (AWGN) alone and for AWGN plus pulse-noise interference for various receiver types and conditions of channel fading. The effect of varying the code rate, both for HDD and SDD, is examined. The amplitude of the signal power a(exp 2)/(sub c) is modeled as a random variable, and the channel is modeled as either Rayleigh fading or Ricean fading, depending on the modulation under consideration.

DTIC

Fading; Frequencies; Phase Shift; Radio Frequency Interference; Reliability Analysis; Transmitters

20050243240 Maryland Univ., College Park, MD USA

A Model for a Thin Magnetostrictive Actuator

Venkataraman, R.; Krishnaprasad, P. S.; Jan. 1, 1998; 10 pp.; In English

Contract(s)/Grant(s): DAAL03-92-G0121; DAAG55-97-1-0114

Report No.(s): AD-A439822; CDCSS-TR-98-6; ISR-TR-98-37; No Copyright; Avail.: CASI: A02, Hardcopy

In this paper, the authors propose a model for dynamic magnetostrictive hysteresis in a thin rod actuator. They derive two equations that represent magnetic and mechanical dynamic equilibrium. The model results from an application of the energy balance principle. It is a dynamic model as it accounts for inertial effects and mechanical dissipation as the actuator deforms, and also eddy-current losses in the ferromagnetic material. The authors show that the model admits a periodic solution that is asymptotically stable when a periodic forcing function is applied.

DTIC

Actuators; Ferromagnetic Materials; Hysteresis; Magnetostriction; Rods

20050243358 Naval Postgraduate School, Monterey, CA USA

Thermomechanical Behavior of Monolithic SN-AG-CU Solder and Copper Fiber Reinforced Solders

Reuse, Rolando; Sep. 1, 2005; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439594; No Copyright; Avail.: CASI: A04, Hardcopy

Solder joints provide both electrical and mechanical interconnections between a silicon chip and the packaging substrate in an electronic application. The thermomechanical cycling in the solder causes numerous reliability challenges, mostly because of the mismatch of the coefficient of thermal expansion between the silicon chip and the substrate. The actual transition to lead-free solders and the trend towards hotter-running, miniaturized and higher current density chips aggravate this situation. Therefore, improved solder joints, with higher resistance to creep and low cycle fatigue, are necessary for future generations of microelectronics. This study focuses on a thermomechanical behavior comparison between monolithic Sn-Ag-Cu, copper fiber and copper ribbon cylindrical reinforced solders. The composite solders were found to reduce the inelastic strain range of the joint relative to monolithic solder, but at the expense of increased stress range.

DTIC

Copper; Fiber Composites; Reinforcing Fibers; Soldered Joints; Soldering; Solders; Thermodynamics

20050243403 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA

Fabrication and Testing of the SRF Cavities for the CEBAF 12 GeV Upgrade Prototype Cryomodule Renascence

Reece, C. E.; Daly, E. F.; Manning, S.; Manus, R.; Morgan, S.; May 2005; 8 pp.; In English

Report No.(s): DE2005-839555; No Copyright; Avail.: National Technical Information Service (NTIS)

Twelve seven-cell niobium cavities for the CEBAF 12 GeV upgrade prototype cryomodule Renascence have been fabricated at JLab and tested individually. This set includes four of the 'Low Loss' (LL) design and eight of the 'High Gradient' (HG) design. The fabrication strategy was an efficient mix of batch job-shop component machining and in-house

EBW, chemistry, and final-step machining to meet mechanical tolerances. Process highlights will be presented. The cavities have been tested at 2.07 K, the intended CEBAF operating temperature. Performance exceeded the tentative design requirement of 19.2 MV/m CW with less than 29 W dynamic heat dissipation. These results, as well as the HOM damping performance are presented.
NTIS
Fabrication; Prototypes; Superconducting Cavity Resonators; Linear Accelerators

20050243404 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Longitudinal Effective CSR Force for a Tilted Thin Bunch
Li, R.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840063; No Copyright; Avail.: National Technical Information Service (NTIS)

In the scheme of magnetic bunch compression, an electron bunch with linear energy chirp (energy-bunch length correlation), imposed by an upstream RF cavity, is sent to a magnetic chicane. The bunch length at the exit of the chicane can thus be manipulated via the pathlength-energy dependence due to chicane dispersion. As a linear energy-chirped bunch (delta-z correlation) being transported through a dispersive region (x-delta correlation), the bunch will have a linear horizontal-longitudinal (x-z) correlation in the configuration space (bunch tilt). Comparing to the case of a nontilted bunch, this x-z correlation modifies the geometry of particle interaction with respect to the direction of particle motion, which consequently modifies the retardation solution and the effective CSR forces. The simulation result of the CSR field for a tilted thin beam was presented earlier by Dohlus. In this paper, we first give an example of the bunch x-z correlation, or bunch tilt, in a bunch compression chicane. The effect of this x-z correlation on the retardation solution and the longitudinal effective force are then analyzed for a line bunch with linear energy chirp transported by design optics.
NTIS
Electrons; Magnetic Compression; Electron Bunching

20050243411 Florida Univ., Gainesville, FL, USA
Multifunctional (Nox/CO/02) Solid-State Sensors for Coal Combustion Control. (Report for September 30, 2003 to October 1, 2004)
Waschsman, E. D.; Mar. 21, 2005; 40 pp.; In English
Report No.(s): DE2005-840269; No Copyright; Avail.: National Technical Information Service (NTIS)

Sensing properties of a La(sub 2)CuO(sub 4)- and WO(sub 3)-based potentiometric NO(sub x) sensor were investigated both in N(sub 2) and in a simulated exhaust gas. We performed temperature programmed reaction (TPR) and desorption (TPD) experiments to determine the reaction and adsorption characteristics of O(sub 2), NO(sub x), CO, CO(sub 2), and their mixtures on the electrodes, and related the results to sensor performance. The relative responses of the La(sub 2)CuO(sub 4)-based sensor under varied concentrations of NO, NO(sub 2), CO, CO(sub 2) and O(sub 2) were studied.
NTIS
Combustion Control; Nitrogen Oxides; Solid State; Coal

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*.

20050240874 Lawrence Livermore National Lab., Livermore, CA USA
Pore Fluid Effects on Shear Modulus for Sandstones with Soft Anisotropy
Berryman, J. G.; Mar. 03, 2005; 16 pp.; In English
Report No.(s): DE2005-15014028; UCRL-PRCOC-203201; No Copyright; Avail.: Department of Energy Information Bridge

A general analysis of poroelasticity for vertical transverse isotropy (VTI) shows that four eigenvectors are pure shear modes with no coupling to the pore-fluid-mechanics. The remaining two eigenvectors are linear combinations of pure compression and uniaxial shear, both of which are coupled to the fluid mechanics. After reducing the problem to a 2x2 system, the analysis shows in a relatively elementary fashion how a poroelastic system with isotropic solid elastic frame, but with anisotropy introduced through the poroelastic coefficients, interacts with the mechanics of the pore fluid and produces shear dependence on fluid properties in the overall mechanical system. The analysis shows, for example, that this effect is always present (though sometimes small in magnitude) in the systems studied, and can be quite large (up to a definite maximum

increase of 20 per cent) in some rocks - including Spirit River sandstone and Schuler-Cotton Valley sandstone.
NTIS
Anisotropy; Isotropy; Modulus of Elasticity; Porosity; Rocks; Sandstones; Shear Properties

20050240882 Lawrence Livermore National Lab., Livermore, CA USA
Incompressible Ale Method for Fluid-Structure Interaction
Dunn, T. A.; Dec. 03, 2004; 34 pp.; In English
Report No.(s): DE2005-15011794; UCRL-CONF-208379; No Copyright; Avail.: National Technical Information Service (NTIS)

Multi-disciplinary analysis is becoming more and more important to tackle todays complex engineering problems. Therefore, computational tools must be able to handle the complex multi-physics requirements of these problems. A computer code may need to handle the physics associated with fluid dynamics, structural mechanics, heat transfer, chemistry, electro-magnetics, or a variety of other disciplines--all coupled in a highly non-linear system. The objective of this project was to couple an incompressible fluid dynamics package to a solid mechanics code. The code uses finite-element methods and is useful for three-dimensional transient problems with fluid-structure interaction. The code is designed for efficient performance on large multi-processor machines. An ALE finite element method was developed to investigate fluid-structure interaction. The write-up contains information about the method, the problem formulation, and some results from example test problems.
NTIS
Fluid Mechanics; Incompressible Fluids

20050240975 Lawrence Livermore National Lab., Livermore, CA USA
Fracture Permeability Evolution in Rock from the Desert Peak EGS Site
Carlson, S. R.; Roberts, J. J.; Detwiler, R. L.; Burton, E. A.; Robertson-Tait, A.; Mar. 03, 2005; 26 pp.; In English
Report No.(s): DE2005-15014075; UCRL-CONF-203528; No Copyright; Avail.: Department of Energy Information Bridge

Fluid flow experiments are being conducted on core specimens of quartz monzonite retrieved from depths of about 1 km at the Desert Peak East EGS site in Churchill County, Nevada. Our immediate goal is to observe permeability evolution in fractures at pressure and temperature conditions appropriate to the Desert Peak geothermal site. Longer term, we aim to evaluate mechanisms that control the evolution of fracture permeability. In the experiments saline water is flowed through an artificial fracture at a constant rate of 0.02 ml/min over a period of several weeks. The constant flow tests are interrupted at selected times for shorter tests in which flow is either stopped or varied between 0 and 2.0 ml/min. The experiments to date were conducted at a confining pressure of 5.5 MPa, pore pressures of 1.38 MPa or 2.07 MPa and temperatures of 167- 169 C. Measurements include differential pressure and electrical resistance across the specimen. The short-term variable flow rate experiments allow us to calculate the effective hydraulic aperture of the fracture at various times during the experiment. Changes in electrical resistivity provide indirect evidence of ongoing mineral dissolution and precipitation processes that are expected to change fracture permeability over time. The early experiments have shown that electrical resistivity rises during flow and falls during intervals in which flow is stopped.
NTIS
Deserts; Fluid Flow; Fracturing; Permeability; Quartz; Rocks

20050240985 Lawrence Livermore National Lab., Livermore, CA USA
Large Eddy Simulation of an Urban 2000 Experiment with Various Time-Dependent Forcing
Chan, S. T.; Leach, M. J.; Jun. 2004; 12 pp.; In English
Report No.(s): DE2005-15014305; UCRL-CONF-204806; No Copyright; Avail.: National Technical Information Service (NTIS)

Under the sponsorship of the U.S. DOE and DHS, we have developed a Computational Fluid Dynamics (CFD) model for simulating airflow and dispersion of chemical/biological agents released in the urban environment. Our model, FEM3MP, is based on solving the three-dimensional, time-dependent, incompressible Navier-Stokes equations on massively parallel computer platforms. The numerical algorithm uses the finite element method for accurate representation of complex building shapes and variable terrain, together with a semi-implicit projection method and modern iterative solvers for efficient time integration. Physical processes treated in our code include turbulence modeling via the RANS (Reynolds Averaged Navier-Stokes) and LES (Large Eddy Simulation) approaches, atmospheric stability, aerosols, UV radiation decay, surface energy budget, and vegetative canopies, etc.
NTIS
Cities; Large Eddy Simulation; Simulation; Time Dependence; Turbulent Flow; Vortices

20050242047 Lawrence Livermore National Lab., Livermore, CA USA
Dynamically Adaptive Arbitrary Lagrangian-Eulerian Method for Hydrodynamics
Anderson, R. W.; Elliott, N. S.; Pember, R. B.; Jan. 28, 2004; 20 pp.; In English
Report No.(s): DE2005-15013468; UCRL-PROC-202244; No Copyright; Avail.: National Technical Information Service (NTIS)

A new method that combines staggered grid Arbitrary Lagrangian-Eulerian (ALE) techniques with structured local adaptive mesh refinement (AMR) has been developed for solution of the Euler equations. The novel components of the combined ALE-AMR method hinge upon the integration of traditional AMR techniques with both staggered grid Lagrangian operators as well as elliptic relaxation operators on moving, deforming mesh hierarchies. Numerical examples demonstrate the utility of the method in performing detailed three- dimensional shock-driven instability calculations.
NTIS
Hydrodynamics; Lagrangian Function; Inertial Confinement Fusion; Deformation

20050242981 Naval Postgraduate School, Monterey, CA USA
Experimental and Computational Investigation of Flow in a Transonic Compressor Inlet
Brunner, Matthew D.; Sep. 1, 2005; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439357; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As part of an initial baseline survey of the inlet flow-field into a transonic compressor rotor, a five-hole probe was calibrated and used to determine the Mach number and inlet pitch angle distributions. The data for Mach number were compared to data obtained with a three-hole probe. A numerical investigation of the flow in the inlet ducting to the rotor was also initiated using the commercial code CFX marketed by ANSYS. Comparisons were also made between the numerical predictions and the experimental measurements. The purpose of the study was to more accurately determine the characteristics of the flow to the rotor of the compressor prior to steam-ingestion experiments to quantify effects on compressor stability.
DTIC
Computational Fluid Dynamics; Transonic Compressors

20050243176 Woods Hole Oceanographic Inst., MA USA
Parameterization of a Two-Phase Sheet Flow Model and Application to Nearshore Morphology
Elgar, Steve; Hsu, Tian-Jian; Hanes, Daniel M.; Nov. 1, 2005; 5 pp.; In English
Contract(s)/Grant(s): N00014-04-1-0217
Report No.(s): AD-A439701; No Copyright; Avail.: CASI: A01, Hardcopy

The overall objective is to develop and test with laboratory and field observations a model that predicts sediment transport and morphological change in the nearshore for a range of wave conditions and sediment characteristics. The specific objectives of this project were to: 1. parameterize the wave-induced bottom stress and sediment transport rate using a two-phase sheet flow model, 2. couple the sediment transport model with a time-domain Boussinesq hydrodynamic model to predict beach profile evolution, and 3. improve the two-phase sheet flow model by comparing its predictions with laboratory and field observations of sediment transport.
DTIC
Hydraulic Analogies; Morphology; Parameterization; Two Phase Flow

20050243179 Wayne State Univ., Detroit, MI USA
Simulation of High-Speed Cavity Flows in a Scramjet Engine by the Space-Time CESE Method
Yu, Shaeng-Tao J.; Kim, Chang-Kee; Zhang, Zeng-Chan; Sep. 1, 2005; 41 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0051
Report No.(s): AD-A439707; AFRL-SR-AR-TR-05-0481; No Copyright; Avail.: CASI: A03, Hardcopy

In this report we summarize numerical results of supersonic flows over open cavities in the setting of a dual-mode ramjet/scramjet engine. To calculate the unsteady cavity flows, we employ the Space-Time Conservation Element and Solution Element (CESE) method, a novel numerical method based on a unified treatment of space and time in calculating flux balance. Supersonic cavity flows with and without fuel injection are studied to understand the mechanisms of mixing enhancement and flame holding by cavities. Without injection, numerical results compared favorably with the experimental data for dominant frequencies and time-averaged pressure coefficients inside the cavities. With an upstream injection, the flow oscillations are drastically suppressed. In a downstream injection arrangement, cavity-generated acoustic waves and vortices greatly enhance

fuel/air mixing. Numerical results show that the CESE method provides high-fidelity numerical results of unsteady flows in the advanced scramjet engine concept.
DTIC
Cavities; Fluid Flow; High Speed; Simulation; Supersonic Combustion Ramjet Engines

20050243354 Naval Postgraduate School, Monterey, CA USA
Flow Field Surveys in a Transonic Compressor Prior to Inlet Steam Ingestion Tests
Villescas, Ivan; Sep. 1, 2005; 159 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439486; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Investigating the effect of steam ingestion into an aircraft jet engine is necessary to improve understanding of stall and surge in transonic axial compressors. Specifically, to understand the 'pop stall' phenomenon experienced by naval fighter jet aircraft during steam catapult launches. Steam leakage from an aircraft carrier catapult system can be ingested into the intake and cause stall or surge in a jet engine upon takeoff. It is important to understand the conditions under which this occurs as the Navy prepares for the fielding of the single engine F-35C, the aircraft carrier variant of the Joint Strike Fighter. This project prepares the structure and instrumentation to investigate the inlet distortion and effects of steam ingestion on a transonic axial compressor. A compressor test facility, including mechanical equipment, data acquisition system, and remote digital control system, was configured to test a transonic compressor rotor, similar to what will be used in the Joint Strike Fighter. Rotor inlet and exit velocity profiles were measured with a three-hole probe to obtain a set of baseline data before future experiments.
DTIC
Flow Distribution; Ingestion (Engines); Surveys; Transonic Compressors; Turbocompressors

20050243356 Naval Postgraduate School, Monterey, CA USA
Analysis of the Failure of a Vacuum Spin-Pit Drive Turbine Spindle Shaft
Pettitt, Jason M.; Sep. 1, 2005; 65 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439579; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Naval Postgraduate School's Rotor Spin Research Facility experienced a failure in the Spring of 2005 in which the rotor dropped from the drive turbine and caused extensive damage. A failure analysis of the drive turbine spindle shaft was conducted in order to determine the cause of failure: whether due to a material or design flaw. Also, a dynamic analysis was conducted in order to determine the natural modes present in the system and the associated frequencies that could have contributed to the failure of the shaft. It was concluded that the failure was due to low cycle fatigue, a possible stress concentration was identified, and a torsional mode was found near the speed at which failure occurred.
DTIC
Failure; Shafts (Machine Elements); Spindles; Stress Concentration; Turbines; Vacuum

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*.

20050242957 Lawrence Livermore National Lab., Livermore, CA USA
Large-Actuator-Number Horizontal Path Correction of Atmospheric Turbulence Utilizing an Interferometric Phase Conjugate Engine
Baker, K. L.; Stappaerts, E. A.; Gavel, D.; Tucker, J.; Silva, D. A.; Aug. 27, 2004; 16 pp.; In English
Report No.(s): DE2005-15014747; UCRL-PROC-206274; No Copyright; Avail.: Department of Energy Information Bridge

An adaptive optical system used to correct horizontal beam propagation paths has been demonstrated. This system utilizes an interferometric wave-front sensor and a large-actuator-number MEMS-based spatial light modulator to correct the aberrations incurred by the beam after propagation along the path. Horizontal path correction presents a severe challenge to adaptive optics systems due to the short atmospheric transverse coherence length and the high degree of scintillation incurred by laser propagation along these paths. Unlike wave-front sensors that detect phase gradients, however, the interferometric wave-front sensor measures the wrapped phase directly. Because the system operates with nearly monochromatic light and uses a segmented spatial light modulator, it does not require that the phase be unwrapped to provide a correction and it also does not require a global reconstruction of the wave-front to determine the phase as required by gradient detecting wave-front

sensors. As a result, issues with branch points are eliminated. Because the atmospheric probe beam is mixed with a large amplitude reference beam, it can be made to operate in a photon noise limited regime making its performance relatively unaffected by scintillation. The MEMS-based spatial light modulator in the system contains 1024 pixels and is controlled to speeds in excess of 800 Hz, enabling its use for correction of horizontal path beam propagation. In this article results are shown of both atmospheric characterization with the system and open loop horizontal path correction of a 1.53 micron laser by the system. To date Strehl ratios of greater than 0.5 have been achieved.
NTIS
Actuators; Adaptive Optics; Interferometry; Atmospheric Turbulence

20050242976 Naval Postgraduate School, Monterey, CA USA
Vegetation Identification With LIDAR
Helt, Michael F.; Sep. 1, 2005; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439337; No Copyright; Avail.: Defense Technical Information Center (DTIC)

LIDAR data taken over the Elkhorn Slough in Central California are analyzed for terrain. The specific terrain element of interest is vegetation, and in particular, tree type. Data taken on April 12th, 2005, were taken over a 10 km 20 km region which is mixed use agriculture and wetlands. Time return and intensity were obtained at ^2.5 m postings. Multi-spectral imagery from QuickBird was used from a 2002 imaging pass to guide analysis. Ground truth was combined with the orthorectified satellite imagery to determine regions of interest for areas with Eucalyptus, Scrub Oak, Live Oak, and Monterey Cyprus trees. LIDAR temporal returns could be used to distinguish regions with trees from cultivated and bare soil areas. Some tree types could be distinguished on the basis of the relationship between first/last extracted feature returns. The otherwise similar Eucalyptus and Monterey Cyprus could be distinguished by means of the intensity information from the imaging LIDAR. The combined intensity and temporal data allowed accurate distinction between the tree types, and task not otherwise practical with the satellite spectral imagery.
DTIC
Optical Radar; Trees (Plants); Vegetation

20050242982 Naval Postgraduate School, Monterey, CA USA
Theory of Multirate Statistical Signal Processing and Applications
Kuchler, Ryan J.; Sep. 1, 2005; 195 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439362; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This dissertation develops basic theory and applications of statistical multirate signal processing. Specific tools and terminology for describing multirate systems in the time and frequency domains are presented. An optimal multirate estimator is derived in both a direct form and recursive form. The Recursive form of the optimal estimator allows calculation of the relative change in performance when input signals are added or removed from the multirate system. The optimal multirate filtering problem also is specialized to the case of optimal multirate linear prediction. An efficient method for calculating the multirate linear prediction coefficients and error variances is developed through the use of the multichannel Levinson recursion and generalized triangular UL factorization. Finally, a multirate sequential classifier is derived and applied to the problem of target classification. It is shown that classifier parameters needed for implementing the multirate sequential classifier are the same as those for multirate linear prediction. The methods presented in this dissertation are useful for multisensor fusion particularly when the sensors are operating at different rates.
DTIC
Linear Systems; Signal Processing

20050243090 Naval Postgraduate School, Monterey, CA USA
Orbit Determination of Highly Eccentric Orbits using a RAVEN Telescope
Thrall, Michael L.; Sep. 1, 2005; 51 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439558; No Copyright; Avail.: CASI: A04, Hardcopy

For the past eight years, the small automated telescope Raven has been tested in detecting and tracking deep space objects. As the Raven has proven successful in tracking this regular and predictable orbit, its one arc-second accuracy made it a perfect candidate to attempt to accurately track the less predictable Highly Eccentric Orbit (HEO) objects. Ranging data was obtained from the Sirius satellite radio company for the Sirius3 satellite (Satellite Control Center (SCC) # 26626). This satellite was chosen for its long dwell time over the USA and for its favorable Raven tracking conditions. Angles-only data obtained from another Raven telescope located at the AMOS Remote Maui Experiment (RME) facility was used to track the satellite of

interest. Then the Analytical Graphics, Inc. Satellite Tool Kit Orbit Determination (STK/OD) program was used to compare the accuracy of the orbit prediction using ranging tracking data from Sirius and angles-only tracking data from Raven. This paper shows the improvement in orbit determination uncertainty obtained by adding Raven observations to the ranging data. The Raven angles data improved the orbit plane uncertainty and eccentricity estimate differences by over 80% when used with the range observations.
DTIC
Eccentric Orbits; Orbit Determination; Telescopes

20050243095 Naval Postgraduate School, Monterey, CA USA
Modeling Low Temperature C-V Profiling in Blocked Impurity Band Detectors
Tschanz, Steven J.; Sep. 1, 2005; 67 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439565; No Copyright; Avail.: CASI: A04, Hardcopy

Silicon Blocked Impurity Band (BIB) detectors are state-of-the-art devices to detect light in the near to mid infrared range (5-40 m). Numerical modeling of BIB detectors is performed using a four-region finite difference approach to study the role of space charge in C-V (capacitance-voltage) profiling of minority carrier doping and the role of blocking layer thickness and minority doping concentration in alternate bias operation. Compensation in the blocking layer is found to play a critical role in determining the net voltage drop in this part of the device under alternate polarity bias. The effect of space charge at the blocking layer/active layer interface on the measured low temperature C-V distribution is modeled as a function of the doping interface between the two layers. The magnitude of the space charge can cause large deviations in the measurement of minority doping concentration from the idealized case which assumes a space-charge free blocking layer and interface. Accurately determining these minority doping concentrations is a crucial step toward solving material growth challenges in proposed far infrared Ge and GaAs devices.
DTIC
Impurities; Infrared Detectors; Low Temperature

20050243173 Northwestern Univ., Chicago, IL USA
The Role of Mitochondria in the Detection of Infrared Light Sources by Mammalian Cells
Albrecht-Buehler, Guenter; Rea, Robert L.; Jul. 1, 2005; 15 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0395
Report No.(s): AD-A439696; AFRL-SR-AR-TR-05-0475; No Copyright; Avail.: CASI: A03, Hardcopy

With permission of the Program Director, Dr. Hugh DeLong and in cooperation with the DARPA programs 'Persistence in Combat (PIC)' and 'Regenesis' (Program Director: Cmdr. Dr. Kurt Henry) the emphasis was shifted to the detection and recording of near-infrared emissions of mammalian cells. The results warranted an immediate re-emphasis on the biological role of near-infrared detection by mammalian cells. During the past grant period we developed a novel and quantitative method to link the near-infrared light scattering of the cells to the distance from which a cell aggregate recruits its members. In short, it measures how far cell can see' each other in the following way. Each cellular aggregate forming on an isotropic, solid surface defines a circular area that marks the initial locations of its cells. The article uses a novel assay to measure the radius R(sub a) of this circle (range of aggregation') and shows in the case of 3T3 cells that it relates directly to the intensity l(sub SC) of their near-infrared light scattering. The results suggest that cells detect distant others by their scattered near-infrared light.
DTIC
Cells (Biology); Ear; Infrared Detectors; Infrared Radiation; Light Sources; Mammals; Mitochondria

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20050243021 Air Force Research Lab., Hanscom AFB, MA USA
Atmospheric Considerations in Engagement-Level Simulations of Tactical High-Energy Laser Systems
Jumper, G. Y.; Roadcap, J. R.; Adair, S. C.; Seeley, G. P.; Fairley, G.; Jan. 1, 2005; 20 pp.; In English
Contract(s)/Grant(s): Proj-2304
Report No.(s): AD-A439447; AFRL-VS-HA-TR-2005-1159; No Copyright; Avail.: CASI: A03, Hardcopy

The atmosphere can have a tremendous impact on tactical high-energy laser (HEL) systems. The variable nature of the atmosphere can produce highly variable performance. System designers need accurate environmental models to optimize the design of these systems. This paper reviews the atmospheric impact of various atmospheric phenomena on laser performance and the measurement and modeling efforts of the Air Force Research Laboratory. Two of these phenomena, optical turbulence and cloud obscuration, have been included in an engagement-level model, DEEST (Directed Energy Environmental Simulation Tool), to determine the optical performance of a tactical laser system. DEEST is described, and various aspects of the model are discussed for the benefit of those who will be modeling tactical HEL systems.
DTIC
High Power Lasers; Lasers; Optical Properties; Simulation

20050243198 Air Force Research Lab., Edwards AFB, CA USA
Recent Laser Propulsion Results from WSMR/HELSTF/PLVTS
Larson, Bill; May 1, 2005; 43 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A439731; No Copyright; Avail.: CASI: A03, Hardcopy

On our 31st trip to the laser facility at WSMR we carried out experiments on laser ablation of black and white Delrin ALSO CALLED POLYOXYMETHYLENE, POLYFORMALDEHYDE, (HCHO)x. Mass ablation and thrust generation (impulse) were accurately measured as a function of input laser energy in one shot experiments. The efficiency of conversion of laser energy to jet kinetic energy depended on the geometry of the energy absorption/conversion zone. The most ideal geometry, an axis symmetric mini thruster, produced ^60% conversion efficiency. The extensively studied 10-cm diameter lightcraft (with inverted paraboloid, plug nozzle geometry) produced ^50% conversion efficiency. The upper limit to energy conversion was computed with CEA code to be 73% for the well defined mini thruster geometry. Thus, total losses amount to ^13% and ^23%. This is significant finding and helps to validate the concept of 'momentum calorimetry', in which experiments like those accomplished here may be conducted to obtain reliable heats of formation. The performance of candidate chemically enhanced laser ablation or other solid propellants may be measured on a small scale. In these most recent experiments, a near-exact match of coupling coefficients (1%) was achieved in a 14-fold scale-down of the 10-cm Lightcraft to the mini thruster.
DTIC
Energy Absorption; Laser Propulsion

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20050241972 Michigan Technological Univ., Houghton, MI, USA
Ignition Improvement of Lean Natural Gas Mixtures: Final Report
Keith, J. M.; Feb. 2005; 132 pp.; In English
Report No.(s): DE2005-839567; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes work performed during a thirty month project which involves the production of dimethyl ether (DME) on-site for use as an ignition-improving additive in a compression-ignition natural gas engine. A single cylinder spark ignition engine was converted to compression ignition operation. The engine was then fully instrumented with a cylinder pressure transducer, crank shaft position sensor, airflow meter, natural gas mass flow sensor, and an exhaust temperature sensor. Finally, the engine was interfaced with a control system for pilot injection of DME. The engine testing is currently in progress. In addition, a one-pass process to form DME from natural gas was simulated with chemical processing software. Natural gas is reformed to synthesis gas (a mixture of hydrogen and carbon monoxide), converted into methanol, and finally to DME in three steps. Of additional benefit to the internal combustion engine, the offgas from the pilot process can be mixed with the main natural gas charge and is expected to improve engine performance. Furthermore, a one-pass pilot facility was constructed to produce 3.7 liters/hour (0.98 gallons/hour) DME from methanol in order to characterize the effluent DME solution and determine suitability for engine use. Successful production of DME led to an economic estimate of completing a full natural gas-to-DME pilot process. Additional experimental work in constructing a synthesis gas to methanol reactor is in progress. The overall recommendation from this work is that natural gas to DME is not a suitable pathway to improved

natural gas engine performance. The major reasons are difficulties in handling DME for pilot injection and the large capital costs associated with DME production from natural gas.
NTIS
Ethers; Ignition; Methyl Compounds; Natural Gas; Radicals

20050242045 Lawrence Livermore National Lab., Livermore, CA USA
HCCI Combustion: Analysis and Experiments
Aceves, S. M.; Flowers, D. L.; Martinzez-Frias, J.; Smith, J. R.; May 04, 2001; 14 pp.; In English
Report No.(s): DE2005-15013312; UCRL-JC-143788; No Copyright; Avail.: National Technical Information Service (NTIS)
Homogeneous charge compression ignition (HCCI) is a new combustion technology that may develop as an alternative to diesel engines with high efficiency and low nitrogen oxides and particulate matter emissions. This paper describes the HCCI research activities being currently pursued at Lawrence Livermore National Laboratory and at the University of California Berkeley. Current activities include analysis as well as experimental work.
NTIS
Combustion; Diesel Engines; Ignition; Natural Gas

20050243074 Naval Postgraduate School, Monterey, CA USA
Laser Velocimetric Flow Mapping and Characterization of Oil Mist Nozzles Used for Blade Excitation in High Cycle Fatigue Testing
Vonderheide, Christopher M.; Sep. 1, 2005; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439536; No Copyright; Avail.: CASI: A05, Hardcopy
The flow patterns of two oil mist nozzles used in rotor blade excitation experiments were flow mapped using a traversing Laser Doppler Velocimeter (LDV) system to determine the velocity and the overall characteristics were recorded photographically. The nozzles were operated in a vacuum test chamber and measurements were obtained at three different spray pressures, at three different axial distances from the nozzle exit. For a 4 gallon per hour (gph) 'mini-mist' nozzle, a 'referenced velocity' was defined which was found to be constant within a hollow cone, and the cone geometry and oil flow rate changed linearly with the oil supply pressure. A 6 gph 'standard' nozzle gave a solid cone, but only gave a pattern free of liquid streaks at low pressures. Oil temperature affected this behavior. The analytic quantification of the spray pattern can be used to design specific blade excitation experiments in high cycle fatigue (HCF) vacuum spin tests.
DTIC
Excitation; Fatigue Tests; Flow Distribution; Laser Doppler Velocimeters; Lasers; Mist; Nozzles; Oils

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*.

20050242961 Lawrence Livermore National Lab., Livermore, CA USA
Cryogenic Target Pylon Stability Working Group Preliminary Report
Debeling, A. G.; Sep. 20, 2004; 18 pp.; In English
Report No.(s): DE2005-15014806; UCRL-TR-206655; No Copyright; Avail.: National Technical Information Service (NTIS)
This preliminary report presents the findings of the Cryogenic Target Pylon Stability Working Group that was assembled to investigate the potential mounting schemes of the Cryogenic Target Pylon and develop a recommended baseline design to mount the pylon. To accomplish this objective the working group agreed that the following five tasks needed to be undertaken. (A) The first task was to construct a finite element model of the Cryogenic Target Pylon and Ignition Target Insertion Cryostat (I-TIC) to be incorporated into the NIF global finite element model. (B) The second task was to incorporate the five different proposed mounting schemes into the NIF global model. These different mounting schemes would then be analyzed to determine the deflection at the pylon tip when subjected to a random vibration spectrum applied at the base of the global model. The results of these five different pylon-mounting schemes would then be compared against each other to determine which design had the best stability characteristics. (C) The third task is not directly associated with the pylon mounting schemes. It involved measuring the force time history at the cryo-cooler mount location and applying this force time history to a stand-alone finite element model that depicts the best estimate of the cryogenic target pylon and I-TIC. (D) The fourth

task was to directly measure deflections at certain locations in the NIF facility and compare these deflections against deflections predicted by the NIF global model. (E) The fifth task of the working group was to investigate the use of a surrogate aluminum pylon to measure actual pylon deflections. The measured deflections would then be compared against the analytical results predicted by the NIF global model that incorporated a similar aluminum pylon. The aluminum surrogate pylon should have similar dimensions, weight and dynamic characteristics as that of the cryogenic target pylon with the I-TIC attached. This test would not only verify the global model results, but also provide confidence that the measured deflections would be similar to those of the actual cryogenic target pylon and I-TIC. Measured deflection of the surrogate pylon can also provide data needed to calculate translation and rotation stiffness at the target chamber support flange Port D62. This information will be incorporated into future finite element models.
NTIS
Cryogenics; Pylons; Stability

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20050243052 Naval Postgraduate School, Monterey, CA USA
Generating Enhanced Natural Environments and Terrain for Interactive Combat Simulations (GENETICS)
Wells, William D.; Sep. 1, 2005; 169 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439499; No Copyright; Avail.: CASI: A08, Hardcopy

Virtual battlefields devoid of vegetation deprive soldiers of valuable training in the critical aspects of terrain tactics and terrain-based situational awareness, but creating realistic landscapes by hand is notoriously expensive; requiring both proprietary tools and trained artists, hampering rapid scenario generation and limiting reuse. GENETICS is a new object placement scheme where the arduous task of placing vegetation objects is reduced to finding readily-available source data and setting a few parameters. Our approach constructs large-scale natural environments at run-time using a procedural image-based algorithm without the need for skilled artists or proprietary tools. The resulting vegetation-laden terrain looks realistic, and the algorithm can be extended to incorporate a wide variety of environmental factors. GENETICS offers researchers the ability to quickly and easily build consistent large-scale synthetic natural environments to examine vegetation clutter requirements necessary to accomplish distributed mission training tasks. This dissertation presents and implements the GENETICS algorithm, compares it against other vegetation placement schemes, and outlines how simulationists can use GENETICS to quickly and cheaply build large-scale natural environments. It also touches upon level of detail algorithms, ecotype modeling and how GENETICS can be used to generate land cover data where none exists.
DTIC
Combat; Genetics; Simulation; Terrain

20050243073 Naval Postgraduate School, Monterey, CA USA
Optimizing the Long-Term Capacity Expansion and Protection of Iraqi Oil Infrastructure
Brown, Patrick S.; Sep. 1, 2005; 139 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439532; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis introduces a tri-level defender-attacker-defender optimization model that prescribes how Iraq's oil infrastructure can, over time, be expanded, protected, and operated, even in the face of insurgent attacks. The outer-most defender model is a mixed-integer program that, given a set of anticipated insurgent attacks, specifies a quarterly capital expansion, defense, and operation plan to maximize oil exports over a decade-long planning horizon. The intermediate attacker model, observing the outer defender plans, is a mixed integer program that re-optimizes insurgent attacks to minimize export flow. The inner-most defender model is a linear program that redirects flow in response to insurgent damage. The author uses open-source descriptions of current Iraqi oil infrastructure and reasonable estimates of the costs to expand capacity and/or defend operating assets, and reduce vulnerability to attacks. He solves this tri-level model by converting it into an equivalent bi-level one, and applying decomposition. For a range of scenarios, he determines the best allocation of effort between improving oil export infrastructure, and defending it.
DTIC
Civil Defense; Crude Oil; Industries; Iraq; Oils; Protection

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*; and *28 Propellants and Fuels*.

20050243038 MaxPower, Inc., Harleysville, PA USA
Develop a Low Cost, Safe and Environmentally Benign High Energy and High Rate Reserve Battery
Chua, David; Sep. 30, 2004; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-SERDP-PP-1360
Report No.(s): AD-A439476; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this program is to develop a low cost, safe and environmentally benign high energy and high rate reserve battery such as used in fuses and air-bursting warheads which are equivalent in energy density to that of the presently used metallic lithium-oxychloride reserve battery. To achieve this overall objective, this phase of the program investigates a new reserve battery in which the negative electrode is a magnesium-based material, and the positive electrodes are high voltage, high capacity cathode materials. This initial effort aims to demonstrate the feasibility of this new reserve cell system under lower rate discharge conditions and to lay the ground work to resolve the challenging issues of anodic passivation that is inherent with magnesium anode.
DTIC
Electric Batteries; Environment Protection; Low Cost; Magnesium

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20050240858 Lawrence Livermore National Lab., Livermore, CA USA
Intergrated Urban Dispersion Modeling Capability
Kosovic, B.; Chan, S. T.; Nov. 07, 2003; 10 pp.; In English
Report No.(s): DE2005-15013789; UCRL-CONF-200827; No Copyright; Avail.: Department of Energy Information Bridge

Numerical simulations represent a unique predictive tool for developing a detailed understanding of three-dimensional flow fields and associated concentration distributions from releases in complex urban settings (Britter and Hanna 2003). The accurate and timely prediction of the atmospheric dispersion of hazardous materials in densely populated urban areas is a critical homeland and national security need for emergency preparedness, risk assessment, and vulnerability studies. The main challenges in high-fidelity numerical modeling of urban dispersion are the accurate prediction of peak concentrations, spatial extent and temporal evolution of harmful levels of hazardous materials, and the incorporation of detailed structural geometries. Current computational tools do not include all the necessary elements to accurately represent hazardous release events in complex urban settings embedded in high-resolution terrain. Nor do they possess the computational efficiency required for many emergency response and event reconstruction applications. We are developing a new integrated urban dispersion modeling capability, able to efficiently predict dispersion in diverse urban environments for a wide range of atmospheric conditions, temporal and spatial scales, and release event scenarios. This new computational fluid dynamics capability includes adaptive mesh refinement and it can simultaneously resolve individual buildings and high-resolution terrain (including important vegetative and land-use features), treat complex building and structural geometries (e.g., stadiums, arenas, subways, airplane interiors), and cope with the full range of atmospheric conditions (e.g. stability). We are developing approaches for seamless coupling with mesoscale numerical weather prediction models to provide realistic forcing of the urban-scale model, which is critical to its performance in real-world conditions.
NTIS
Cities; Hazardous Materials; Urban Research

20050240873 Lawrence Livermore National Lab., Livermore, CA USA
Very Fine Aerosols from the World Trade Center Collapse Piles: Anaerobic Incineration
Cahill, T. A.; Cliff, S. S.; Shackelford, J.; Meier, M.; Dunlap, M.; Sep. 12, 2003; 20 pp.; In English
Report No.(s): DE2005-15014009; UCRL-CONF-202594; No Copyright; Avail.: National Technical Information Service (NTIS)

The collapse of the World Trade Center structures (South Tower, North Tower, and WTC 7) presented two very different types of air pollution events: 1. Initial fires and collapse-derived 'dust storm' 2. Continuing emissions from the debris piles Both cases shared the unusual aspect of a massive ground level source of particulate matter in a highly populated area with potential health impacts. EPA summarized 5 causal factors most likely to explain the statistically solid data connecting fine PM2.5 aerosols and human health. (1) Biological aerosols (bacteria, molds, viruses) (2) acidic aerosols (3) very fine/ultra fine (\h 0.1 mm) insoluble aerosols (4) fine transition metals (5) high temperature organics It was important to ascertain if these potentially causal factors were present in the WTC plumes.
NTIS
Aerosols; Air Pollution; Collapse; Debris; Disasters; Health; Incinerators

20050240899 Sierra Research, Inc., Sacramento, CA, USA, Cambridge Systematics, Inc., Washington, DC, USA
COMMUTER Model v2.0 User Manual
Carlson, T. R.; Dulla, R. G.; Kuzmyak, J. R.; Porter, C. D.; Oct. 2005; 68 pp.; In English
Contract(s)/Grant(s): EPA-GS-10F-0198N
Report No.(s): PB2006-101098; No Copyright; Avail.: National Technical Information Service (NTIS)
The COMMUTER model (subsequently referred to as simply 'COMMUTER') is a spreadsheet-based computer model that estimates the travel and emissions impacts of transportation air quality programs focused on commuting. The model is particularly useful for programs such as those recognized under the EPA's Best Workplaces for Commuters and other Commuter Choice Programs.
NTIS
Computerized Simulation; User Manuals (Computer Programs)

20050240902 Environmental Protection Agency, Athens, GA, USA
Uncertainty and the Johnson-Ettinger Model for Vapor Intrusion Calculations
Weaver, J. W.; Tillman, F. D.; Sep. 2005; 46 pp.; In English
Report No.(s): PB2006-101094; EPA/600/R-05/110; No Copyright; Avail.: CASI: A03, Hardcopy
The Johnson-Ettinger Model is widely used for assessing the impacts of contaminated vapors on residential air quality. Typical use of this model relies on a suite of estimated data, with few site-specific measurements. Software was developed to provide the public with automated uncertainty analysis applied to the model. An uncertainty analysis was performed on the model, that accounted for synergistic effects among variable model parameters. This analysis showed that a simple one-at-a time parameter uncertainty analysis provides a rough guide for the uncertainty generated by individual parameters and allowed their ranking. The one-at-a-time analysis, however, underestimated the uncertainty in the model results when all or groups of parameters were assumed to be uncertain. An apparent increase in simulated cancer risk caused by the uncertainty introduced from the input parameters was as much as 1285%. The model response to the input parameters showed that for the example studied, there was a positive skew in the model response to parameter variation.
NTIS
Intrusion; Mathematical Models; Vapors

20050240903 Environmental Protection Agency, Athens, GA, USA
Review of Recent Research on Vapor Intrusion
Tillman, F. D.; Weaver, J. W.; Sep. 2005; 50 pp.; In English
Report No.(s): PB2006-101093; EPA/600/R-05/106; No Copyright; Avail.: CASI: A03, Hardcopy
This paper reviews current and recent research in the area of vapor intrusion of organic compounds into residential buildings. We begin with a description of the challenges in evaluating the subsurface-to-indoor air pathway. A discussion of the fate and transport mechanisms affecting vapors along this pathway is then presented. Following this discussion is a brief overview of current Federal regulations and proposed guidance concerning vapor intrusion. A review of site studies involving vapor intrusion that have been published in scientific literature is then presented, with a focus on evidence of the extent of the problem. Published approaches to modeling vapor intrusion are presented next, followed by conclusions and ideas about future research needs.
NTIS
Intrusion; Vapors

20050240909 Federal Railroad Administration, Washington, DC, USA
Interim Final Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings. Final Environmental Impact Statement
Dec. 05, 2003; 196 pp.; In English
Report No.(s): PB2006-100997; No Copyright; Avail.: CASI: A09, Hardcopy

Implementation of the rule would require that locomotive horns be sounded at most public highway-rail grade crossings in the USA. The rule contains provisions that would set a maximum sound level for locomotive horns, limit the duration of horn sounding, and prescribe when and how to sound the horn. The rule also provides opportunities for any community to establish a quiet zone and eliminate the requirement for sounding locomotive horns.
NTIS
Crossings; Environmental Surveys; Highways; Locomotives; Noise Pollution; Rails; Warning Systems

20050240914 Sierra Research, Inc., Sacramento, CA, USA, Cambridge Systematics, Inc., Washington, DC, USA
Procedures Manual for the COMMUTER Model v2.0
Kuzmyak, J. R.; Carlson, T. R.; Dulla, R. G.; Decker, S. D.; Porter, C. D.; Oct. 2005; 104 pp.; In English
Report No.(s): PB2006-101088; No Copyright; Avail.: CASI: A06, Hardcopy

This manual describes a set of procedures that can be used to evaluate voluntary mobile source emission reduction and commuter choice incentive programs for State Implementation Plan (SIP) and employer-based commuter choice programs. To simplify their use, they have been implemented in a spreadsheet model, entitled COMMUTER, whose operation is explained in a companion report entitled 'COMMUTER Model User Manual for Analysis of Voluntary Mobile Source Emission Reduction and Commuter Choice Incentive Programs.' The procedures are intended to be simple to apply, with data requirements the minimum necessary to evaluate alternative programs. At the same time, the analytical techniques employed in these procedures are consistent with existing state-of-the-practice travel modeling techniques widely employed by transportation professionals.
NTIS
Computerized Simulation; Manuals; Procedures

20050240916 Texas Univ., Austin, TX, USA
Analyze the Impact of Traffic on Air Quality and Select Appropriate ITS Strategies for Emissions Mitigation
Wang, Z.; Walton, C. M.; Nov. 2004; 100 pp.; In English
Report No.(s): PB2006-100987; No Copyright; Avail.: CASI: A05, Hardcopy

This report presents a framework for analyzing the air quality impact of transportation sector and selecting appropriate Intelligent Transportation Systems (ITS) strategies to reduce mobile source emissions. First within a GIS framework, the mobile source emissions are estimated on the basis of vehicle fleet composition, emission factors and traffic characteristics. Then, a concise four-step method is proposed to select ITS strategies to reduce traffic emissions according to the Federal Highway Administration (FHWA) ITS planning process version 2.1. Following the four-step method, the appropriate ITS strategies can be identified and their potential benefits and impact can be evaluated. In this study, the emission problems are defined based on the emissions modeling within a GIS framework. The ITS strategies are screened under the guidance of the National ITS Architecture. The identified ITS strategies are evaluated by doing experiments with ITS Deployment Analysis System (IDAS). A case study was performed in Austin, TX. It shows that the proposed emissions modeling method and the ITS strategy selection method is very helpful for regional ITS planning and evaluation. The methods and results from this report will be very useful for decision-makings in ITS investments and deployments.
NTIS
Air Quality; Traffic; Exhaust Emission

20050240917 Environmental Protection Agency, Washington, DC, USA
Breve Guia para el Moho, la Humedad y su Hogar (Brief Guide to Mold, Moisture, and Your Home)
January 2005; 24 pp.; In Spanish
Report No.(s): PB2006-100985; EPA/402/K-03/008; No Copyright; Avail.: CASI: A03, Hardcopy

The Guide provides information and guidance for homeowners and renters on how to clean up residential mold problems and how to prevent mold growth.
NTIS
Buildings; Moisture

20050240919 Environmental Protection Agency, Washington, DC, USA
Brief Guide to Mold, Moisture, and Your Home
January 2005; 24 pp.; In English
Report No.(s): PB2006-100981; EPA/402/K-02/003; No Copyright; Avail.: CASI: A03, Hardcopy

The Guide provides information and guidance for homeowners and renters on how to clean up residential mold problems and how to prevent mold growth.
NTIS
Buildings; Moisture

20050240925 University of Central Florida, Orlando, FL, USA
First-Order Kinetic Gas Generation Model Parameters for Wet Landfills
Reinhart, D. R.; Faour, A. A.; You, H.; Jun. 2005; 72 pp.; In English
Report No.(s): PB2006-100879; EPA-600/R-05/072; No Copyright; Avail.: National Technical Information Service (NTIS)

Landfill gas is produced as a result of a sequence of physical, chemical, and biological processes occurring within an anaerobic landfill. Landfill operators, energy recovery project owners, regulators, and energy users need to be able to project the volume of gas produced and recovered over time from a landfill. Mathematical and computer models for predicting gas yields are widely available. The U.S. Environmental Protection Agency (U.S. EPA) developed a methodology for determining landfill gas generation based on a first-order degradation model and has provided default values for model input parameters. However, these values are based on data obtained from conventional landfills. Waste stabilization can be enhanced and accelerated so as to occur significantly more rapidly if the landfill is designed and operated as a bioreactor, primarily involving moisture addition. Enhanced waste stabilization will result in increased gas production; therefore, the rate constant (k) and methane generation potential (L0) values will be different from conventional landfills. The objective of this report is to investigate landfill gas collection from wet cells and estimate first-order gas generation model parameters. The task was accomplished by doing a literature review regarding landfill gas generation and modeling. Case studies of gas collection from wet landfills were identified. Parameters were determined through statistical comparison of predicted and actual gas collection.
NTIS
Air Pollution; Landfills

20050240957 Environmental Protection Agency, Seattle, WA, USA
U.S. Department of Energy 100 K Area K Basins Hanford Site, 100 Area, Benton County, Washington Amended Record of Decision, Decision Summary and Responsiveness Summary
Jun. 2005; 36 pp.; In English
Report No.(s): PB2006-101132; No Copyright; Avail.: CASI: A03, Hardcopy

In March-April 1999 The U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) signed the K Basins Interim Action Record of Decision (ROD). The ROD directed removal of the spent nuclear fuel (SNF), sludge, water, and debris from the two K Basins in Hanford's 100 K Area. The ROD also directed that the basins be decontaminated to the extent necessary to make it safe to drain the water from the basins which is used for shielding and contamination control from radioactivity in the basins. The amended remedy changes the sludge disposition and how underwater debris is retrieved, treated, and disposed from both the 105-K East and 105-K West Spent Nuclear Fuel (SNF) Basins. These changes will result in increased protection to human health and the environment.
NTIS
Radioactive Wastes; Spent Fuels; Washington; Waste Disposal

20050240968 Geological Survey, Reston, VA USA, Colorado Dept. of Public Health and Environment, Denver, CO, USA
Effects of Emission Reductions at the Hayden Powerplant on Precipitation, Snowpack, and Surface-Water Chemistry in the Mount Zirkel Wilderness Area, Colorado, 1995-2003
Mast, M. A.; Campbell, D. H.; Ingersoll, G. P.; January 2005; 42 pp.; In English
Report No.(s): PB2006-100081; USGS-SIR-2005-5167; No Copyright; Avail.: National Technical Information Service (NTIS)

In 2004, the U.S. Geological Survey (USGS), in cooperation with the Colorado Department of Public Health and Environment, conducted a study to evaluate the effects of emission reductions at the Hayden powerplant on the chemistry of precipitation, snowpack, and surface water in areas downwind from the powerplant including the Mount Zirkel Wilderness Area. Precipitation chemistry data were obtained from the National Atmospheric Deposition Program (NADP), which is a national network that has been in operation since the early 1980s and has more than 220 precipitation stations. Snowpack

chemistry data were obtained from the Rocky Mountain Snowpack (RMS) network, which is a monitoring network of over 50 snow-sampling sites in the Rocky Mountain region and has been operated by the USGS since 1993 (Turk and others, 1992; Ingersoll, 1995; Ingersoll and others, 2002). This report compares chemical constituent concentrations and deposition rates (for precipitation and snowpack) for periods before and after installation of emission controls at the Hayden powerplant at selected sites from each of the three monitoring networks.
NTIS
Precipitation (Chemistry); Precipitation (Meteorology); Snow Cover; Supports; Surface Water; Water; Wilderness

20050240981 Lawrence Livermore National Lab., Livermore, CA USA
Gaussian Modeling of Tracer Concentrations During the Joint Urban 2003 Experiment
Gouveia, F. J.; Jun. 2004; 14 pp.; In English
Report No.(s): DE2005-15014323; UCRL-CONF-204906; No Copyright; Avail.: Department of Energy Information Bridge
The Joint Urban 2003 Experiment (JU2003) was conducted in Oklahoma City, Oklahoma during the summer of 2003. This extensive field experiment included over a hundred scientists measuring airflow, tracer concentration, and other variables pertinent to urban dispersion. During JU2003, researchers installed anemometers in and around the urban area for continuous measurement of airflow during the 35-day experiment. Additionally, they fielded instruments to measure the atmospheric concentration of the inert tracer sulfur hexafluoride SF6 during ten Intensive Observation Periods (IOPs). Also during the IOPs, additional instruments were fielded to measure airflow using temporary tripod-mounted anemometers. 12-hour long IOP featured two or three separate 30-minute tracer releases, and several puff releases. There were a total of 29 thirty-minute releases, and all were evaluated in this study. The location and time of the releases varied for the different IOPs. Releases were made at three locations: Westin Hotel, Botanical Gardens, and Park Avenue. Six of the IOPs were conducted in the daytime, four at night.
NTIS
Atmospheric Circulation; Atmospheric Models; Contaminants

20050240982 Lawrence Livermore National Lab., Livermore, CA USA
Energy Flowchart Scenarios of Future U.S. Energy Use Incorporating Hydrogen Fueled Vehicles
Berry, G.; Daily, W.; Jun. 14, 2004; 30 pp.; In English
Report No.(s): DE2005-15014336; UCRL-TR-204891; No Copyright; Avail.: National Technical Information Service (NTIS)
This project has adapted Lawrence Livermore National Laboratory (LLNL) energy flowcharts of historical U.S. energy use drawn from the DOE Energy Information Administration (EIA) data to include scenarios involving hydrogen use. A flexible automated process for preparing and drawing these flowcharts has also been developed. These charts show the flows of energy between primary sectors of the economy so that a user can quickly understand the major implications of a proposed scenario. The software can rapidly generate a spectrum of U.S. energy use scenarios in the 2005-2050 timeframe, both with and without a transition to hydrogen-fueled transportation. These scenarios indicate that fueling 100% of the light duty fleet in 2050 (318 million 80 mpg-equivalent compressed hydrogen fuel cell vehicles) will require approximately 100 million tonnes (10.7 quads) of H(sub 2)/year, reducing petroleum use by at least 7.3 million barrels of oil/day (15.5 quads/yr).
NTIS
Energy Policy; Hydrogen

20050240983 California Univ., Davis, CA, USA
Impact of Organic Substrate on No Oxidation in Biofilters
Chang, D. P.; Krone, R. B.; Jun. 2005; 26 pp.; In English
Contract(s)/Grant(s): ARB-00-311
Report No.(s): PB2006-100592; No Copyright; Avail.: CASI: A03, Hardcopy
This project complemented a project funded by the California Energy Commission's Energy Innovations Small Grant (EISG) program. The EISG project examined the feasibility of using a commercial carbon-foam packing to enhance the specific surface area on which the biofilm develops in an aerobic biofilter. The enhanced surface area would reduce the mass-transfer limitation in the removal of nitric oxide (NO) from exhaust streams. The specific objectives of this study were to: determine the effects of organic addition on the biofilm, and to determine the role of heterotrophic microorganisms in enhancing NO removal. In this project, enhanced aerobic biodegradation of NO as a result of organic substrate addition was not conclusively observed. The explanations of such an observation provided by the authors of the earlier study appear to be unsubstantiated. Our alternate explanation for high removal efficiencies observed at EBCTs of a few minutes is that abiotic

oxidation occurs rapidly in both the gas and aqueous phases when the NO concentration exceeds about 100 ppm. Although enhanced removal of NO was observed when glucose was added in the present study, the weight of evidence suggests that NO removal was most likely a result of reduction rather than oxidation to nitrate. As a practical matter, the ratio of carbon consumed to nitrogen removed for high removal of NO in the present study was greater than one order of magnitude. That ratio is consistent with other studies of NO reduction by bacteria and fungi under overall aerobic conditions.
NTIS
Carbon; Foams; Nitrogen; Oxidation; Substrates

20050240984 California Univ., Berkeley, CA, USA
Economy-Wide Effects of Large-Scale Air Pollution Control Regulations
Berck, P.; Jun. 2005; 66 pp.; In English
Contract(s)/Grant(s): ARB/R-05-838
Report No.(s): PB2006-100594; No Copyright; Avail.: CASI: A04, Hardcopy

This report provides a very brief description of a model of the California economy that was designed for the evaluation of environmental and fiscal policies. Most of this report is devoted to the production of a new version of the Environmental Dynamic Revenue Analysis Model, 2003 (EDRAMO3). This updated version of the Environmental Dynamic Revenue Analysis Model (EDRAM) differs from the earlier versions in that it uses a more recent base year (fiscal year 2003) as well as more accurate energy accounting and provides much greater detail for industrial sectoring. The greater detail in industrial sectoring facilitates evaluating policies that directly affect only a small fraction of the California economy.
NTIS
Air Pollution; Air Quality; Climate; Commerce; Pollution Control; Regulations

20050241677 Bechtel SAIC Company, LLC, Las Vagas, NV, USA
Dose Rate Evaluation for Spent Fueld Aging Areas at Yucca Mountain
Radulescu, G.; Su, S. D.; January 2005; 6 pp.; In English
Report No.(s): DE2005-840134; No Copyright; Avail.: Department of Energy Information Bridge

This calculation demonstrates that the MCNP code is a viable tool for determination of the direct and skyshine radiation dose contributions from the proposed repository aging areas. The code provides statistically satisfactory results, which compare favorably to those for similar existing NRC-certified storage casks. The design parameters selected for the aging system produce some measurable effects on the dose rates both inside and outside the aging pads. In particular, the cask array pitch affects the worker dose calculated inside the pad, and the skyshine dose beyond the protective area fences. The effect of the pad spacing is relatively minor.
NTIS
Dosage; Mountains; Radioactive Wastes

20050241680 Lawrence Livermore National Lab., Livermore, CA USA
Day 1 DOPPTEX Model Imput Files
Foster, K. T.; Aug. 23, 2004; 130 pp.; In English
Report No.(s): DE2005-15014769; UCRL-TR-206172; No Copyright; Avail.: Department of Energy Information Bridge

This file contains the source term information and some turbulence parameterization values of interest. The file is a collection of Fortran namelists. Not all variables will be pertinent for general use. Although the source term can be found from the variables in the adpic source namelist. The location of the source is Latitude: 35.2118 degrees North and Longitude: 120.8536 West. This is equivalent to UTM X = 695.368 km and UTM Y = 3898.439 km. There is no significant thermal or momentum component to the release. The source may be approximated by a 1-meter radius sphere. Other values of potential interest can be found in the adpic metparams namelist. However many of these parameters were assigned values based on a visual scan of pertinent raw data files, and are open for interpretation.
NTIS
Atmospheric Models; Fortran

20050241974 National Energy Technology Lab., Pittsburgh, PA USA
Heterogeneous Reburning by Mixed Fuels. Final Report for the Period September 25, 2002 through September 24, 2004
Chen, W. Y.; Gathitu, B. B.; January 2005; 40 pp.; In English
Report No.(s): DE2005-839991; No Copyright; Avail.: National Technical Information Service (NTIS)

Recent studies of heterogeneous reburning, i.e., reburning involving a coal-derived char, have elucidated its variables, kinetics and mechanisms that are valuable to the development of a highly efficient reburning process. Young lignite chars contain catalysts that not only reduce NO, but they also reduce HCN that is an important intermediate that recycles to NO in the burnout zone. Gaseous CO scavenges the surface oxides that are formed during NO reduction, regenerating the active sites on the char surface. Based on this mechanistic information, cost-effective mixed fuels containing these multiple features has been designed and tested in a simulated reburning apparatus. Remarkably high reduction of NO and HCN has been observed and it is anticipated that mixed fuel will remove 85% of NO in a three-stage reburning process.
NTIS
Fuels; Heterogeneity; Catalysts; Oxides

20050242052 Pacific Northwest National Lab., Richland, WA, USA
Evaluation of Airflow Patterns in the Transfer Area of the 105 KE Basin
Fritz, B. G.; Khan, F.; Mendoza, D. P.; Feb. 2003; 34 pp.; In English
Report No.(s): DE2005-15010112; PNNL-14204; No Copyright; Avail.: Department of Energy Information Bridge
The purpose of this study was to provide a qualitative evaluation of airflow patterns within the 105 KE Basin. The KE Basin is located within the 100 K Area of the Hanford Site in Washington State. Within the basin, spent nuclear fuel is stored underwater. Future activities at the 105 KE facility will include pumping sludge that has accumulated at the bottom of the basin. This sludge will be pumped into a shipping cask, and hauled to a separate facility for separation and treatment of any contamination that may have become entrained in the sludge. The shipping cask will be transported on an engineered shipping trailer. The potential exists for radioactive contamination to become airborne during pumping activities. The results of this study indicated that additional continuous air monitor (CAM) alarms need to be installed within the 105 KE Basin. The results of the airflow study dictate placement of CAM alarms and fixed head air samplers used to estimate worker dose.
NTIS
Air Flow; Air Pollution; Flow Distribution; Pollution Control; Radioactive Wastes

20050243082 Air Force Inspection and Safety Center, Kirtland AFB, NM USA
Bioenvironmental Engineer's Guide to Ionizing Radiation
Rademacher, Steven E.; Oct. 1, 2005; 193 pp.; In English
Report No.(s): AD-A439547; AFIOH/SD-BR-SR-2005-0004; No Copyright; Avail.: CASI: A09, Hardcopy
The AF Institute for Operational Health's predecessor organization, the USAF Occupational and Environmental Health Laboratory published a similar guide for bioenvironmental engineers (BEEs) in 1985, covering many of the issues important to radiation safety tasks accomplished by BEEs in the 1980s. This report updates that guide and provides significantly more detail on radioactive materials, radiation detection principles and newer detection instruments, and identification of unknown radioactive materials in accidents, incidents, and weapons of mass destruction scenarios. The guide provides examples of public and occupation dose calculations and other measurement/evaluation tasks. While organized to be an encompassing document to address the vast majority of ionizing radiation issues posed to BEEs, other documents like AFIs 40-201 and 48-148, and AFM 48-125 are referenced for regulatory details. BEEs should contact consultants at the Radiation Surveillance Division (AFIOH/SDR) for technical issues beyond the scope of this guide. This report supersedes USAFOEHL Report 85-144RI111HXA, 'Ionizing Radiation Guidebook for Bioenvironmental Engineers (BEEs).'
DTIC
Bioengineering; Engineers; Ionizing Radiation; Radioactive Materials

20050243400 Westinghouse Savannah River Co., Aiken, SC, USA
Stabilizing and Packaging Pu Materials Per 3013 at SRS
Hensel, S. J.; McNew, R. T.; January 2005; 10 pp.; In English
Report No.(s): DE2005-839553; WSRC-MS-2005-00070; No Copyright; Avail.: Department of Energy Information Bridge
The Savannah River Site (SRS) began packaging Pu metals into 3013 containers in April, 2003 and oxides in October, 2003. A total of 919 outer 3013 containers were made in the FB-Line at SRS when stabilization and packaging was completed in January, 2005. Experiences, lessons learned, and an overview of packaging activities are presented.
NTIS
Packaging; Plutonium; Stabilization

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20050242035 Geological Survey, Reston, VA USA, Agency for International Development, Washington, DC, USA
Seismotectonic Map of Afghanistan, with Annotated Bibliography
Wheeler, R. L.; Bufe, C. G.; Johnson, M. L.; Dart, R. L.; January 2005; 38 pp.; In English
Report No.(s): PB2006-100069; USGS-OFR-2005-1264; No Copyright; Avail.: National Technical Information Service (NTIS)

A seismotectonic amp shows geologic, seismological, and other information that is pertinent to seismic hazards but previously was scattered among many sources. Afghanistan is part of the Eurasian plate. Afghan seismicity is driven by the relative northward movements of the arabian plate past western Afghanistan at 33 mm/yr and of the Indian plate past eastern afghanistan at 39mm/yr or faster as both plates subduct under Eurasia. The purpose of a seismological map is to show geological, seismological, and other geophysical information together that was previously scattered and is likely to be useful to seismologists who will compute seismic-hazard maps, geologists studying possible geologic controls on earthquake occurrence, and anyone who requires an overview of the present-day tectonics.
NTIS
Afghanistan; Annotations; Bibliographies; Tectonics; Seismology; Earthquakes

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20050240870 Lawrence Livermore National Lab., Livermore, CA USA
Atmospheric Dispersion Analysis Using MACCS2
Yang, J. M.; Glaser, R.; Feb. 03, 2004; 14 pp.; In English
Report No.(s): DE2005-15013998; UCRL-CONF-202161; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available
Nuclear Power Plants; Radioactive Wastes; Waste Management

20050240877 Lawrence Livermore National Lab., Livermore, CA USA
Influences on the Height of the Stable Boundary Layer as Seen in Large-Eddy Simulations
Kosvoic, B.; Lundquist, J. K.; Mar. 30, 2004; 8 pp.; In English
Report No.(s): DE2005-15014036; UCRL-PROC-203266; No Copyright; Avail.: Department of Energy Information Bridge

Numerical weather prediction (NWP) models and atmospheric dispersion models rely on parameterizations of planetary boundary layer height. In the case of a stable boundary layer, errors in boundary layer height estimation can result in gross errors in boundary-layer evolution and in prediction of turbulent mixing within the boundary layer. We use large-eddy simulations (LES) of moderately stable boundary layers to characterize the effects of various physical processes on stable boundary layers. The stable boundary layer height is assumed to be a function of surface friction velocity, geostrophic wind, Monin-Obukhov length, and the strength of the temperature inversion atop the stable boundary layer. This temperature inversion induces gravity waves with a frequency determined by the strength of the temperature inversion. Using LES, we show that gravity waves atop a stable boundary layer do influence the height of the stable boundary layer, and the domain size of an LES of a SBL must be sufficient to resolve those gravity waves and their effects on an evolving stable boundary layer. We also show that the correct SBL height is crucial to correctly approximating the bulk Richardson number across the layer. The geostrophic drag coefficient, however, is not found to be particularly sensitive to the stable boundary layer height.
NTIS
Boundary Layer Stability; Boundary Layers; Large Eddy Simulation; Atmospheric Models

20050240920 Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO, USA
Aid to Streamlining Fire-Weather Station Networks
Furman, R. W.; Sep. 1975; 14 pp.; In English
Report No.(s): PB2006-100977; FSGTR-RM-17; No Copyright; Avail.: CASI: A03, Hardcopy

For reasons of economy it may be necessary to close one or several fire-weather stations in a protection area. Since it is logical to close those stations that will have the least impact on the ability of the fire manager to assess overall fire danger, it is desirable to know if there is duplication in monitoring fire climate, and to what degree. A method is proposed for determining this duplication, based on an analysis of six elements of fire climate. Stations are grouped on the basis of similarity of sequences of these fire climate elements over the fire season.
NTIS
Fires; Forest Fires; Streamlining

20050242970 Westinghouse Savannah River Co., Aiken, SC, USA
Savannah River Site Annual Meteorology Report for 2004
Hunter, C. H.; January 2005; 50 pp.; In English
Report No.(s): DE2005-839550; WSRC-RP-2005-01405; No Copyright; Avail.: National Technical Information Service (NTIS)

Summaries of meteorological observations collected at the Savannah River Site in 2004 show a year that was overall cooler and drier than average. Although the annual rainfall of 42.9 inches was the eleventh driest of all the years over a period of record that began in 1952, rainfall was quite variable through the year. September total rainfall of 10.26 inches was the highest in this 53 year record; conversely, the monthly rainfall in March, 0.81 inches, was the lowest on record. Rainfall of 0.01 inch or more occurred on 104 days during the year. The annual average temperature for 2004, 63.4 degrees F, was the eleventh coldest of any year in an available record that dates to 1964. Cooler than average conditions were observed in 9 of the 12 months of the year. The coldest temperature during the year was 20.3 degrees F on the morning of December 15; the warmest observed temperature was 98.2 degrees F on the afternoon of July 14. The most notable weather event of 2004 was an active Atlantic hurricane season that resulted in six named storms striking the Southeast U.S. during August and September. Although each of these storms posed a significant threat to the SRS, their eventual paths resulted in only minimal impacts. The remnants of hurricanes Frances and Jeanne produced 24-hr rainfall totals of 3.99 inches (Sept. 8) and 3.48 inches (Sept. 27), respectively. Surface winds associated with Jeanne resulted in sustained speeds approaching 15 mph with gusts to 35 mph on September 27. An ice storm on January 26 produced an estimated accumulation of one-fourth to one-half inch of ice, resulting in scattered power outages and considerable damage to trees across the Site. A strong cold front moving through the area on March 7 produced a 15-minute average surface wind of 24 mph with a gust to near 50 mph.
NTIS
Meteorological Parameters; Meteorology; Rivers

20050242973 Naval Postgraduate School, Monterey, CA USA
Climatic Variations of the California Current System: Application of Smart Climatology to the Coastal Ocean
Feldmeier, Joel W.; Sep. 1, 2005; 168 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439299; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Northern Oscillation Index (NOI), an atmospheric climate index relating climate variations in the tropical Pacific and Northeast Pacific was used to selectively average output from the Parallel Ocean Climate Model (POCM 4C) for 1979-1998. Composites, or smart climatologies, were made representing El Nino (EN) and La Nina (LN) conditions, as well as a long-term mean (LTM) average or traditional climatology, for November to March. Conditions in the California Current System (CCS) in the smart climatologies were consistent with large-scale features noted in previously published studies of EN and LN. Overall, the patterns of anomalies (POCM 4C Smart Climatology minus POCM 4C Traditional Climatology) in salinity, temperature, and currents were opposite in sign and magnitude between the EN and LN composites. This was expected for opposite phases of the same climate variation, and many of the model's EN/LN differences were found to be statistically significant. Therefore, POCM 4C smart climatologies provide better estimates of ocean state and circulation patterns than traditional climatology. Such smart climatologies offer improved environmental information to Naval operational and strategic planners. They also are useful for studying climate variations, and in improving boundary and initial conditions for ocean and atmosphere models.
DTIC
Climatology; Coasts; Marine Environments; Ocean Currents; Ocean Models; Oceans; Pacific Ocean

20050242979 Naval Postgraduate School, Monterey, CA USA
The Impacts of Weather Forecasts on Military Operations: A System for Conducting Quantitative Near-Real Time Analyses
Butler, Mark; Sep. 1, 2005; 101 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439354; No Copyright; Avail.: CASI: A06, Hardcopy

We have developed, tested, and operationally implemented a web based system for collecting and analyzing in near-real time weather forecast and observational data to assess: (a) the performance of forecasts; and (b) the operational impacts of forecasts. A major goal of the system is to quantify the impacts of weather forecasts on the planning execution and outcomes of military operations. Our tests and implementation were focused on the METOC support provided by Naval Pacific Meteorology and Oceanography Detachment (NPMOD) Fallon to Naval Strike and Air Warfare Center (NSAWC) operations at Naval Air Station Fallon. In this application of the system METOC and NSAWC data are collected by NPMOD Fallon personnel and entered via a web interface into a database at the Naval Postgraduate School (NPS) where the data are analyzed and results are reported in near-real time. The results include quantitative assessments of: (1) forecasts used in planning NSAWC missions (e.g. forecast accuracy probability of detection); (2) changes made during mission planning in response to forecasted weather (e.g. changes in mission schedule targets weapons tactics); (3) deviations from mission plans that occurred during missions in response to weather conditions actually encountered by air crews (e.g. changes in targets weapons delivered tactics); (4) positive and negative impacts on mission planning execution and outcomes due to forecasts (e.g. missions that avoided or incurred delays cancellations inappropriate weapons load outs missions that might have avoided problems had the forecast been followed by mission planners); (5) METOC Tactical Decision Aid forecast accuracy and mission impacts (e.g. TAWS WOF accuracy weather impacts on weapon sensors); and (6) forecast performance and mission impacts with respect to specific weather factors (e.g. surface and aloft winds dust fog).
DTIC
Forecasting; Military Operations; Real Time Operation

20050243146 Naval Postgraduate School, Monterey, CA USA
Analysis of High-Resolution COAMPS (Trademark) With Observed METOC Data to Demonstrate Atmospheric Impact on EM Propagation
Murphy, Richard M.; Sep. 1, 2005; 94 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439648; No Copyright; Avail.: CASI: A05, Hardcopy

Current U.S. Navy Special Warfare and submarine concepts of operations (CONOPS) dictate that in-situ environmental data collection is limited or not possible. Therefore, predicted data from operational models, such as the Coupled Ocean Atmosphere Mesoscale Prediction System (COAMPS), are essential to estimate the impacts of environmental conditions on the detection of enemy targets and counter-detection by radar and optical sensors. This study compares the use of high-resolution COAMPS data and in-situ shipboard and rawinsonde measurements for detection prediction purposes. The evaluation is based on data from Fleet Exercise SILENT HAMMER conducted off the Southern California coast near San Clemente Island in October 2004. An instrumented vessel was used for continuous surface layer data collection and frequent rawinsonde launches. COAMPS meteorological predictions were obtained at 3- and 9-km resolutions. The shipboard and COAMPS data provided refractivity profiles that were then used with propagation models within the BUILDER and AREPS graphical user interfaces to obtain signal-to-noise and propagation loss versus range diagrams. An increase in the horizontal resolution of COAMPS from 9 to 3 km did not significantly improve the prediction of meteorological variables within the lower marine boundary layer. However, counter-intuitively, the higher resolution did slightly improve detection range estimates.
DTIC
Data Acquisition; High Resolution; Marine Environments; Meteorological Parameters; Radiosondes; Submarines

20050243163 Naval Postgraduate School, Monterey, CA USA
Development of a Weather Radar Signal Simulator to Examine Sampling Rates and Scanning Schemes
Schroder, Ulf P.; Sep. 1, 2005; 175 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439673; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A weather radar signal simulator that produces an output consisting of a vector of I and Q values representing the radar return permits investigation of the performance of different estimators for the weather signal parameters and their sensitivity when varying radar parameters and precipitation models. Although several empirical statistical models are available to describe precipitation behavior, the creation of a physical model enables adaptation to actual data (e.g. rain rate, wind shears) thereby making it possible to apply and examine different scanning schemes, especially rapid scanning schemes. A physical model allows gradual improvements to realism to study the effects on the radar return for different phenomena. A Weather Radar Signal Simulator has been developed in MATLAB. Several different functionalities have been implemented allowing for stepped frequency, multiple PRFs, pulse compression using a chirp, and variation of both weather and radar input parameters. Post processing capabilities include autocorrelation and FFT (for single PRF only); estimation of weather parameters such as reflectivity factor, Z; average doppler, radial velocity, and velocity spread; pedagogical plots including a

Phasor plot of phase change over time and a velocity histogram, instantaneous observed reflectivity and power for each pulse over time.
DTIC
Meteorological Radar; Sampling; Simulators; Statistical Analysis; Weather

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*.

20050240986 Lawrence Livermore National Lab., Livermore, CA USA
FRMAC Health and Safety Working Group Update
Hadley, R. T.; Apr. 20, 2004; 30 pp.; In English
Report No.(s): DE2005-15014114; UCRL-CONF-203676; No Copyright; Avail.: National Technical Information Service (NTIS)

In the event of a major radiological emergency, 17 federal agencies with various statutory responsibilities have agreed to coordinate their efforts at the emergency scene under the umbrella of the Federal Radiological Emergency Response plan (FRERP). This cooperative effort will assure the designated Lead Federal Agency (LFA) and the state(s) that all federal radiological assistance fully supports their efforts to protect the public. The mandated federal cooperation ensures that each agency can obtain the data critical to its specific responsibilities. This Overview of the Federal Radiological Monitoring and Assessment Center (FRMAC) Operations describes the FRMAC response activities to a major radiological emergency. It also describes the federal assets and subsequent operational activities which provide federal radiological monitoring and assessment of the off-site areas. These off-site areas may include one or more affected states.
NTIS
Health; Radiology; Safety

20050243004 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Detection of Subclinical Mastitis in Small Ruminants on Six Farms in Northern Tanzania
Lehman, Mark W.; Oct. 18, 2005; 24 pp.; In English
Contract(s)/Grant(s): AFIT-CI04-1687
Report No.(s): AD-A439423; No Copyright; Avail.: CASI: A03, Hardcopy

Small ruminants represent an important role in the pastoral life of the Maasai people of northern Tanzania. Although the Maasai culture centers on cattle, East African goats and Fat-tailed sheep are the predominant livestock in this area and are extensively managed on free range semi-arid landscape. The milk and meat from these animals are a main component of the Maasai diet. The milk is often consumed hot, combined with tea and spices and served as chai. The Maasai pastoralists also consume fresh or fermented milk. while both milk and meat are nutritionally important to these people, these animals are used for subsistence rather than high production. Because of this the estimated number of lactating small ruminants ranges from 5 to 20% of the typical herd or flock, and sheep and goats are managed and raised as one group. This study was conducted in the Mondului district near the town of Gelai, a remote area which represents the traditional lifestyle of the Masaai. One water source from a nearby mountain spring, supplies two main water supply points for the entire area. Most of the residents live in smaller surrounding villages, or 'bomas', comprised of traditional homes constructed of dung and stick, and encircled by fences made of thorny acacia braches. The homes have dirt floors and thatched roofs, with very poor ventilation. Young lambs and kids are housed inside the homes at night, while the adult livestock are housed within the thorn fences of the bomas. The typical day begins with the women collecting dung to patch the houses, then milking the livestock and preparing a meal. Because water is scarce, there is no hand-washing or proper teat sanitation prior to milking. These common practices would lend evidence that there is a potential for a high prevalence of mastitis among all livestock, including the small ruminants. Mastitis is inflammation of the mammary gland and can be caused by several different bacterial and/or viral infections.
DTIC
Infectious Diseases; Livestock; Mammary Glands; Tanzania

20050243007 Naval Postgraduate School, Monterey, CA USA

An Analysis of the Use of Medical Applications Required for Complex Humanitarian Disasters and Emergencies via Hastily Formed Networks (HFN) in the Field

Kelley, Sean W.; Sep. 1, 2005; 189 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439426; No Copyright; Avail.: CASI: A09, Hardcopy

This thesis analyzes the feasibility, efficacy and usability of medical operations working in concert with a Fly-Away-Kit (FLAK) and the forming of Hastily Formed Networks (HFNs) in support of Humanitarian Assistance and Disaster Relief (HA/DR) operations. The initial focus of this research is on the requirements, situation, area of operations, and mission differences between nongovernmental organizations and governmental organizations. The thesis researches and discusses the possibilities for implementing medical technology in the field and the conditions and scenarios in HA/DR that may affect its success. This process will also define the requirements for medical operations as well as facilitate a methodology for ensuring those requirements are met. This thesis investigates the suitability of currently available COTS hardware and software components for medical operations. In addition, it includes a comprehensive review of the value of electronic medical records and telemedicine technologies. Virtually all organizations responding to the December 26, 2004 Southeast Asia tsunami did not have the benefit of large scale medical information technology. For example, the ability to ascertain the real extent of injuries due to the tsunami was hampered by the lack of a central database. Initial media reports claimed a death toll of over 300,000 people, when in fact hindsight now provides a more accurate tally of just over 200,000 dead. This disparity resulted from an archaic system of tracking and accounting. Undoubtedly, humanitarian medical organizations will greatly benefit from the implementation of medical information technology capabilities. This thesis lays the groundwork for further research into medical technologies that can be deployed in the field with humanitarian medical teams in the near future.

DTIC

Computer Programs; Computer Techniques; Disasters; Emergencies; Medical Services; Supplying

20050243016 Air Force Inst. for Environment, Safety and Occupational Health Risk Analysis, Brooks AFB, TX USA

A Review of Cancer in Missileers at Malmstrom Air Force Base, Montana

Garcia, Marco V.; Apr. 1, 2005; 10 pp.; In English

Report No.(s): AD-A439441; IOH-RS-BR-TR-2005-0003; No Copyright; Avail.: CASI: A02, Hardcopy

In 2001, based on concerns regarding a link between a suspected increase in cancer and work exposures for missileers at Malmstrom AFB in Montana, a group of Bio-environmental Engineers and Industrial Hygienists in coordination with Preventive and Occupational Medicine specialists from AFIOH (formerly AFIERA) conducted a site evaluation and sampling for possible chemical and biologic contaminants at their facilities. Results of all testings did not demonstrate any levels above acceptable standards according to state and federal regulations. The survey concluded that Launch Control Centers (LCCs) provide a safe and healthy working environment. Unfortunately, this information was not widely distributed to those with a need to know (specifically workers with the conditions and their families). Since then, a list of some other cancer cases among the same population has been collected. Clearly, this perpetuates the level of concern among those affected. Four years later, based on the number of documented cancer cases and after review of available documents and new information, we believe that there is not sufficient evidence to consider the possibility of a cancer clustering to justify further investigation. We emphasize that !he need for education and risk communication is critical, especially when the resulting condition can be fatal as is the case with some types of cancers.

DTIC

Armed Forces (United States); Biological Effects; Cancer; Contamination; Military Personnel; Sampling

20050243028 Princeton Univ., NJ USA

EGFR Activation by Spatially Restricted Ligands

Goodrich, Jennifer S.; Jun. 1, 2005; 20 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0393

Report No.(s): AD-A439462; No Copyright; Avail.: CASI: A03, Hardcopy

Misregulation of Transforming Growth Factor alpha (TGFalpha) and increased Epidermal Growth Factor Receptor (EGFR) activity has been associated with an increased prognosis of breast cancer. During oogenesis in Drosophila melanogaster, local EGFR activation by the spatially restricted TGF alpha-like ligand, Gurken (Grk), is required for axis formation in the egg and future embryo. Squid, a heterogeneous nuclear ribonucleoprotein (hnRNP) functions in the localization and translational regulation of grk mRNA. The purpose of this project is to identify factors that function with Squid to produce spatially-restricted EGFR activation. I have identified an arginine methyltransferase (CG6554) that interacts with Squid, but mutations in this enzyme do not produce a phenotype. I have gathered evidence that Squid is methylated on

arginine residues. This methylation could function to mediate Squid's different roles in regulating Grk expression. I generated several Squid transgenes in which the potential methylation sites have been mutated. Characterization of these transgenes should allow us to elucidate the function of Squid methylation and its role in the regulation of Grk expression. These factors, which interact with Squid to control Grk expression, could define potential causes of EGFR misregulation that result in human breast cancer, and they may provide possible targets for drug development.
DTIC
Breast; Cancer; Genetics; Ligands; Mammary Glands; Methylation

20050243114 Naval Postgraduate School, Monterey, CA USA
Resource Sharing: Building Collaboration for Regionalization
Reinertson, Susan K.; Sep. 1, 2005; 51 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439591; No Copyright; Avail.: CASI: A04, Hardcopy

The major challenge in securing the homeland is to provide for all citizens effective and capable prevention and responsiveness to chemical, biological, radiological, nuclear, and explosive events. States have different homeland security organizational structures, priorities, funding strategies, and implementation methods. Consequently, the nation lacks a clear, uniform prevention and response strategy that translates into an overall capability that cannot be qualitatively defined. To combat this situation, the Department of Homeland Security (DHS) has linked future funding to implementation of a holistic approach to homeland security program strategies, which include implementing intrastate and interstate regional approaches that effectively leverage resource sharing. North Dakota responded to funding reductions by addressing its first comprehensive statewide regional plan to develop a more efficient and effective homeland security program; however, actual implementation was not realistic. A tiered approach to sharing resources through regionalization means jurisdictional capability levels will be thoroughly examined and homeland security allocations distributed accordingly. Local jurisdictions in North Dakota exhibit very independent attitudes; instituting regionalization, which changes levels of funding, is controversial. Therefore, it was vital to first devise a plan that determined statewide acceptability for a regional approach. It was also deemed necessary to develop standardized baseline equipment lists corresponding to each of the four levels of weapons of mass destruction (WMD) capability as defined by DHS. The baseline lists provide specific guidance, direction and clarity for equipment purchasing decisions and circumvents the complex and disjointed method currently in use.
DTIC
Decision Making; Security

20050243138 Arizona Univ., Tucson, AZ USA
Verification of Single-Peptide Protein Identifications by the Application of Complementary Database Search Algorithms
Rohrbough, James G.; Breci, Linda; Merchant, Nirav; Miller, Susan; Haynes, Paul A.; Oct. 20, 2005; 29 pp.; In English
Report No.(s): AD-A439637; CI-04-1688; No Copyright; Avail.: CASI: A03, Hardcopy

Protein identifications from complex biological mixtures often involve the application of tandem mass spectrometry techniques. One such technique, known as the Multi-Dimensional Protein Identification Technique, or MudPIT, involves the use of computer search algorithms that automate the process of identifying proteins present in the sample mixture based on mass spectrometry analysis. This technique involves digestion of the protein mixture with a protease such as trypsin, followed by liquid chromatography separation using first a strong cation exchange column followed by a reverse-phase separation. Peptides eluting from these separations are subjected to ionization and fragmentation in the mass spectrometer. The database search algorithms are then used to match the acquired spectra to peptide sequences from a protein database. These algorithms, while helpful, are far from perfect when it comes to accuracy of peptide identifications. These programs identify peptides by comparing the collected spectra to predicted spectra from the database sequences and applying a score to that identification. The peptide with the highest score is the one selected as the identification.
DTIC
Algorithms; Data Bases; Peptides; Proteins

20050243147 Naval Postgraduate School, Monterey, CA USA
Self-Diagnostics Digitally Controlled Pacemaker/Defibrillators: A Design Plan for Incorporating Diagnostics and Digital Control in the schema of a Pacemaker/Defibrillator Design
Nedd, Steven; Sep. 1, 2005; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439649; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research addresses the need for a pacemaker/defibrillator that could perform an automatic system self-diagnostics check to assure operational functionality and give doctors a chance to assess a patient's status in the event they are experiencing complications, as pointed out in an article in the journal Health Scout, which stated that 'St. Jude Medical Inc., the nation's second-largest pacemaker manufacturer, has warned doctors that at least 90 of its pacemakers being used by heart patients could stop emitting the electrical signal that regulates heartbeat'. The proposed functionality would also serve the military in determining the whereabouts or state of being of an individual on the battlefield. This thesis investigates the use of Unified Modeling Language (UML) Diagrams, Object-Oriented Analysis and Design, and Structured Query Language (SQL) to develop the high level architecture of a system to store and retrieve digital/wireless communication information from a pacemaker/ defibrillator, or other device, and to alert medical personnel when a person is experiencing problems with their health. It presents the requirements and architectural design of the Self-Diagnostics Digitally Controlled Pacemaker/ Defibrillator Device. Applications of the SDDCPDD design concept for military missions are explored.
DTIC
Diagnosis; Digital Systems; Heart; Maintainability; Medical Equipment; Medical Personnel; Military Operations; Pulse Communication; Radiotelephones

20050243180 Cleveland Clinic Foundation, Cleveland, OH USA
Neural Mechanism of Chronic Fatigue Syndrome
Yue, Guang H.; Apr. 1, 2004; 44 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0665
Report No.(s): AD-A439708; No Copyright; Avail.: CASI: A03, Hardcopy

Nearly one million Americans suffer from chronic fatigue syndrome (CFS). More than 15% of Gulf War veterans (GWV) were found to have CFS. The disease significantly reduces work production of civilian patients and combat ability/ readiness of US military forces. Increasing scientific evidence suggests that CFS is a biological illness involving pathology of the central nervous system (CNS). However, little is known about how the CNS is affected by CFS. This study will focus on evaluating brain activities of CFS patients during fatigue and non-fatigue muscle exercises. Our hypothesis is that the brain activation pattern in CFS differs from that of healthy controls. Aim 1 of the study is to determine brain activation patterns during motor activity in CFS patients using functional magnetic resonance imaging. Aim 2 is to examine brain activation patterns during motor activity in CFS patients by analyzing signals of electroencephalograms. Aim 3 is to evaluate signal relationships among different brain regions and between the brain and muscle. Measurements will be made from four groups of participants: a civilian CFS group, a civilian control group, a GWV CFS group, and a GWV control group. We expect that the study will provide objective information for diagnosis of CFS.
DTIC
Brain; Central Nervous System; Signs and Symptoms

20050243184 Burnham Inst., La Jolla, CA USA
Egr1 Target Genes That Regulate Growth/Survival of Prostate Cells
Yu, Jianxiu; Mar. 1, 2005; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0028
Report No.(s): AD-A439713; No Copyright; Avail.: CASI: A03, Hardcopy

Last year I finished the study of the related co-activators p3OO and CBP. I have shown that the immediate early response TF, Egr1, acts upstream of p300/CBP to induce or to repress transcription, depending on the stimulus. I have shown that serum stimulation of prostate cells results in cell growth by the up-regulation of p300/CBP. In contrast, the stimulus of ultraviolet irradiation leads to cell cycle block and apoptosis through the inhibition of p300/CBP. This year, I studied the effect of Egr1 on the expression of the related p73 and p53 tumor suppressor genes, having found several Egr1 binding sites in their promoters. Endogenous and exogenous Egr1 expression causes the transcriptional activation of the TAp73 isoforms from promoter Pi, and the modest activation of p53. The most notable finding was of positive feedback loops from both TAp73 and deltaNp73 isoforms and from p53 on Egr1 expression, strengthening our view that Egr1 is a tumor-suppressor by its genotoxic stress-responses that can substitute for the often mutant p53 in cancer cells. The interactive network between Egr1, p53, TAp73 and deltaNp73 explains how cancer cells make extensive responses to chemotherapy and irradiation even in the absence of wt p53.
DTIC
Cancer; Estrogens; Genes; Irradiation; Prostate Gland; Survival; Targets

20050243186 Case Western Reserve Univ., Cleveland, OH USA
Prostatic Fluid Cells
Pretlow, Thomas G.; May 1, 2005; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0039
Report No.(s): AD-A439716; No Copyright; Avail.: CASI: A02, Hardcopy

Most research that requires long-term propagation of prostate cancer (PCA) cells is carried out with three cell lines: DU 145, PC-3, and LNCaP. All but one of these lines, LNCaP, fail to express prostate specific antigen (PSA), androgen receptors, and/or any other prostate phenotype. Some prostatic fluids contain PCA cells. Our goals were (1) to test the tumorigenicity of and to develop transplantable xenografts from POA cells in prostatic fluid, (2) to develop methods for enhancing the tumorigenicity of small numbers of these PCA cells without deliberately altering their genes, (3) to test these methods for enhancement of tumorigenicity with prostatic fluid cells, and (4) to initiate clinical follow-up. As detailed in the body of our report, our aims that required prostatic fluid have been limited by exceptionally weak clinical collaboration that has become progressively weaker. The fluids that we tested earlier were%promising. The quantity and quality of prostatic fluids received from our clinical Collaborator, Dr. Martin Resnick, declined progressively. Coinjection of lethally irradiated, growth-factor-producing cells was encouraging in some experiments in the case of some tumors; however, results were quite variable in repeated experiments.
DTIC
Body Fluids; Cancer; Prostate Gland; Transplantation; Tumors

20050243226 Vanderbilt Univ., Nashville, TN USA
Manipulation of NF-KappaB Activity in the Macrophage Lineage as a Novel Therapeutic Approach
Yull, Fiona E.; May 1, 2005; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0456
Report No.(s): AD-A439787; No Copyright; Avail.: CASI: A02, Hardcopy

The aim of this proposal is to investigate the contribution of NF-kB signaling within macrophages in defining the macrophage's role in normal and neoplastic mammary development. The proposed experiments use multiple murine lines and novel assay systems. We have been developing novel murine models with which to address this issue. We are continuing to use our established IkBa and transplantation technology to investigate the effects of constitutive NF-kB activity within macrophages on mammary development and believe that elevated NF-kB may result in increased macrophage recruitment. To more effectively monitor NF-kB activity within specific cell types we have undergone a collaborative effort and generated a novel Luciferase/GFP reporter transgenic. The inducible model system that we proposed to use in our studies requires three transgenic components; an inducible dominant inhibitor, an inducible constitutive activator and a macrophage specific expressor of the reverse transactivator protein. We have generated and confirmed the functionality of the first two transgenics and are characterizing the third. We are making good progress towards the goal of the study.
DTIC
Enzymes; Macrophages; Neoplasms; Therapy

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*.

20050243083 Naval Postgraduate School, Monterey, CA USA
Sleep and Predicted Cognitive Performance of New Cadets during Cadet Basic Training at the USA Military Academy
Miller, Daniel B.; Sep. 1, 2005; 141 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439549; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The amount of sleep being received per day among New Cadets at West Point during Cadet Basic Training (CBT) was investigated. Sleep was measured using actigraphy on a stratified sample of 80 New Cadets. The results indicated that New Cadets slept an average of approximately 340 minutes or 5 hours, 40 minutes per night. The results were compared to self-reported survey data to determine whether sleep prior to arrival at West Point matched measured sleep at CBT. The findings indicate that the study population is sleep-deprived during CBT. The study population was sleeping on average 2 hours, 6 minutes less per night during CBT than prior to their arrival at West Point. The findings also indicate that the amount

of sleep was not related to gender, race, cadet company assignment, age, recruited athlete status, or circadian chronotype (i.e., Morning/Evening preference).
DTIC
Cognition; Education; Mental Performance; Sleep; Sleep Deprivation; United States

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*.

20050240958 National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
Interim Survey Report: Recommendations for Ergonomics Interventions for Ship Construction Processes at Bath Iron Works Corporation Shipyard, Bath Maine
Hudock, S. D.; Wurzelbacher, S. J.; Siegfried, K.; Jul. 2000; 34 pp.; In English
Report No.(s): PB2006-100874; EPHB-229-13B; No Copyright; Avail.: CASI: A03, Hardcopy

A pre-intervention quantitative risk factor analysis was performed at various shops and locations at Bath Iron Works shipyard in Bath, Maine as a method to identify and quantify risk factors that workers may be exposed to in the course of their normal work duties. This survey was conducted as part of a larger project, funded through Maritech Advanced Shipbuilding Enterprise and the U.S. Navy, to develop projects to enhance the commercial viability of domestic shipyards. Several operations were identified for further analysis including: unloading of small parts for subassembly, connecting electrical cables at a junction box, pulling cable through the vessel, equipment load-in, insulation installation, welding, and grinding. The application of exposure assessment techniques provided a quantitative analysis of the risk factors associated with the individual tasks. Possible engineering interventions to address these risk factors for each task are examined in this report.
NTIS
Baths; Construction; Human Factors Engineering; Iron; Ships; Shipyards; Surveys

20050242987 Army Research Lab., Aberdeen Proving Ground, MD USA
Future Force Warrior, Engineering Design Event Number 4
Turner, Daniel D.; Carstens, Christian B.; Torre, Joseph; Oct. 1, 2005; 186 pp.; In English
Report No.(s): AD-A439392; ARL-TR-3626; No Copyright; Avail.: CASI: A09, Hardcopy

The Human Research and Engineering Directorate of the U.S. Army Research Laboratory conducted an experiment to evaluate the form, fit, and user acceptance of the Future Force Warrior (FFW) body systems and headgear system ensembles (without functional electronics). The ensembles included new components and the addition of leader and Soldier variations. They were evaluated in the context of dismounted Infantry tactical activities. Additionally, the experiment investigated the form, fit, and comfort, of a chemical and biological (CB) overgarment with a functional personal air ventilation system (PAVS) and a functional personal air-purifying respirator (PAPR). The experiment was executed from 9 to 13 May 2005, with one Infantry squad as participants. Soldiers received familiarization training on the prototype equipment. The exercises included an overland open terrain environment, an urban warfare environment, and an individual movement techniques course.
DTIC
Armor; Military Personnel

20050243008 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site, Desert Extreme Scoring Record Number 528
Overbay, Larry; Robitaille, George; Jul. 1, 2005; 89 pp.; In English
Report No.(s): AD-A439428; ATC-8997; No Copyright; Avail.: CASI: A05, Hardcopy

This scoring record documents the efforts of Human Factors Applications, Inc. to detect and discriminate inert unexploded ordnance (UXO) utilizing the YPG Standardized UXO Technology Demonstration Site Desert Extreme. The scoring record was coordinated by Larry Overbay and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Deserts; Discriminant Analysis (Statistics); Human Factors Engineering; Scoring; Standardization

20050243048 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site, Moguls Scoring Record Number 573
Overlook, Larry; Robitaille, George; Aug. 1, 2005; 73 pp.; In English
Report No.(s): AD-A439495; ATC-9007; No Copyright; Avail.: CASI: A04, Hardcopy

This scoring record documents the efforts of Parsons to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Moguls. The scoring record was coordinated by Larry Overbay and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Discriminant Analysis (Statistics); Scoring; Standardization

20050243053 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site, Moguls Scoring Record Number 676
Overbay, Larry; Robitaille, George; Aug. 1, 2005; 118 pp.; In English
Report No.(s): AD-A439500; ATC-9065; No Copyright; Avail.: CASI: A06, Hardcopy

This scoring record documents the efforts of Human Factors Applications (HFA), Inc. to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Moguls. Scoring Records have been coordinated by Larry Overbay and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include, the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Discriminant Analysis (Statistics); Human Factors Engineering; Scoring; Standardization

20050243068 California Polytechnic State Univ., San Luis Obispo, CA USA
Proceedings of the Workshop on The Human-Computer Partnership in Decision-Support Held in San Luis Obispo, California on May 2-4, 2000
Sep. 1, 2000; 231 pp.; In English
Report No.(s): AD-A439523; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Decision Support Workshop of May 2-4, 2000 held in San Luis Obispo, Cal., was the second in a series that was started one year earlier as a joint project of the Office of Naval Research and the Collaborative Agent Design Research Center of Cal Poly. The goal of this series of Workshops is to provide a forum where connections can be established on one hand between developers and proponents of decision support tools, with potential users such as managers of large, complex organizations/systems on the other. Clearly, the military belong to this class of users and it is furthermore not surprising that ONR has a vested interest in promoting research in this particular field. It is also clear that the class of potential users is not restricted to the military - in fact civilian government bodies as well as business and industry entities should be strongly interested in adopting these tools (and their future refinements) for their own specific purposes. The list of the speakers and the topics presented during the Workshop does indeed attest to the variety of areas where decision support systems are already in use. This Workshop has concentrated on the human-computer interaction. Although computers are after all man-made devices, there is a peculiarity in the way humans interact with a computer that has no parallel in human-human interactions.
DTIC
Computers; Conferences; Decision Support Systems; Human-Computer Interface

20050243080 Naval Postgraduate School, Monterey, CA USA
Applied Warfighter Ergonomics: A Research Method for Evaluating Military Individual Equipment
Takagi, Koichi; Sep. 1, 2005; 293 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439544; No Copyright; Avail.: CASI: A13, Hardcopy

The objective of this research effort is to design and implement a laboratory and establish a research method focused on scientific evaluation of human factors considerations for military individual equipment under both laboratory and field conditions. This integrated approach for laboratory and field conditions is the first of its kind for military human factors research, enabling an unparalleled degree of scientific rigor in the collection of empirical human factors data. This effort

includes: 1) a state-of-the-art usability laboratory designed specifically for quantitatively evaluating military individual equipment; 2) a rugged, embarkable, fully self-contained, portable usability laboratory for field research in military environments; 3) a codified manual for using the two main configurations (stationary and portable) of the usability laboratory, written for the beginning usability researcher; 4) a set of validated procedures for applying sound human factors principles, and traditional and non-parametric statistics to the specific problem of usability testing of military individual equipment; 5) a proof-of-concept practical application of the laboratory and procedures to a specific problem, namely the usability testing of ruggedized personal digital assistants (RPDAs) designed for USA Special Forces operations.
DTIC
Human Factors Engineering; Military Technology

20050243341 Air Force Inst. for Environment, Safety and Occupational Health Risk Analysis, Brooks AFB, TX USA
Estimating Organic Vapor Cartridge Service Life
DeCamp, David S.; Costantino, Joseph; Black, Jon E.; Nov. 1, 2004; 53 pp.; In English
Report No.(s): AD-A439710; IOH-RS-BR-SR-2005-0005; No Copyright; Avail.: CASI: A04, Hardcopy

Respirator cartridge change-out schedules depend upon many factors such as the contaminant, airborne concentration, humidity, temperature cartridge, and worker characteristics. End of service life indicator (ESLI) estimator calculators have been created by several cartridge manufacturers including 3M, North, and MSA. This technical report details background information pertaining to cartridge change-out schedules with regard to OSHA and Air Force requirements and manufacturer calculators which may be used to establish cartridge change-out schedules.
DTIC
Cartridges; Estimating; Respirators; Service Life; Vapors

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*.

20050240896 National Telecommunications and Information Administration, Washington, DC USA
Reduced Reference Video Calibration Algorithms
Pinson, M. H.; Wolf, S.; Oct. 2005; 52 pp.; In English
Report No.(s): PB2006-101106; NTIA-TR-06-433; No Copyright; Avail.: CASI: A04, Hardcopy

This report describes four Reduced Reference (RR) video calibration algorithms of low computational complexity. RR methods are useful for performing end-to-end in-service video quality measurements since these methods utilize a low bandwidth network connection between the original (source) and processed (destination) ends. The first RR video calibration algorithm computes temporal registration of the processed video stream with respect to the original video stream (i.e., video delay estimation). The second algorithm jointly calculates spatial scaling and spatial shift. The third algorithm calculates luminance gain level offset of the processed video stream with respect to the original video stream. The fourth algorithm estimates the valid video region of the original or processed video stream (i.e., the portion of the video image that contains actual picture content). All the algorithms utilize only the luminance (Y) image plane of the video signal.
NTIS
Algorithms; Calibrating

20050240953 Bureau of Labor Statistics, Washington, DC, USA
Which Workers Gain from Computer Use
Zoghi, C.; Pabilonia, S. W.; Jun. 2004; 44 pp.; In English
Report No.(s): PB2006-101336; BLS/WP-373; No Copyright; Avail.: CASI: A03, Hardcopy

Workers who use computers earn more than those who do not. Is this a productivity effect or merely selection. Using the Canadian Workplace and Employee Survey, we control for selection and find a wage premium of 3.8% for the average worker upon adopting a computer. This premium, however, obscures important differences in returns to computer adoption across education and occupation groups. We find that long-run returns to computer use are over 5% for most workers. Differences between short-run and long-run returns may suggest that workers share training costs through sacrificed wages.
NTIS
Inequalities; Personnel

20050240959 Bureau of Labor Statistics, Washington, DC, USA, Rutgers - The State Univ., Camden, NJ, USA
Anticipative Feedback Solution for the Infinite-Horizon, Linear-Quadratic, Dynamic, Stackelberg Game
Chen, B.; Zadrozny, P. A.; Nov. 2001; 36 pp.; In English
Report No.(s): PB2006-101326; BLS/WP-350; No Copyright; Avail.: CASI: A03, Hardcopy

This paper derives and illustrates a new suboptimal-consistent feedback solution for an infinite-horizon, linear-quadratic, dynamic, Stackelberg game. This solution lies in the same solution space as the infinite-horizon, dynamic-programming, feedback solution but puts the leader in a preferred equilibrium position. The idea comes from Kydland (1977) who suggested deriving a consistent feedback solution for an infinite-horizon, linear-quadratic, dynamic, Stackelberg game by varying the coefficients in the player's linear constant-coefficient decision rules. Here feedback is understood in the sense of setting a current control vector as a function of a predetermined state vector. The proposed solution is derived for discrete- and continuous-time games and is called the anticipative feedback solution. The solution is illustrated with a numerical example of a duopoly model.
NTIS
Feedback; Games; Horizon

20050240960 Bureau of Labor Statistics, Washington, DC, USA, Rutgers - The State Univ., Camden, NJ, USA
Higher Moments in Perturbation Solution of the Linear-Quadratic Exponential Gaussian Optimal Control Problem
Chen, B.; Zadrozny, P. A.; Nov. 2001; 34 pp.; In English
Report No.(s): PB2006-101325; BLS/WP-348; No Copyright; Avail.: CASI: A03, Hardcopy

The paper obtains two principal results. First, using a new definition of higher-order (less than 2) matrix derivatives, the paper derives a recursion for computing any Gaussian multivariate moment. Second, the paper uses this result in a perturbation method to derive equations for computing the 4th-order Taylor-series approximation of the objective function of the linear-quadratic exponential Gaussian (LQEG) optimal control problem. Previously, Karp (1985) formulated the 4th multivariate Gaussian moment in terms of MacRae's definition of a matrix derivative. His approach extends with difficulty to any higher (less than 4) multivariate Gaussian moment. The present recursion straightforwardly computes any multivariate Gaussian moment. Karp used his formulation of the Gaussian 4th moment to compute a 2nd-order approximation of the finite-horizon LQEG objective function. Using the simpler formulation, the present paper applies the perturbation method to derive equations for computing a 4th-order approximation of the infinite-horizon LQEG objective function. By illustrating a convenient definition of matrix derivatives in the numerical solution of the LQEG problem with the perturbation method, the paper contributes to the computational economist's toolbox for solving stochastic nonlinear dynamic optimization problems.
NTIS
Linear Quadratic Gaussian Control; Mathematical Models; Optimal Control; Perturbation

20050240972 Lawrence Livermore National Lab., Livermore, CA USA
Adaptive Sampling for Noisy Problems
Cantu-Paz, E.; Mar. 29, 2004; 18 pp.; In English
Report No.(s): DE2005-15014044; UCRL-CONF-203216; No Copyright; Avail.: Department of Energy Information Bridge

The usual approach to deal with noise present in many real-world optimization problems is to take an arbitrary number of samples of the objective function and use the sample average as an estimate of the true objective value. The number of samples is typically chosen arbitrarily and remains constant for the entire optimization process. This paper studies an adaptive sampling technique that varies the number of samples based on the uncertainty of deciding between two individuals. Experiments demonstrate the effect of adaptive sampling on the final solution quality reached by a genetic algorithm and the computational cost required to find the solution. The results suggest that the adaptive technique can effectively eliminate the need to set the sample size a priori, but in many cases it requires high computational costs.
NTIS
Sampling; Genetic Algorithms; Noise

20050240978 Lawrence Livermore National Lab., Livermore, CA USA
High Performance Tools & Technologies
Collette, M.; Corey, B.; Johnson, J.; Dec. 2004; 90 pp.; In English
Report No.(s): DE2005-15014498; UCRL-TR-209289; No Copyright; Avail.: Department of Energy Information Bridge

This goal of this project was to evaluate the capability and limits of current scientific simulation development tools and technologies with specific focus on their suitability for use with the next generation of scientific parallel applications and High

Performance Computing (HPC) platforms. The opinions expressed in this document are those of the authors, and reflect the authors' current understanding and functionality of the many tools investigated. As a deliverable for this effort, we are presenting this report describing our findings along with an associated spreadsheet outlining current capabilities and characteristics of leading and emerging tools in the high performance computing arena. This first chapter summarizes our findings (which are detailed in the other chapters) and presents our conclusions, remarks, and anticipations for the future. In the second chapter, we detail how various teams in our local high performance community utilize HPC tools and technologies, and mention some common concerns they have about them. In the third chapter, we review the platforms currently or potentially available to utilize these tools and technologies on to help in software development. Subsequent chapters attempt to provide an exhaustive overview of the available parallel software development tools and technologies, including their strong and weak points and future concerns. We categorize them as debuggers, memory checkers, performance analysis tools, communication libraries, data visualization programs, and other parallel development aides. The last chapter contains our closing information. Included with this paper at the end is a table of the discussed development tools and their operational environment.
NTIS
Computers; Information Systems; Scientific Visualization; Computer Programming

20050241689 Lawrence Livermore National Lab., Livermore, CA USA
Discrete Wavelet Transform with Lifting: A Step by Step Introduction
Elofson, C.; Oct. 12, 2004; 20 pp.; In English
Report No.(s): DE2005-15014818; UCRL-TR-4818; No Copyright; Avail.: National Technical Information Service (NTIS)

There is a great deal of information pertaining to wavelets readily available from various sources; several of the more recent sources describe the lifting technique for constructing wavelets. The tutorial paper by Sweldens and Schroder gives a thorough explanation of the lifting approach for Haar bases. While it provides an excellent introduction to the topic, it is not immediately obvious how this approach is extended to nonuniformly spaced data on finite intervals. The present paper provides intermediate steps that supplement the material. After working through the following discussion, the reader should have no problem deriving the relevant equations presented in Sweldens and Schroder's article. Because of the abundance of information on the Haar basis, this discussion will instead work through the steps using a linear basis set.
NTIS
Signal Processing; Wavelet Analysis

20050241855 Nanyang Technological Univ., Nanyang, Singapore
Characterization of Indirectly Measurable Antenna Balun/Impedance-Matching Device
Lu, Y.; Lee, T. W.; Teo, K. M.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1323-1326; In English; See also 20050241839; Copyright; Avail.: Other Sources

This paper presents a novel approach for S-parameter characterization of an indirectly measurable antenna balun/impedance-matching device. A back-to-back measurement setup is proposed and a system of complex variable nonlinear equations is derived tu relate the measurable undesired parameters and the unmeasureable desired parameters. Then the genetic algorithm (GA) is proposed to solve the system of complex variable nonlinear equations to obtain the desired S-parameters. Unlike conventional GA, the chromosomes in our approach are represented directly by comptex numbers instead of normal binary coding. The representation of chromosome in complex numbers increases the efficiency and flexibility of GA in engineering applications. With the GA-solved S-parameters, we are able to characterize the antenna input impedances. The simulated and measured results of the antenna system show that the proposed GA approach is valid and this approach can also be extended to some other indirect measurement.
Author
Antenna Design; Couplers; Genetic Algorithms; Impedance Matching

20050242064 Lawrence Livermore National Lab., Livermore, CA USA
Analytical Tests for Ray Effect Errors in Discrete Ordinate Methods for Solving the Neutron Transport Equation
Chang, B.; Mar. 24, 2004; 14 pp.; In English
Report No.(s): DE2005-15014046; UCRL-TR-203127; No Copyright; Avail.: National Technical Information Service (NTIS)

The paper contains three analytical solutions of transport problems which can be used to test ray-effect errors in the numerical solutions of the Boltzmann Transport Equation (BTW).
NTIS
Errors; Neutrons; Boltzmann Transport Equation; Numerical Analysis

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*.

20050241890 Illinois Univ., Urbana, IL, USA
Use of Preconditioners to Ease Disparate Grid Size Problem
Bowen, J. M.; Chew, W. C.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1770-1773; In English; See also 20050241839
Contract(s)/Grant(s): F49620-96-1-0025; N00014-95-0872; ECS93-2145; Copyright; Avail.: Other Sources

In recent years, many fast algorithms |lave been proposed to rapidly solve electromagnetic scattering from perfect conductors in free space. Each algorithm uses tile method of moments as a starting point and seeks to speed the solution of the resulting matrix equation by implementing a fast matrix-vector multiply. The underlying assumption is that an iterative solver using the fast matrix vector multiply will converge to a solution in only a small fraction of N, where N is the number of unknowns in the problem. This turns out to be true for large, sufficiently smooth scatterers with no fine features. In this case, the scatterer can be described adequately by a mesh of almost uniformly sized patches whose edges are no smaller than 0.1(lambda).
Derived from text
Algorithms; Electromagnetic Scattering; Computational Grids

20050242984 Naval Postgraduate School, Monterey, CA USA
Hysteresis Control of Parallel-Connected Hybrid Inverters
Little, Bradford P.; Sep. 1, 2005; 164 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439368; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Integrated Power Systems will be used on future naval combatants. These systems will allow unprecedented control of shipboard power to propel the ship, sense the battle-space, and engage the enemy. One crucial enabling technology is robust power conversion modules like the hybrid dc to ac inverter. This thesis is a further exploration of the hybrid inverter scheme consisting of a six-step voltage-source inverter (VSI) and a hysteresis controlled current-source inverter (CSI). The six-step controller was redesigned to make it independent of the hysteresis controller. The hysteresis controller is fed a reference signal extracted from the total output current. The signal is filtered and modified by the closed-loop system such that the total output current approaches a perfect sine wave limited only by bandwidth. The modified closed-loop controller was compared to a previous Naval Postgraduate School effort and found to improve current total harmonic distortion from 3.2% to 1.8%. This thesis proves that existing power electronic technology can be used to produce high-fidelity waveforms for high-power Naval Propulsion Drives (50-100 MW).
DTIC
Hysteresis; Inverters

20050243041 Maryland Univ., Baltimore, MD USA
Semantic Web in the Context Broker Architecture
Chen, Harry; Finin, Tim; Joshi, Amupam; Jan. 1, 2005; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-1-0215; NSF-9875433
Report No.(s): AD-A439483; No Copyright; Avail.: CASI: A03, Hardcopy

This document describes a new architecture that exploits Semantic Web technologies for supporting pervasive context-aware systems. This architecture called Context Broker Architecture (CoBrA) differs from other architectures in using the Web Ontology Language OWL for modeling ontologies of context and for supporting context reasoning. Central to our architecture is a broker agent that maintains a shared model of context for all computing entities in the space and enforces the privacy policies defined by the users when sharing their contextual information. We describe the use of CoBrA, its associated

ontologies, and its privacy protection mechanism in an intelligent meeting room prototype.
DTIC
Architecture (Computers); Semantics

20050243142 Maryland Univ., Baltimore, MD USA
Towards Distributed Service Discovery in Pervasive Computing Environments
Chakraborty, Dipanjan; Joshi, Anupam; Yesha, Yelena; Finin, Tim; Jan. 1, 2005; 36 pp.; In English
Contract(s)/Grant(s): F30602-97-1-0215
Report No.(s): AD-A439642; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The paper proposes a novel distributed service discovery protocol for pervasive environments. The protocol is based on the concepts of peer-to-peer caching of service advertisements and group-based intelligent forwarding of service requests. It does not require a service to be registered with a registry or lookup server. Services are described using the Web Ontology Language (OWL). We exploit the semantic class/subClass hierarchy of OWL to describe service groups and use this semantic information to selectively forward service requests. OWL-based service description also enables increased flexibility in service matching. We present simulation results that show that our protocol achieves increased efficiency in discovering services (compared to traditional broadcast-based mechanisms) by efficiently utilizing bandwidth via controlled forwarding of service requests.
DTIC
Computer Storage Devices; Data Storage; Semantics

20050243197 Maryland Univ., Baltimore, MD USA
Semantic Web in a Pervasive Context-Aware Architecture
Chen, Harry; Finin, Tim; Joshi, Anupam; Jan. 1, 2005; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-1-0215
Report No.(s): AD-A439730; No Copyright; Avail.: CASI: A02, Hardcopy

This document describes a new approach that explores the use of Semantic Web languages in building an architecture for supporting context-aware systems. This new architecture called Context Broker Architecture (CoBrA) differs from other architectures in using the Web Ontology Language OWL for modeling ontologies of context and for supporting context reasoning. Central to our architecture is a broker agent that maintains a shared model of context for all computing entities in the space and enforces the privacy policies defined by the users. We also describe the use of CoBrA and its associated ontologies in prototyping an intelligent meeting room.
DTIC
Internets; Semantics

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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.

20050241920 Ghent Univ., Belgium
A Singular Value-Based Preconditioner for Large Scattering Problems
De Backer, B.; Knockaert, L.; De Zutter, D.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1534-1537; In English; See also 20050241839; Copyright; Avail.: Other Sources

The udvent of an ever increasing computer capacity has in recent years touched off an increased interest in the use of integral equations for the solution of large scattering problems, In electromagnetics, an integral equations formulating has traditionally been paired with the method of moments (MOM) discretization technique, by which the scattering problem is reduced to a simple system of linear equations ZJ = E. However, if the MOM is applied in the classical way, using pulse, triangle, or Dirac basis and testing functions, this leads invariably to a dense system matrix Z. In terms of the storage requirements and system solution time this dense matrix structure proves to he a serious obstacle to an efficient solution of larger problems, even on today's computers. Far these electrically larger problems, it is, however, possible to exploit the reduced interaction properties of the integral operator at higher frequensies. Numerous techniques have in recent years been presented to do so. One of these is to transform the interaction matrix to an alternative form by both left and right multiplying

this matrix with appropriate transformation matrices. In this way, the resulting alternative system can be sparsified, leading to a reduction in both the storage requirements and matrix-vector multiplication time.
Derived from text
Computers; Integral Equations; Matrices (Mathematics); Scattering; Transformations (Mathematics)

20050242989 Minnesota Univ., Minneapolis, MN USA
MPI-Based Adaptive Parallel Grid Services
Rao, Lakshman A.; Weissman, Jon; Aug. 26, 2003; 13 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439405; TR-03-032; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents the design and implementation of an adaptive MPI implementation (adaptive-MPI) that allows an MPI application to adapt to respond to changing CPU availability. An adaptive MPI application can start sooner with fewer processors, opportunistically add processors later should they become available, and release processors to avoid suspension should the resource owner take them back. The behavior of adaptive-MPI is well-suited to the unpredictable and dynamic nature of the Grid. We presents results that indicate the systems overhead of adaptive MPI is small, and that performance benefits in terms of reduced waiting time and reduced completion time can be achieved relative to traditional MPI.
DTIC
Computational Grids; Messages; Parallel Processing (Computers); Protocol (Computers)

20050242999 Massachusetts Univ., Amherst, MA USA
Using Wearable Computers to Construct Semantic Representations of Physical Spaces
Diaz, Fernando; Jan. 1, 2005; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DABT63-99-1-0022; DABT6399-1-0004
Report No.(s): AD-A439417; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The representation of physical space has traditionally focused on keyphrases such as 'Computer Science Building' or 'Physics Department' that help us in describing and navigating physical spaces. However, such keyphrases do not capture many properties of physical space. As with the assignment of a keywork to describe a piece of text, these constructs sacrifice meaningful information for abstraction. We propose a system of spatial representation based on richer, emergent language models that encode information lost in keyphrase approaches. We use a mix of wearable and ubiquitous computing environments for the construction of these models. Wearable computers infer language models of their hosts. These language models then act as semantic paint over spaces in a ubiquitous computing environment. Spaces collect this information and construct representations based on interactions with augmented humans. A prototype navigation system based on this theory is presented and compared to traditional representations.
DTIC
Architecture (Computers); Computers; Semantics

20050243005 Naval Postgraduate School, Monterey, CA USA
Games for Training: Leveraging Commercial Off the Shelf Multiplayer Gaming Software for Infantry Squad Collective Training
Noland, Joseph M.; Jones, Jason M.; Sep. 1, 2005; 179 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439424; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Combat arms units (both Marine and Army) often do not have enough people, time and resources to properly train collective tasks at the squad level. Resources are often retained by higher headquarters due to tight deployment schedules, land restrictions, logistics constraints and a myriad of other reasons. Due to the current operational demands of combat arms brigades and regiments, the reality of limited resources is often a contributing factor in poor performance at the squad level. Leaders at all levels will need to look for innovative ways to sustain training levels at the small unit level. The scope of this study examined the collective and leader tasks that are required for successful execution of Infantry squad missions (using the Army Training and Evaluation Plan ARTEP 7-8 Drill), and how those tasks could be trained with the use of commercial off-the-shelf multiplayer gaming software. The end-state of this research study is to provide initial analysis on what collective skills games can be used to train at the Infantry squad level, and develop a training model recommendation for the integration of this tool into existing unit plans.
DTIC
Commercial Off-the-Shelf Products; Computer Programs; Education; Games; War Games

20050243018 Duke Univ., Durham, NC USA

Exploiting Parallelism in Geometry Processing with General Purpose Processors and Floating-Point SIMD Instructions

Yang, Chia-Lin; Sano, Barton; Lebeck, Alvin R.; Jan. 1, 2005; 31 pp.; In English

Contract(s)/Grant(s): CDA-95-12356; CDA-97-2637

Report No.(s): AD-A439443; No Copyright; Avail.: CASI: A03, Hardcopy

Three dimensional (3D) graphics applications have become very important workloads running on today's computer systems. A cost-effective graphics solution is to perform geometry processing of 3D graphics on the host CPU and have specialized hardware handle the rendering task. In this paper, we analyze microarchitecture and SIMD instruction set enhancements to a RISC superscalar processor for exploiting parallelism in geometry processing for 3D computer graphics. Our results show that 3D geometry processing has inherent parallelism. Adding SIMD operations improves performance from 8% to 28% on a 4-issue dynamically scheduled processor that can issue at most 2 floating-point operations. In comparison, an 8-issue processor, ignoring cycle time effects, can achieve 20% to 60% performance improvement over a 4-issue. If processor cycle time scales with the number of ports to the register file, then doubling only the floating-point issue width of a 4-issue processor with SIMD instructions gives the best performance among the architectural configurations that we examine (the most aggressive configuration is an 8-issue processor with SIMD instructions).

DTIC

Floating Point Arithmetic; Simd (Computers)

20050243046 Army Research Lab., Aberdeen Proving Ground, MD USA

Warriors Edge Simulation and Gaming System: The Squad Simulation

Thomas, Mark; Moss, Gary; Aug. 1, 2005; 42 pp.; In English

Contract(s)/Grant(s): Proj-P622783.Y10

Report No.(s): AD-A439492; ARL-TR-3564; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In August 2004, the U.S. Army Research Laboratory (ARL) participated in a technology development effort to insert web-based information technologies into military operations. The exercise, sponsored by the Office of the Secretary of Defense, was the second year of the Horizontal Fusion portfolio. ARL was responsible for Army Urban Operations. Called Warriors Edge (WE), technologies showcased this year by ARL included micro robots, sensors, integrated soldier sensor/communications backpacks, mobile networking, and local-to-global information fusion and multilevel security. The WE exercise consisted of 15 soldiers representing a dismounted infantry platoon. The 15 live soldiers were comprised of a platoon headquarters section with a rifle squad. The adjacent squads were simulated using a computer game called SquadSim. The game software simulated a dismounted infantry rifle squad composed of a squad leader and two fire teams. The squad leader was played by a subject matter expert (SME). The SME controlled the squad leader using the computer interface to the SquadSim. The fire teams reacted to the squad leader's actions using computer-generated forces logic. This report describes the game software developed for the second year of the ARL WE.

DTIC

Computer Programs; Computerized Simulation; Game Theory; Logistics Management; Military Operations; Simulation

20050243058 Minnesota Univ., Minneapolis, MN USA

CLUTO - A Clustering Toolkit

Karypis, George; Apr. 23, 2002; 66 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008

Report No.(s): AD-A439508; TR-02-017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Clustering algorithms divide data into meaningful or useful groups, called clusters, such that the intra-cluster similarity is maximized and the inter-cluster similarity is minimized. These discovered clusters can be used to explain the characteristics of the underlying data distribution and thus serve as the foundation for various data mining and analysis techniques. The applications of clustering include characterization of different customer groups based upon purchasing patterns, categorization of documents on the World Wide Web, grouping of genes and proteins that have similar functionality, grouping of spatial locations prone to earth quakes from seismological data, etc. CLUTO is a software package for clustering low and high dimensional datasets and for analyzing the characteristics of the various clusters.

DTIC

Algorithms; Computer Programs; Software Development Tools

20050243070 Army Research Lab., Aberdeen Proving Ground, MD USA
A Programmer's Guide to the Overwatching Fires Behavior
Fields, MaryAnne; Baranoski, MyVan H.; Haug, B. H.; Jul. 1, 2005; 38 pp.; In English
Report No.(s): AD-A439527; ARL-TR-3548; No Copyright; Avail.: CASI: A03, Hardcopy

This report describes the software modules required to demonstrate an overwatching fires (OWF) behavior on a team of laboratory robotic platforms. The modules are divided into three types-servers, an operator control unit (OCU), and the OWF application. Servers are independent software programs that communicate with sensors and actuators on-board the robot. The OCU is an independent process that allows operators to start, modify, and stop the OWF behavior. The OWF application consists of several modules that control sensing, communication, movement, and shooting for each of the robots in the team.
DTIC
Computer Programming; Fires; Manuals; Robots

20050243077 Naval Postgraduate School, Monterey, CA USA
Analysis of Binary XML Suitability for NATO Tactical Messaging
Bayer, Matthew E.; Sep. 1, 2005; 129 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439540; No Copyright; Avail.: CASI: A07, Hardcopy

The ability to efficiently transfer information among tactical systems is essential for network-centric operations. However, maintaining interoperability among heterogeneous networks and applications is a challenging issue, especially for large enterprises such as the US Department of Defense and NATO. Each of these organizations maintain extensive communication networks of tactical systems that process and manage all types of data. Additional complexity is added when considering that many systems are built with a variety of proprietary or legacy data formats. Establishing and maintaining interoperability is difficult. Using XML, many interoperability issues can now be successfully addressed. XML provides a self-describing way to effectively structure information that can be applied to compose diverse tactical communications. However, XML is inefficient for network transmission since it uses a text-based format which can consume more memory (and thus more bandwidth) than binary equivalents. In addition, parsing text-based documents is slow and computationally expensive. One potential solution is to use GZIP to reduce the file size before transmission. Unfortunately, this solution has limitations since it often provides suboptimal compression and also requires additional processing time when extracting data. Recent standardization efforts have identified promising new encodings for XML that use binary representations to reduce parsing time, memory size, and bandwidth requirements.
DTIC
Communication Networks; Document Markup Languages; North Atlantic Treaty Organization (NATO)

20050243109 Naval Postgraduate School, Monterey, CA USA
Authentication Scenario for CyberCIEGE
Mueller, David S.; Sep. 1, 2005; 116 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439585; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Frequent media reports of the loss or compromise of data stored on computer systems indicate that attempts to educate users on proper computer security policies and procedures seem to be ineffective. In an effort to provide a means of education that will more fully engage users, the CyberCIEGE game was created. It is hoped that by playing CyberCIEGE users will absorb computer security concepts better than they have through more traditional forms of instruction, since many computer users find games to be a compelling experience. The reason for this training is that many users do not understand why good passwords and password management are important for information systems. This thesis developed a scenario for CyberCIEGE to teach players about the issues involved in developing a password policy for a computer system. Limited testing showed that the scenario accomplishes this. CyberCIEGE uses a Scenario Definition Language to give developers and educators the ability to create scenarios that focus on particular concepts. A Scenario Definition Tool was created to aid scenario developers in the creation of scenarios for the game. This work also involved beta testing of the Scenario Definition Tool, which resulted in several improvements.
DTIC
Access Control; Computer Information Security; Computerized Simulation; Computers; Education; Games; Numerical Control; Operators (Personnel); Policies

20050243126 Naval Postgraduate School, Monterey, CA USA
Compilation of Theses Abstracts
Jun. 1, 2005; 141 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439613; NPS-09-05-005; No Copyright; Avail.: CASI: A07, Hardcopy

It would be a fair argument to say that there is perhaps no invention that has had as much impact on the world as that of the Internet. The Internet, however, was conceived in the minds of government employees. Just as government influenced the development of the Internet, the same can be said of Radio Frequency Identification (RFID) Technology. The Department of Defense (DoD) had a very large impact on the development of RFID. Many DoD funded projects and experiments helped pave the way for and significantly influenced the development of RFID technology. This project examines the extent of that DoD influence and shows the correlation between DoD and RFID developments in the civilian sector. From Defense projects in minefield location to tracking containers in ships on the high seas in support of the war on terror, this project explains how specific government sponsored projects had a direct influence on the current state of RFID technology.
DTIC
Abstracts; Internets; Theses

20050243129 Minnesota Univ., Minneapolis, MN USA
Probabilistic Stream Relational Algebra: A Data Model for Sensor Data Streams
Liu, Haiyang; Hwang, San-yih; Srivastava, Jaideep; Jul. 12, 2004; 21 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014; F30602-03-C-0243
Report No.(s): AD-A439622; TR-04-029; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Sensor data streams exhibit special characteristics such as inherent information uncertainty and inherent data sample correlations, both within and across streams. We introduce a new data model, called Probabilistic Stream Relational Algebra (PSRA), that models a sensor data stream as a set of probabilistic data samples, along with prediction strategies for each attributes, capturing domain knowledge of inherent data correlations. We also explicitly associate every operation with schedule, specifying when next data sample should be produced, to facilitate resource management in sensor networks. We prove that operators in PSRA are non-blocking, thus making PSRA especially suitable for data stream processing. We also show that conventional relational model and existing deterministic data stream processing model can be modeled in PSRA.
DTIC
Algebra; Correlation; Data Flow Analysis; Data Processing; Energy Consumption; Models

20050243136 Army Research Lab., Adelphi, MD USA
Software Tools for Measuring and Calculating Electromagnetic Shielding Effectiveness
Tesny, Neal; Sep. 1, 2005; 46 pp.; In English
Report No.(s): AD-A439634; ARL-TR-3645; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The evaluation and the analysis of high-altitude electromagnetic pulse response of shielded enclosures require the availability of software tools able to acquire data and calculate shielding effectiveness. This report describes new software tools for measuring and calculating shielding effectiveness. The tools are written in MATLAB in graphical user interface format and are unique in that they allow for real-time analysis and plotting of the results in graphical form. Sample output is also presented.
DTIC
Electromagnetic Shielding; Software Development Tools

20050243143 Naval Postgraduate School, Monterey, CA USA
The Forward Observer Personal Computer Simulator (FOPCSim) 2
McDonough, James; Strom, Mark; Sep. 1, 2005; 123 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439644; No Copyright; Avail.: CASI: A06, Hardcopy
Due to declining budgets and decreases in ammunition allowances, the opportunity to conduct live fire artillery training has been greatly reduced. The available simulation trainers are either outdated, require specialize contractor support, or are not deployable. FOPCSim was developed at no cost, is freely available, takes advantages of modern 3D graphics, eliminates costly contractor support, and will run on laptops in support of deploying units. The simulator provides users with real-time performance feedback based on the Marine Corps Training and Readiness standards and was designed according to a cognitive task analysis of the call for fire procedures. To evaluate how well FOPCSim trains the call for fire procedures, an experiment was conducted at The Basic School in Quantico, Virginia. FOPCSim was used in place of the current simulation: Training Set, Fire Observation (TSFO) to evaluate its training effectiveness. By eliminating the overhead associated with most simulators, FOPCSim allows users to perform the call for fire procedures with a high degree of repetitiveness which is needed to train this type of task.
DTIC
Computer Programs; Computerized Simulation; Contract Management; Personal Computers; Simulation

20050243145 Naval Postgraduate School, Monterey, CA USA

Spatial Orientation and Familiarity in a Small-Scale Real Environment Using PC-Based Virtual Environment Technology

Mollmer, Matthew; Sep. 1, 2005; 65 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439646; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Conducting training in a new or unfamiliar environment requires a certain amount of time to acquire the necessary spatial orientation and familiarity to that environment's physical layout. This thesis explores the effects of exposing individuals to a PC-based virtual replication of a small-scale real world training environment to determine if such exposure has any effect on an individual's ability to acquire the necessary spatial orientation and familiarity of the real world environment. In this thesis individual spatial orientation and familiarity to the layout of the real world environment will be measured using a set of retrieval tasks conducted in the real environment and by development of a sketched map of that environment. Establishing a link between an individual's ability to gain an acceptable level of spatial orientation and familiarity with a real world environment by first exposing them to a PC-based virtual replication of that environment is vital to the future of video game development and virtual simulation technologies

DTIC

Attitude (Inclination); Exposure; Information Retrieval; Microcomputers; Video Signals; Virtual Reality

20050243152 Massachusetts Univ., Amherst, MA USA

Coordinated Teams of Reactive Mobile Platforms

Sweeney, J.; Brunette, T. J.; Yang, Y.; Grupen, Roderic A.; Jan. 1, 2005; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439657; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper presents techniques for exploiting redundancy in teams of mobile robots. In particular, the authors address tasks involving the kinematic coordination of several communicating robots. Teams are modeled as highly redundant spatial mechanisms for which multi-objective, concurrent controllers are constructed using a generalization of null-space control. The goal is to develop a methodology in which the robustness and error suppression in a control theoretic substrate can be used to preserve critical properties in teams of reactive robots. The resulting 'safe' control options can then be explored while guaranteeing global compliance with system specifications. The proposed architecture depends on a set of concurrent, low-dimensional control processes that interact in a well-defined manner. Cascaded null space projections and coordination templates are used to manage control interactions across platforms that actively maintain constraints for pairs of robots. Pair-wise policies can then be combined to represent coordinated, multi-robot tasks. To illustrate the approach, the authors demonstrate a distributed control that maintains critical connectivity in line-of-sight communication networks.

DTIC

Control; Line of Sight; Reactivity; Redundancy; Robots

20050243153 Massachusetts Univ., Amherst, MA USA

Exploiting Redundancy to Implement Multi-Objective Behavior

Yang, Yuandong; Brock, Oliver; Grupen, Roderic A.; Jan. 1, 2005; 7 pp.; In English

Contract(s)/Grant(s): DABT63-99-1-0022; DABT63-99-1-0004

Report No.(s): AD-A439658; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Teams of robots can be redundant with respect to a given task. This redundancy can be exploited to pursue additional objectives during the execution of the task. in this paper, the authors describe a control-based method to exploit such redundancy for the execution of additional behavior, leading to the improvement of overall performance. The control-based method provides a suitable mechanism for combining controllers with different objectives. The mechanism ensures that the subordinate controllers do not interfere with superior controllers. Thus, it allows one to build controllers exhibiting complex behavior from simple primitives, while maintaining their provable performance characteristics. The effectiveness of the framework is demonstrated by experiments with a multi-robot exploration task.

DTIC

Control; Redundancy; Robot Control; Robots

20050243161 Naval Postgraduate School, Monterey, CA USA

An Analysis of IEEE 802.11B and 802.16 Technologies as Part of the Tactical Internet

Caceres, Francisco A.; Swearingin, Brad E.; Sep. 1, 2005; 187 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439669; No Copyright; Avail.: CASI: A09, Hardcopy

This research evaluates IEEE 802.11b and 802.16 technologies to examine whether these wireless technologies can integrate into the tactical Internet. In order to establish a baseline, the current Marine Corps systems architecture is analyzed with emphasis placed on mobile forces at the Regimental level and below. A side-by-side comparison between existing communication assets in the Marine Corps inventory, such as the Enhanced Position Location Reporting System (EPLRS) and Single Channel Ground and Airborne Radio System (SINCGARS), and available 802.11b/16 technologies will evaluate whether existing Command and Control requirements are met, determine the existence and extent of excess capacity, and identify potential adaptations required to implement commercial-off-the-shelf (COTS) technology into a military environment. The method for side-by-side evaluation will incorporate both COTS products as well as Marine Corps tactical communication devices in laboratory as well as field experimentation. This research captures key performance metrics such as range, power consumption, security, and bandwidth, but remains focused on the needs of the warfighter by evaluating performance of the system in support of Command and Control Compact Edition (C2CE) and Command and Control Personal Computer (C2PC) applications.
DTIC
Commercial Off-the-Shelf Products; Internets

20050243165 Naval Postgraduate School, Monterey, CA USA
Channel Estimation Techniques for Single and Multiple Transmit Antenna Orthogonal Frequency Division Multiplexing (OFDM) Systems
Sen, Mumtaz B.; Sep. 1, 2005; 93 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439677; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Orthogonal frequency division multiplexing (OFDM) is an efficient multi-carrier modulation technique which can be combined with transmitter and receiver diversity communication systems. Maximal ratio combining (MRC) and space-time block coding (STBC) can be used in conjunction with receiver and transmitter diversity in order to increase the communication system's performance. For these systems, channel estimation and tracking must be performed since the receiver requires channel state information for decoding. In this thesis, block-type and comb-type channel estimation algorithms for OFDM systems over multipath fading channels are studied and simulated. Performance results using simulated frequency-selective channels are presented.
DTIC
Estimating; Frequency Division Multiplexing; Multipath Transmission; Telecommunication

20050243168 New York Univ., New York, NY USA
Infrastructure for Automatic Dynamic Deployment of J2EE Applications in Distributed Environments
Akkerman, Anatoly; Totok, Alexander; Karamcheti, Vijay; Jan. 1, 2005; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N66001-00-1-8920; N66001-01-1-8929
Report No.(s): AD-A439681; CIMS-TR-2005-867; No Copyright; Avail.: CASI: A03, Hardcopy

Recent studies showed potential for using component frameworks for building flexible adaptible applications for deployment in distributed environments. However this approach is hindered by the complexity of deployment of component-based applications which usually involves a great deal of configuration of both the application components and system services they depend on. In this paper we propose an infrastructure for automatic dynamic deployment of J2EE applications that specifically addresses tbe problems of (1) inter-component connectivity specification and its effects on component configuration and deployment and (2) application component dependencies on application server services, their configuration and deployment. The proposed intrastructure provides simple yet expressive abstractions for potential application adaptation through dynamic deployment and undeployment of components . We implement the infrastructure as a part of the JBoss J2EE application server and test it on several sample J2EE applications.
DTIC
Architecture (Computers); Deployment; Software Development Tools

20050243212 Utah Univ., Salt Lake City, UT USA
The Stability of Geometric Inference in Location Determination
Sutherland, Karen T.; Jul. 8, 1994; 104 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): IRI-9196146
Report No.(s): AD-A439757; UUCS-94-021; No Copyright; Avail.: CASI: A06, Hardcopy

Geometric inference is widely used in computer vision, but very little attention has been given to the question of how geometric properties affect the resulting errors in the inferences made. This thesis addresses the problem of the stability of geometric inference in determining locations with a goal of being able to predict type and magnitude of the errors which occur and to determine on what basis to make geometric inferences which will minimize error. It is shown that the amount of the error occurring in a localization process using angular measurements to features depends heavily on which features are used, that the amount of the error occurring in such a localization process is not a function of the number of features used, that it is possible to develop simple heuristic functions for choosing features for localization which will significantly decrease error in that localization, that it is possible to decrease localization error in a particular direction, and that, if features have been identified but knowledge of left to right order in the view is unknown, simple steps can be taken to aid in determining that ordering. This knowledge is applied in the domain of robot navigation in outdoor, unstructured environments.
DTIC
Computer Vision; Inference; Position (Location); Stability

20050243238 Naval Postgraduate School, Monterey, CA USA
Modeling, Simulation and Performance Analysis of Multiple-Input Multiple-Output (MIMO) Systems with Multicarrier Time Delay Diversity Modulation
Shahid, Muhammad; Sep. 1, 2005; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439819; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis investigates the fundamentals of multiple-input single-output (MISO) and multiple-input multiple-output (MIMO) radio communication systems with space-time codes. A MISO system and MIMO systems were designed using multicarrier delay diversity modulation (MDDM). MDDM was incorporated with orthogonal frequency division multiplexing (OFDM). The design was implemented with binary phase shift keying (BPSK). Matlab was used to simulate the design, which was tested in both an additive white Gaussian noise (AWGN) channel and in a slow fading frequency nonselective multipath channel with AWGN. The receiver design was incorporated with the maximal ratio combiner (MRC) receiving technique with perfect knowledge of channel state information (CSI). The theoretical performance was derived for both channels and was compared with the simulated results.
DTIC
Frequency Division Multiple Access; MIMO (Control Systems); Performance Prediction; Performance Tests; Reliability Analysis; Simulation; Telecommunication; Time Lag

20050243242 Florida Univ., Gainesville, FL USA
An Extensible Markup Language (XML)-Based Software Architecture Enabling Model Fusion for the Battle Infosphere
Fishwick, Paul A.; Sep. 1, 2005; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-1-0592; Proj-558B
Report No.(s): AD-A439827; AFRL-IF-RS-TR-2005-328; No Copyright; Avail.: CASI: A03, Hardcopy

XML (eXtensible Markup Language) is the ubiquitous low-level language of the World Wide Web, and forms the primary structure for the emerging Semantic Web. The Semantic Web is the vision, and ongoing implementation, of how the web will transform over time to connect disparate pieces of knowledge, data, and resources. Our purpose in this contract was to create a foundation for the Semantic Web, suitable for deployment within the Air Force Infosphere project. The concept behind the Infosphere is one of rapid data and knowledge interchange, between physical objects, models, and computational processes. In our work, we created two XML schemas, defining two applications: MXL and DXL. MXL (Multimodeling eXchange Language) defines dynamic system models at a fairly high level of abstraction, and DXL (Dynamics eXchange Language) defines a low-level, block-oriented, language for a wide variety of simulation applications. With initial results in 2001, these two languages represented the first thorough implementations of XML in simulation, and they led the way to subsequent, higher level ontology studies.
DTIC
Architecture (Computers); Document Markup Languages; Languages; Semantics; Wide Area Networks

20050243377 Maryland Univ., Baltimore, MD USA
Profile Driven Data Management for Pervasive Environments
Perich, Filip; Avancha, Sasikanth; Chakraborty, Dipanjan; Joshi, Anupam; Yesha, Yelena; Jan. 1, 2005; 11 pp.; In English
Contract(s)/Grant(s): NSF IIS-98-75433; NSF CCR-00-70802
Report No.(s): AD-A439699; No Copyright; Avail.: CASI: A03, Hardcopy

The past few years have seen significant work in mobile data management, typically based on the client/proxy/server model. Mobile/wireless devices are treated as clients that are data consumers only, while data sources are on servers that typically reside on the wired network. With the advent of 'pervasive computing' environments an alternative scenario arises where mobile devices gather and exchange data from not just wired sources, but also from their ethereal environment and one another. This is accomplished using ad-hoc connectivity engendered by Bluetooth like systems. In this new scenario, mobile devices become both data consumers and producers. We describe the new data management challenges which this scenario introduces. We describe the design and present an implementation prototype of our framework, MoGATU, which addresses these challenges. An important component of our approach is to treat each device as an autonomous entity with its 'goals' and 'beliefs', expressed using a semantically rich language. We have implemented this framework over a combined Bluetooth and Ad-Hoc 802.11 network with clients running on a variety of mobile devices. We present experimental results validating our approach and measure system performance.
DTIC
Data Management; Client Server Systems; Data Processing; Autonomy

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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.

20050242031 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Jefferson Lab's Trim Card II
Allison, T.; Higgins, S.; Martin, E.; Merz, W.; Philip, S.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840059; No Copyright; Avail.: Department of Energy Information Bridge

Jefferson Lab's Continuous Electron Beam Accelerator Facility (CEBAF) uses Trim Card I power supplies to drive approximately 1900 correction magnets. These trim cards have had a long and illustrious service record. However, some of the employed technology is now obsolete, making it difficult to maintain the system and retain adequate spares. The Trim Card II is being developed to act as a transparent replacement for its aging predecessor. A modular approach has been taken in its development to facilitate the substitution of sections for future improvements and maintenance. The resulting design has been divided into a motherboard and 7 daughter cards which has also allowed for parallel development. The Trim Card II utilizes modern technologies such as a Field Programmable Gate Array (FPGA) and a microprocessor to embed trim card controls and diagnostics. These reprogrammable devices also provide the versatility to incorporate future requirements.
NTIS
Microprocessors; Computer Storage Devices

20050242974 Naval Postgraduate School, Monterey, CA USA
The USA Navy Reserve Component's Account Management Challenge in a Navy Marine Corps Intranet Environment
Graves, Gwendolyn M.; Sep. 1, 2005; 219 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439333; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Declining budgets and the reduction of workforce has caused many organizations to perform additional job assignments with fewer personnel. These organizations realized that in order to survive in a competitive market, scarce resources would provide the most value if used to work on mission-essential tasks, while allowing the performance of support functions by an outside source (called outsourcing). The Department of the Navy (DoN) is one organization that has chosen to outsource many business areas, but none bigger than the outsourcing of information technology (IT) to form the Navy Marine Corps Intranet (NMCI)-the largest IT outsourcing contract to date. While the DoN has faced many challenges since the onset of the NMCI contracting agreement, this thesis focuses on the challenges faced by the Navy Reserve with managing the Intranet's user accounts. The research uses the principles of Business Process Redesign (BPR) and Knowledge Management (KM) to determine the current state (As-Is) and to recommend changes in the account management process. Specifically, the Knowledge-Value Added (KVA) methodology was used to determine the amount of knowledge quantitatively embedded in each sub-process for a relative comparison of the value that the sub-processes provide to the overall process.
DTIC
Computer Networks; Information Management; Logistics Management; Navy; United States

20050242975 Naval Postgraduate School, Monterey, CA USA

Wireless Local Area Network (WLAN) Vulnerability Assessment and Security

Kessel, Adam; Goodwin, Shane; Sep. 1, 2005; 177 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439336; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The proliferation of wireless computer equipment and Local Area Networks (LANs) create an increasingly common and growing threat to Marine Corps Network infrastructure and communication security (COMSEC). This threat requires a capable deterrent in order to mitigate risks associated with both official and un-official wireless LANs. The potential efficiencies gained by employing wireless technology within the Marine Corps and DoD is quite significant. The Marine Corps must leverage this relatively inexpensive technology to conduct operations cheaper, faster and more effectively. However, these same wireless LAN capabilities have introduced new ways in which critical information infrastructure can be viewed, altered or even denied. Our thesis proposes the assessment of multiple installations within DoD ill order to identify vulnerabilities and ensure secure employment of wireless technologies. These assessments will enable the development of adequate measures to secure existing wireless transmissions and protect future transmissions from observation, modification or denial of service.

DTIC

Communication Networks; Local Area Networks; Security; Vulnerability; Wireless Communication

20050242985 Naval Postgraduate School, Monterey, CA USA

Automating Case Reports for the Analysis of Digital Evidence

Cassidy, Regis H. F.; Sep. 1, 2005; 235 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439380; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The reporting process during computer analysis is critical in the practice of digital forensics. Case reports are used to review the process and results of an investigation and serve multiple purposes. The investigator may refer to these reports to monitor the progress of his analysis throughout the investigation. When acting as an expert witness, the investigator will refer to organized documentation to recall past analysis. A lot of time can elapse between the analysis and the actual testimony. Specific reports may also be used in court as visual aids. Not all cases make it to court, but corporate managers will still likely want to review a case report. Since digital forensics is a relatively new field and can have a high learning curve, reports may be used as a mechanism for sharing knowledge of digital forensic practices. Existing open source forensics tools are an inexpensive alternative to commercial products, but lack the functionality to generate case reports. Open source tools are more likely to be accepted by the professional forensics community with this added capability. This thesis adds case report features to the Sleuth Kit and Autopsy Forensic Browser suite of tools, the premiere open-source forensics analysis software currently available.

DTIC

Computer Information Security; Information Systems

20050242991 Naval Postgraduate School, Monterey, CA USA

Lessons Learned From an Afloat Installation of an Ashore Command and Control System

Falbo, John; Newcomb, Christopher; Sep. 1, 2005; 153 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439407; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The installation process for afloat systems is very stringent. This rigor is necessary to ensure the Warfighters can fully utilize the functionality provided by information technology (IT) aboard a ship, especially when underway removed from most technical support and assistance. However, this rigor also increases the difficulty of executing an afloat installation. The purpose of this thesis is to document the lessons learned from the installation of the Ocean Surveillance Information System (OSIS) Evolutionary Development (OED) on board the USS Blue Ridge (LCC-19). OED is an ashore multi-level secure (MLS) command and control and intelligence (C2I) computer system that is fielded at the Joint Intelligence Centers and Joint Analysis Centers. The MLS aspect of OED allows the operator to view and add value to data from multiple security domains on one workstation. In the space, weight, and power (SWAP) constrained environment of a ship, this technology is very advantageous. Since OED is an ashore system, this afloat installation presented a number of challenges and a unique perspective into the installation process. This thesis documents these challenges, how they were overcome and provides future installers recommendations to improve the planning of future afloat installations.

DTIC

Command and Control; Information Systems; Installing

20050243056 New York Univ., New York, NY USA

A Distributed Adaptive Cache Update Algorithm for the Dynamic Source Routing Protocol

Yu, Xin; Kedem, Zvi M.; Jan. 1, 2003; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N66001-01-1-8929

Report No.(s): AD-A439506; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On-demand routing protocols use route caches to make routing decisions. Due to frequent topology changes. cached routes easily become stale. To address the cache staleness issue in DSR (the Dynamic Source Routing protocol). prior work mainly used heuristics with ad hoc parameters to predict the lifetime of a link or a route. However heuristics cannot accurately predict timeouts because topology changes are unpredictable. In this paper. We present a novel distributed cache update algorithm to make route caches adapt quickly to topology changes without using ad hoc parameters. We define a new cache structure called a cache table to maintain the information necessary for cache updates. When a node detects a link failure, our algorithm proactively notifies all reachable nodes that have cached the broken link in a distributed manner. We compare our algorithm with DSR with path caches and with Link-Maxlife through detailed simulations. We show that our algorithm significantly outperforms DSR with path and with Link-MaxLife.

DTIC

Algorithms; Protocol (Computers); Radiotelephones

20050243064 Maryland Univ., College Park, MD USA

Detection and Prevention of MAC Layer Misbehavior for ad hoc Networks

Cardenas, Alvaro A.; Radosavac, Svetlana; Baras, John S.; Jan. 1, 2004; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A439517; ISR-TR-2004-30; SEIL-TR-2004-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is known that 802.11 is not resilient to selfish behavior and denial of service (DoS) attacks targeting the MAC layer. In this study we assess the performance of the CSMA/CA scheme and investigate its efficiency with regard to security and information assurance in mobile ad hoc wireless networks. We investigate several variants of selfish node behaviors that abuse the random choice of Contention Window in the 802.11 DCF MAC protocol. We show that selfish behavior in the MAC layer can have devastating side effects on the performance of wireless networks similar to the effect of DoS attacks. Our main contributions are the prevention and detection of backoff manipulation in an ad hoc network. First we propose an algorithm to prevent backoff manipulation in a communication link between a sender and a receiver when at least one of the nodes behaves honestly. Secondly, we introduce algorithms for detection of backoff manipulation by a pair of colluding nodes.

DTIC

Access Control; Communication Networks; Multiple Access; Numerical Control; Prevention

20050243071 Army Research Lab., Aberdeen Proving Ground, MD USA

Diskless Linux Cluster How-To

Shumaker, Justin L.; Sep. 1, 2005; 28 pp.; In English

Report No.(s): AD-A439528; ARL-TR-3607; No Copyright; Avail.: CASI: A03, Hardcopy

Diskless linux clustering is not yet a turn-key solution. The process of configuring a cluster of diskless linux machines requires many modifications to the stock linux operating system before they can boot cleanly. This guide will help the experienced linux user to take a set of Pre-eXecution Environment capable machines and configure them appropriately. The following is a guide designed for instructing a skilled administrator on the steps necessary for configuring a diskless linux cluster. It is assumed that the reader is familiar with TFTP, DHCP, Pre-eXecution boot Environment (PXE), configuring and compiling kernels, and has general unix knowledge. Be prepared for some trial and error. During the writing of this report, I rebooted a diskless node well over 100 times in order to perfect the configuration. With the aid of this report one should only have to reboot their cluster a few times until the configuration is in good working order. As an overview, one will begin by configuring a 'master' node from where the slave nodes will retrieve their data. First, the process will begin with the configuration of TFTP and DHCP, which will allow the slaves to get an IP, hostname, kernel, and ramdisk. Next, a file from the SysLinux UNIX tape archive is used to permit PXE booting. Later, a custom kernel and ramdisk are created exclusively for the slave nodes for their boot process. Finally, the slaves are configured to operate in a diskless environment. The Post-Install section provides insight into some additional useful configurations as well as how a few of the problems that were encountered along the way were resolved.

DTIC

Computers; Unix (Operating System)

20050243075 Maryland Univ., College Park, MD USA

Rate of Degradation of Centralized Optimization Solutions and Its Application to High Performance Domain Formation in Ad Hoc Networks

Manousakis, Kyriakos; Baras, John S.; McAuley, Anthony J.; Morera, Raquel; Jan. 1, 2004; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-2-01-0011

Report No.(s): AD-A439537; TR-2004-26; No Copyright; Avail.: CASI: A02, Hardcopy

Future military systems such a FCS require a robust and flexible network that supports thousands of ad hoc nodes; therefore, we must ensure the scalability of networking protocols (e.g., routing, security and (QoS). The use of hierarchy is a powerful solution to the scaling problem, since it allows networking protocols to operate on a limited number of nodes, as opposed to the entire network. We have proposed an automated solution to dynamically create and maintain such hierarchy based on a combination of global optimization algorithms 1 and local distributed maintenance protocols 2. Global optimization clearly improves performance in a static network but, it is unclear how effective it is in a dynamic ad hoc environment. As network and node characteristics change, the optimization algorithm may use incomplete, stale, or even inaccurate metrics. In this paper, were analyze how the hierarchy created deteriorates from the optimal as network conditions change. We show that the fragility of the optimization depends on the particular cost function and the number of metrics that change. More important, we show, for the first time, that global optimization can remain effective for long periods with good cost functions, even in large dynamic ad hoc networks (where metrics may change rapidly due to node mobility and links making and breaking). This result shows that, with fast optimization algorithms such as modified Simulated Annealing 1, future military systems can use global optimization to autoconfigure domains to significantly improve performance. We also show that local maintenance protocols support the global optimization mechanisms by extending the time the hierarchy remains feasible.
DTIC

Algorithms; Communication Networks; Computer Networks; Degradation; Optimization

20050243085 Minnesota Univ., Minneapolis, MN USA

Situational Awareness Analysis Tools for Aiding Discovery of Security Events and Patterns

Kumar, Vipin; Kim, Yongdae; Srivastava, Jaideep; Zhang, Zhi-Li; Shaneck, Mark; Chandola, Varun; Liu, Haiyang; Choi, Changho; Simon, Gyorgy; Eilertson, Eric; Sep. 1, 2005; 142 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-03-C-0243; Proj-B104

Report No.(s): AD-A439552; AFRL-IF-RS-TR-2005-335; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of the effort was to develop a comprehensive situational awareness analysis tool for discovery of intrusive behavior in information infrastructures and understanding anomalous network traffic. The University of Minnesota team has developed a comprehensive, multi-stage analysis framework which provides tools and analysis methodologies to aid cyber security analysts in improving the quality and productivity of their analyses. It consists of several components: various Level-I sensors and analysis modules for detecting suspicious or anomalous events and activities, the output of which are then fed into a multi-step Level-II analysis system - the core of the analysis framework - that correlate and fuse Level-I sensor data and alerts, extract likely attack contexts and produce sequences of attack events to build a plausible attack scenario.
DTIC

Security; Situational Awareness; Software Development Tools

20050243092 Purdue Univ., West Lafayette, IN USA

Internet Protocol (IP) Network Measurement, Characterization, Modeling, and Control for Self-Managed Networks

Cleveland, William S.; Chen, Hui; Xi, Bowei; Cao, Jin; Sep. 1, 2005; 54 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-1-0150; Proj-N162

Report No.(s): AD-A439560; AFRL-IF-RS-TR-2005-341; No Copyright; Avail.: Defense Technical Information Center (DTIC)

IP network technology cannot continue on an ever-increasing course of technological complexity and yet require the kind of human intervention that is necessary today for network management. Networks must be self-managing. This can only be done by a system of measurement that copes with the dynamics of packet movement. This system must process the packet-level measurements into variables that characterize network behaviors, which then form the basis for control algorithms that react to the variables. Such packet level measurements can lead to characterization and control at the application layer, at the transport layer, at the network layer (including overlay networking), and in some cases at the link layer. The research documented in this report used tools of statistics, data mining and machine learning to (1) determine network

variables derivable from the measurements that characterize network behavior; (2) develop models of the critical network variables that characterize performance, usage, security, and early onset of problems; and (3) develop automated control methods based on the variables.
DTIC
Adaptive Control; Characterization; Computer Networks; Internets; Network Control; Protocol (Computers)

20050243099 Naval Postgraduate School, Monterey, CA USA
Developing a Reliable Methodology for Assessing the Computer Network Operations Threat of Iran
Patterson, Jason P.; Smith, Matthew N.; Sep. 1, 2005; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439569; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis is part of a project at the Naval Postgraduate School to assess the Computer Network Operations (CNO) threat of foreign countries. CNO consists of Computer Network Attack (CNA), Computer Network Exploitation (CNE), and Computer Network Defense (CND). Threats to the nation's critical infrastructures come from an adversary using CNA and CNE to degrade, deny or destroy access to the information systems they depend upon. Defensive capabilities are also addressed since exploitation, attack, and defense are inherently related. The result of a successful cyber-attack upon these critical infrastructures has the potential to cripple a country's communications and other vital services, economic well-being, and defensive capabilities. The goal of this thesis is to develop a methodology for assessing the CNO threat of Iran. The methodology is based on open sources that can supplement classified information acquired by the intelligence community.
DTIC
Computer Networks; Computers; Information Systems; Iran; Operators (Personnel)

20050243112 Maryland Univ., Baltimore, MD USA
A Security Architecture Based on Trust Management for Pervasive Computing Systems
Kagal, Lalana; Undercoffer, Jeffrey; Perich, Filip; Joshi, Anupam; Finin, Tim; Jan. 1, 2005; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0591
Report No.(s): AD-A439588; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Traditionally, stand-alone computers and small networks rely on user authentication and access control to provide security. These physical methods use system-based controls to verify the identity of a person or process, explicitly enabling or restricting the ability to use, change, or view a computer resource. However, these strategies are inadequate for the increased flexibility that distributed networks such as the Internet and ubiquitous/ pervasive computing environments require, as these systems lack central control and in addition, their users are not all predetermined. Users in pervasive environments expect to access locally hosted resources and services anytime and anywhere leading to serious security risks and access control problems. We propose a solution based on distributed trust management which involves developing a security policy, assigning credentials to entities, verifying that the credentials conform to the policy, delegating trust to third parties, revoking rights and reasoning about users access rights. This paper presents an infrastructure that complements existing security features like Public Key Infrastructure (PKI) and Role Based Access Control with distributed trust management to provide a highly flexible mode of enforcing security in pervasive computing environments.
DTIC
Architecture (Computers); Computer Networks; Computers; Management Systems; Security

20050243120 Carnegie-Mellon Univ., Pittsburgh, PA USA
Profiler-2000: Attacking the Insider Threat
Maxion, R. A.; Tan, K. M.; Killourhy, S. S.; Townsend, T. N.; Sep. 1, 2005; 151 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0528; Proj-IAST
Report No.(s): AD-A439600; AFRL-IF-RS-TR-2005-319; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Profiler project was concerned with fundamental theoretical and measurement issues in the field of anomaly/intrusion detection, particularly as directed at the problem of insiders. Major issues addressed were: scientifically sound foundations for divers anomaly detectors; tools and methods for assessment of detector effectiveness; and controlled benchmark data sets for testing. Major accomplishments of the project were: determining how the interaction between the architectural aspects of a detection algorithm, such as detection mechanism and coverage, can result in unanticipated vulnerabilities that allow an

adversary to undermine the detector; production of calibrated test data sets; and rigorous assessment and error analysis of an anomaly detector in an insider-threat environment.
DTIC
Anomalies; Computer Information Security; Detection; Intrusion; Warning Systems

20050243125 Maryland Univ., Baltimore, MD USA
A Policy Language for a Pervasive Computing Environment
Kagal, Lalana; Finin, Tim; Joshi, Anupam; Jan. 1, 2005; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-1-0215
Report No.(s): AD-A439609; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we describe a policy language designed for pervasive computing applications that is based on deontic concepts and grounded in a semantic language. The pervasive computing environments under consideration are those in which people and devices are mobile and use various wireless networking technologies to discover and access services and devices in their vicinity. Such pervasive environments lend themselves to policy-based security due to their extremely dynamic nature. Using policies allows the security functionality to be modified without changing the implementation of the entities involved. However, along with being extremely dynamic these environments also tend to span several domains and be made up of entities of varied capabilities. A policy language for environments of this sort needs to be very expressive but lightweight and easily extensible. We demonstrate the feasibility of our policy language in pervasive environments through a prototype used as part of a secure pervasive system.
DTIC
Policies; Wireless Communication

20050243135 Maryland Univ., Baltimore, MD USA
Developing Secure Agent Systems Using Delegation Based Trust Management
Kagal, Lalana; Finin, Tim; Joshi, Anupam; Jan. 1, 2005; 9 pp.; In English
Contract(s)/Grant(s): F30602-00-2-0591
Report No.(s): AD-A439633; No Copyright; Avail.: CASI: A02, Hardcopy

We present an approach to some security problems in multi-agent systems based on distributed trust and the delegation of permissions, and credibility. We assume an open environment in which agents must interact with other agents with which they are not familiar. In particular, an agent will receive requests and assertions from other agents and must decide how to act on the requests and assess the credibility of the assertions. In a closed environment, agents have well known and familiar transaction partners whose rights and credibility are known. The problem thus reduces to authentication the reliable identification of agents' true identity. In an open environment, however, agents must transact business even when knowing the true identities is un-informative. Decisions about who to believe and who to serve must be based on an agent's properties. These properties are established by proving them from an agent's credentials, delegation assertions, and the appropriate security policy. We begin by describing our approach and the concepts on which it is built. Then we present a design that provides security functions (authorization and credibility assessment) in a typical agent framework (FIPA) and describe initial work in its realization using the semantic web language DAML+OIL.
DTIC
Damage; Identities; Security

20050243139 Maryland Univ., Baltimore, MD USA
SOUPA: Standard Ontology for Ubiquitous and Pervasive Applications
Chen, Harry; Perich, Filip; Finin, Tim; Joshi, Anupam; Jan. 1, 2005; 11 pp.; In English
Contract(s)/Grant(s): F30602-97-1-0215
Report No.(s): AD-A439638; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe a shared ontology called SOUPA Standard Ontology for Ubiquitous and Pervasive Applications. SOUPA is designed to model and support pervasive computing applications. This ontology is expressed using the Web Ontology Language OWL and includes modular component vocabularies to represent intelligent agents with associated beliefs, desires, and intentions, time, space, events, user profiles, actions, and policies for security and privacy. We discuss how SOUPA can be extended and used to support the applications of CoBrA, a broker-centric agent architecture for building smart meeting

rooms, and MoGATU, a peer-to-peer data management for pervasive environments.
DTIC
Computer Techniques; Semantics; User Requirements

20050243140 Maryland Univ., Baltimore, MD USA
Neighborhood-Consistent Transaction Management for Pervasive Computing Environments
Perich, Filip; Joshi, Anupam; Yesha, Yelena; Finin, Timothy; Jan. 1, 2005; 11 pp.; In English
Contract(s)/Grant(s): F30602-00-2-0591
Report No.(s): AD-A439639; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper examines the problem of transaction management in pervasive computing environments and presents a new approach to address them. We represent each entity as a mobile or static semi-autonomous device. The purpose of each device is to satisfy user queries based on its local data repository and interactions with other devices currently in its vicinity. Pervasive environments, unlike traditional mobile computing paradigm, do not differentiate between clients and servers that are located in a fixed, wired infrastructure. Consequently, we model all devices as peers. These environments also relax other assumptions made by mobile computing paradigm, such as the possibility of reconnection with a given device, support from wired infrastructure, or the presence of a global schema. These fundamental characteristics of pervasive computing environments limit the use of techniques developed for transactions in a mobile computing environments. We define an alternative optimistic transaction model whose main emphasis is to provide a high rate of successful transaction terminations and to maintain a neighborhood-based consistency. The model accomplishes this via the help of active witnesses and by employing an epidemic voting protocol. The advantage of our model is that it enables two or more peers to engage in a reliable and consistent transaction while in a pervasive environment without assuming that they can talk to each other via infrastructure such as base stations. The advantage of using active witnesses and an epidemic voting protocol is that transaction termination does not depend on any single point of a failure. Additionally, the use of an epidemic voting protocol does not require all involved entities to be simultaneously connected at any time and, therefore, further overcomes the dynamic nature of the environments. We present the implementation of the model and results from simulations.
DTIC
Computer Storage Devices; Data Management; Data Storage

20050243150 Maryland Univ., College Park, MD USA
Balanced-RED: An Algorithm to Achieve Fairness in the Internet
Anjum, Farooq M.; Tassiulas, Leandros; Mar. 8, 1999; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AFOSR-95-1-0061; NCR-9502614
Report No.(s): AD-A439654; CSHCN-TR-99-9; ISR-TR-99-17; No Copyright; Avail.: CASI: A03, Hardcopy

The problem of fair bandwidth sharing among adaptive (Transmission Control Protocol) and nonadaptive (Computer-Based Reference/User Datagram Protocol) flows at an Internet gateway is considered. An algorithm that drops packet preventively, in an attempt to actively penalize the nonadaptive traffic that attempts to 'steal' buffer space, and therefore bandwidth from the adaptive traffic flows, is presented. This gateway algorithm provides fairness to the different flows passing through a gateway irrespective of whether the flow incorporates end-to-end feedback or not. Furthermore, the algorithm conforms with the scaling and design principles of the Internet. The resulting advantage is that nonadaptive applications have no incentive to remain so. The characteristics of the algorithm provided, Balanced Random Early Detection (BRED), is that it is simple to implement, maintains a small state, and is hence scalable. It should be remarked that a flow in this paper is identified by its source/destination addresses. The performance of the algorithm is compared with other gateway algorithms and it is shown that, in the presence of nonadaptive traffic, it achieves a more balanced bandwidth allocation among the different flows. The behavior of a flow subjected to the given algorithm also was analyzed in detail.
DTIC
Algorithms; Bandwidth; Detection; Frequency Assignment; Internets; Packet Switching; Protocol (Computers)

20050243151 Maryland Univ., College Park, MD USA
Functioning of TCP Algorithms over a Wireless Link
Anjum, Farooq M.; Tassiulas, Leandros; Mar. 28, 1999; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AFOSR-95-1-0061; NCR-9502614
Report No.(s): AD-A439655; CSHCN-TR-99-10; ISR-TR-99-20; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, the authors investigate the behavior of the various algorithms of Transmission Control Protocol (TCP), the internet data transport protocol, over wireless links with correlated packet losses. For such a scenario, they show that the performance of NewReno is worse than the performance of Tahoe in many situations, and even OldTahoe in a few situations, on account of the inefficient fast recovery method of NewReno. They also show that random loss leads to significant throughput deterioration when either the product of the square of the bandwidth-delay ratio and the loss probability when in the good state exceeds 1, or the product of the bandwidth-delay ratio and the packet success probability when in the bad state is less than two. The performance of Sack is always seen to be the best and the most robust, thereby arguing for the implementation of TCP Sack over the wireless channel. They also show that, under certain conditions, the performance depends not only on the bandwidth-delay product, but also on the nature of timeout, whether coarse or fine. They also have investigated the effects of reducing the fast retransmit threshold.
DTIC
Algorithms; Bandwidth; Internets; Packet Switching; Protocol (Computers); Transmission Loss; Wireless Communication

20050243159 Maryland Univ., Baltimore, MD USA
Vigil: Providing Trust for Enhanced Security in Pervasive Systems
Kagal, Lalana; Undercoffer, Jeffrey; Perich, Filip; Joshi, Anupam; Finin, Tim; Yesha, Yelena; Jan. 1, 2005; 35 pp.; In English
Contract(s)/Grant(s): F30602-97-1-0215
Report No.(s): AD-A439667; No Copyright; Avail.: CASI: A03, Hardcopy

Computing today is moving away from the desktop, becoming diffused into our surroundings and onto our personal digital devices. Moreover, ad-hoc networks such as Bluetooth provide for spontaneous connectivity between computationally enabled devices within proximity to each other. In such pervasive computing environments, users expect to access resources and services at any time from anywhere. This expectation results in serious security issues, since devices are constantly interacting with others outside of their 'home' environments. We describe the security challenges in pervasive computing, explaining why traditional security mechanisms fail to meet the demands of these environments. We use an agent-oriented paradigm to model the interactions between computationally enabled entities in such dynamic environments, and present an infrastructure that combines existing authentication features like Simple Public Key Infrastructure (SPKI) with notions of policy driven interaction and distributed trust, in order to provide a highly flexible approach for enforcing security policies in pervasive computing environments. We present an implementation of the system on a variety of handheld/laptop devices using Bluetooth/802.11, and include an ontology to describe principals, credentials and policies.
DTIC
Networks; Protocol (Computers); Security; Warning Systems

20050243172 Arizona State Univ., Tempe, AZ USA
Cyber Signal/Noise Characteristics and Sensor Models for Early Cyber Indications and Warning
Ye, Nong; Sep. 1, 2005; 195 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-03-C-0233; Proj-B104
Report No.(s): AD-A439692; AFRL-IF-RS-TR-2005-332; No Copyright; Avail.: CASI: A09, Hardcopy

We designed a method to develop a suite of specialized cyber sensors that are optimized to detect cyber attack observables. We develop our sensors using scientific knowledge of characteristics of cyber signal (attack data) and noise (normal 'norm' data). In our approach, we built models for attack norm characteristics. To detect characteristics, we used our norm model to filter out noise from mixed data and our attack model to detect a cyber signal. Our solution aims to reduce false alarm rates, increase detection rates and provide earlier detection with knowledge gained from our scientific investigation of attacks. The development phases of the attack-norm separation approach include classifying and profiling cyber attacks, analytical discovery of signet and noise characteristics, designing and testing sensor models, sensor fusion models, and finally an optimized suite of cyber sensors. We have created a number of sensors based on a subset of cyber attacks and tested them to show performance of attack detection and recognition.
DTIC
Early Warning Systems; Signal to Noise Ratios; Warning Systems

20050243201 Maryland Univ., College Park, MD USA
Key Management for Secure Multicast Communications
Poovendran, R.; Jan. 1, 1999; 109 pp.; In English
Report No.(s): AD-A439736; CSHCN-99-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Providing key management schemes for large scale multicast groups has become an important problem due to many potential commercial applications such as stock quote and software distribution on the Internet. For secure multicast communication, all the group members have to share a common session key. Since the member dynamics such as join or deletion do not necessarily terminate the multicast session, it is important to update the session key to all the valid members, so that the non-members do not have access to the future keys. Finding efficient ways for key generation and distribution in the presence of member dynamics is an actively researched problem. This dissertation considers the single sender, multiple receiver model of secure multicast communication. The goal is to develop schemes that have reduced computational overhead at the time of key generation, minimize the amount of message units required at the time of key updates, and minimize the number of keys to be stored by the sender as well as receivers.
DTIC
Message Processing; Security

20050243221 Duke Univ., Durham, NC USA
Self-Tuned Congestion Control for Multiprocessor Networks
Thottethodi, Mithuna; Lebeck, Alvin R.; Mukherjee, Shubhendu S.; Jan. 1, 2005; 13 pp.; In English
Contract(s)/Grant(s): DABT63-98-1-0001
Report No.(s): AD-A439780; No Copyright; Avail.: CASI: A03, Hardcopy

Network performance in tightly-coupled multiprocessors typically degrades rapidly beyond network saturation. Consequently, designers must keep a network below its saturation point by reducing the load on the network. Congestion control via source throttling -- a common technique to reduce the network load -- prevents new packets from entering the network in the presence of congestion. Unfortunately, prior schemes to implement source throttling either lack vital global information about the network to make the correct decision (whether to throttle or not) or depend on specific network parameters, network topology, or communication patterns. This paper presents a global knowledge-based, self-tuned, congestion control technique that prevents saturation at high loads across different network configurations and communication patterns. Our design is composed of two key components. First, we use global information about a network to obtain a timely estimate of network congestion. We compare this estimate to a threshold value to determine when to throttle packet injection. The second component is a self-tuning mechanism that automatically determines appropriate threshold values based on throughput feedback. A combination of these two techniques provides high performance under heavy load, does not penalize performance under light load, and gracefully adapts to changes in communication patterns.
DTIC
Communication Networks; Computer Networks; Congestion; Multiprocessing (Computers)

20050243379 Army Research Lab., Adelphi, MD USA
On Trust Establishment in Mobile Ad-Hoc Networks
Eschenauer, Laurent; Jan. 1, 2002; 46 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439702; CSHCN-MS-2002-4; No Copyright; Avail.: CASI: A03, Hardcopy

We present some properties of trust establishment in mobile, ad-hoc networks and illustrate how they differ from those of trust establishment in the Internet. We motivate these differences by providing an example of ad-hoc network use in battlefield scenarios, yet equally practical examples can be found in non-military environments. We present a framework for trust establishment in mobile ad-hoc networks and argue that peer-to-peer networks are especially suitable to solve the problems of generation, distribution, and discovery of trust evidence in mobile ad-hoc networks. We evaluate our approach through simulation with NS-2.
DTIC
Networks; Internets; Simulation

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*.

20050243057 Naval Postgraduate School, Monterey, CA USA
From Sticks and Stones to Zeros and Ones: The Development of Computer Network Operations as an Element of Warfare. A Study of the Palestinian-Israeli Cyberconflict and What the USA Can Learn from the 'Interfada'
Wrona, Jacqueline-Marie W.; Sep. 1, 2005; 151 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Palestinian-Israeli Cyberconflict erupted in 2000, when Israeli hackers crippled the prime website of Hezbollah by mobilizing pro-Israeli supporters to bomb the site with automated floods of electronic mail. In retaliation, Hezbollah rallied pro-Arab supporters for a counter-attack, which soon downed the main Israeli government website and the Israeli Foreign Ministry site. Attacks involving website defacements, denial-of-service, viruses, and Trojan horses occurred by both parties for a span of months, effectively shutting down websites, disrupting Internet service and e-commerce. A study and analysis of the utilization and effects of Computer Network Operations (CNO) between pro-Israeli and pro-Palestinian actors during the al-Aqsa Intifada may highlight current trends in warfare, support the notion that information may level the battlefield, and provide the USA with the means to better protect itself against such attacks in the future. This thesis seeks to collect, classify, analyze, define, and resolve IO/IW; the utilization and effects of CNO during the Al-Aqsa Intifada, and how such analysis can be applied to USA national security.
DTIC
Computer Networks; United States; Warfare

20050243065 Maryland Univ., College Park, MD USA
Biologically Inspired Algorithms for Optimal Control
Shao, Cheng; Hristu-Varsakelis, Dimitrios; Jan. 1, 2004; 58 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0465; DAAG55-97-1-0114
Report No.(s): AD-A439518; ISR-TR-2004-29; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Cooperative control systems are increasingly emerging as significant alternatives to their centralized counterparts. The rising interest in deploying cooperative systems is fueled by the development of decentralized systems with low cost and performance advantages. For example, mobile exploration and information gathering tasks can often be accomplished cheaply and more reliably by swarms of small autonomous robots as opposed to a single more sophisticated one. Cooperative control is also applied in many tasks that can not be performed by a single system, e.g. satellite arrays that enable global communication, geographically remote systems that communicate via network and others. The goal of our research is to investigate optimal control in cooperative systems, using algorithms inspired from biology. We begin with a review of collective behavior in biological systems.
DTIC
Algorithms; Control; Optimal Control; Robots

20050243066 Maryland Univ., College Park, MD USA
A Local Pursuit Strategy for Bio-Inspired Optimal Control with Partially-Constrained Final State
Shao, Cheng; Hristu-Varsakelis, Dimitrios; Jan. 1, 2005; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439519; ISR-TR-2005-76; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Inspired by the process by which ants gradually optimize their foraging trails, this report investigates the cooperative solution of a class of free-final time, partially-constrained final state optimal control problems by a group of dynamic systems. A class of cooperative, pursuit-based algorithms are proposed for finding optimal solutions by iteratively optimizing an initial feasible control. The proposed algorithms require only short-range, limited interactions between group members, avoid the need for a 'global map' of the environment on which the group evolves, and solve an optimal control problem in 'small' pieces, in a manner which will be made precise. The performance of the algorithms is illustrated in a series of simulations and laboratory experiments.
DTIC
Control; Optimal Control; Robots

20050243154 Naval Postgraduate School, Monterey, CA USA
Using Open Source Software in Visual Simulation Development
Salvatore, Richardo B.; Sep. 1, 2005; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439660; No Copyright; Avail.: CASI: A06, Hardcopy

The convergence between personal computer-based games and virtual environments technologies dramatically reduced development costs and potentially increased the use of the technology in training activities. Using open source/ free software tools in the process can expand these possibilities, resulting in even greater cost reduction and allowing the flexibility needed in a training environment. This thesis presents a configuration and architecture to be used when developing training visual simulations using both personal computers and open source tools. Aspects of the requirements needed in a visual simulation development, processes to develop an application and issues related to the use, licensing and selection of open source/free

software are analyzed to identify their limitations and possibilities. This architecture was tested by developing a small visual simulation. The tools and engine used are presented to enable any future project applying open source software to follow similar procedures.
DTIC
Computerized Simulation; Education; Human Factors Engineering; Open Source Licensing (Computers); Simulation; Virtual Reality; Visual Signals

20050243211 Maryland Univ., College Park, MD USA
Decentralized Control of Autonomous Vehicles
Baras, John S.; Tan, Xiaobo; Hovareshti, Pedram; Jan. 1, 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0465
Report No.(s): AD-A439756; CSHCN-TR-2003-8; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Decentralized control methods are appealing in coordination of multiple vehicles due to their low demand for long-range communication and their robustness to single-point failures. An important approach in decentralized multi-vehicle control involves artificial potentials or digital pheromones. In this paper we explore a decentralized approach to path generation for a group of combat vehicles in a battlefield scenario. The mission is to maneuver the vehicles to cover a target area. The vehicles are required to maintain good overall area coverage, and avoid obstacles and threats during the maneuvering. The gradient descent method is used, where each vehicle makes its moving decision by minimizing a potential function that encodes information about its neighbours, obstacles, threats and the target. We conduct analysis of vehicle behaviors by studying the vector field induced by the potential function. Simulation has shown that this approach leads to interesting emergent behaviors, and the behaviors can be varied by adjusting the weighting coefficients of different potential function terms.
DTIC
Autonomous Navigation; Autonomy; Simulation

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20050241675 Helsinki Univ., Helsinki, Finland
The group of orbit preserving G-homeomorphisms of an equivariant simplex for G a lie group
Goebel, Roman; Martio, Olli, Editor; 2005; ISSN 1239-6303; 67 pp.; In English
Report No.(s): Rept-144; Copyright; Avail.: Other Sources; Abstract Only

In this thesis we study deformations of the group of orbit preserving G-homeomorphisms of a fixed equivariant simplex Delta(sub n)(G; K(sub 0),... K(sub n)), denoted henceforth by X. Although the focus in the literature has been on the left G-action Phi: G x X approaches X, the equivariant simplex X also exhibits a natural right N(sup n, sub 0)-action Psi: X x N(sup n, sub 0) approaches X which commutes with the left G-action and preserves G-orbits. Here for k = 0 and below for any 0 less than or = k less than or = n we denote by N(sup n, sub k) the intersection N(K(sub k) intersection ... intersection N(K(sub n)) of normalizers.
Derived from text
Numerical Analysis; Lie Groups

20050241853 Tsukuba Univ., Japan
Moment Method Analysis of a Loop Array using Wavelet Expansions
Ojiro, Yasushi; Hirasawa, Kazuhiro; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1744-1747; In English; See also 20050241839; Copyright; Avail.: Other Sources

The application of a wavelet expansion to the moment method (WMoM) is studied for the analysis of a circular loop and a Yagi-Uda circular loop array. The usual expansion and weighting functions are replaced by periodic wavelets defined in the finite interval [0,1]. The periodic wavelet in [0,I] is constructed from the cardinal B-spline with the minimum support. Current distributions from the WMoM with the quadratic cardinal B-spline wavelet agree well with the results of the conventional moment method {MoM) and the sparse generalized impedance matrix is obtained. By using the threshold processing, the

WMoM may exhibit the advantages of shorter computation time and smaller storage for the matrix equation compared with the MoM.
Author
Wavelet Analysis; Method of Moments; Numerical Analysis; Matrices (Mathematics)

20050241871 Space Systems/Loral, Palo Alto, CA, USA
A Modified Iterative Refinement Algorithm for Efficient Solution of Parameter-Dependent Sets of Linear Equations
Simon, Peter S.; Kenney, Charles S.; McInturff, Kim; Jobsky, Robert W.; Bryan, Thomas A.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1510-1513; In English; See also 20050241839; Copyright; Avail.: Other Sources

A modified iterative refinement (MIR) algorithm is presented that reduces the time required to solve systems of linear equations that arise when using the method of moments to analyze electromagnetic problems over a band of frequencies. In such an analysis one typically factors the system matrix and solves the linear system at each analysis frequency. With MIR, the I.U. factorization of the system matrix obtained at one frequency is used to compute solutions at several additional nearby frequencies, often resulting in a major savings in computational effort. Since MIR is not an interpolation technique, answers obtained are numerically exact to any desired degree of precision.
Author
Linear Equations; Algorithms; Interpolation; Method of Moments; Frequencies; Factorization

20050241873 Calabria Univ., Arcavacta di Rende, Italy
IMPROVED SPECTRAL ITERATION TECHNIQUE FOR the SCATTERING FROM METALLIC CYLINDERS
Costanzo, Sandra; Di Massa, Giuseppe; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1538-1541; In English; See also 20050241839; Copyright; Avail.: Other Sources

The use of the EFIE (Electric Field Integral Equation) static solution, incorporating the correct edge behavior, as an initial estimate of the current distribution in an iterative scheme, is considered. The procedure for improving the initial form of the current density is developed by manipulating the integral equation in the Fourier transform domain. Imposing the static solution of the currant as first step in the iterative solution for the Fredholm integral equation of the first kind means to extract the singular part of the equation and consequently to improve the convergence.Diffraction by strips,semi-infinite conducting wedges, equilater triangular and square cylinders are considered as illustrative examples and validations of the method which is efficient in the entire frequency range, including also the resonance region. The procedure depicted with semplicity is applicable to more complex structures like printed circuits on gratified dielectric support, where the Green's function is known in the spectral domain.
Author
Current Density; Current Distribution; Fredholm Equations; Green's Functions; Integral Equations

20050241919 Illinois Univ., Chicago, IL, USA, Demaco, Inc., Champaign, IL, USA
Requirements Scaling Properties in Large Scale Computing
Song, J. M.; Chew, W.C.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1518-1521; In English; See also 20050241839
Contract(s)/Grant(s): N00014-95-1-0872; NSF ECS 93-02145; F49620-96-1-0025; Copyright; Avail.: Other Sources

We have witnessed the rapid progress of computational electromagnetics recently, due to its increased importance. Computational electromagnetics problems are generally solved by differential equation solvers as well as integral equation solvers [1]. Differential equation solvers solve for the field in a problem: the field permeates the whole of space in general, and hence the number of unknowns needed to model the problem correctly is generally large. Differential equation solvers have caught on in popularity recently, because of their associated sparse matrices. On the contrary, integral equation solvers solve for induced currents in a problem: the current resides only on the support of the body, and hence, the number of unknowns is generally small. But integral equation solvers yield dense matrices which are more costly to solve. Hence, the popularity of integral equation solvers has been impeded until recently.
Derived from text
Computational Electromagnetics; Differential Equations; Integral Equations

20050241948 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA

ScaleME: A Portable Scaleable Multipole Engine for Electromagnetic and Acoustic Integral Equation Solvers

Feng, Ling; Chao-Fu, Wang; Jian-Ming, Jin; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1774-1777; In English; See also 20050241839; Copyright; Avail.: Other Sources

Recently we have seen the development of the fast multipole algorithm (FMA) and its multilevel extensions as one of the most powerful techniques for accelerating integral equation solvers for electromagnetic and acoustic radiation and scattering problems. Using FMA, researchers have been able to solve electromagnetic problems o[unprecedented sizes. The objective of the present paper is to report some preliminary results from a new portable, scalable, parallel implementation of the dynamic multilevel fast multipole algorithm (MLFMA), called the ScaleME for Scaleable Multipole Engine. The algorithm is implemented as a library of user callable functions and is targeted at distributed memory machines and networked cluster of workstations using the message passing paradigm. The portability of the library is achieved by the use of the message passing interface (MPI). To the best of the authors' knowledge, this is the first ever implementation of this kind.

Derived from text

Algorithms; Electromagnetic Radiation; Acoustics; Integral Equations

20050241951 China Univ. of Science and Technology, Anhui, China

A New Method to Determine the Current Distribution on the EMC Dipole

Zhu, Qi; Xu, Shanjia; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1614-1617; In English; See also 20050241839; Copyright; Avail.: Other Sources

The determination of the current distribution on the dipole of microstrip antennas and the coupling between elements of arrays are of especially important for the analysis of microstrip antennas and arrays. Unfortunately, the calculation which involves the evaluation of Sommerfeld Integrals is tedious and lima-consuming because of the existence of the surface wave poles and the oscillation of the high order Bessel function. A new method is proposed in this paper to calculate the current distribution by using Chebyshev decomlx_sition to deal with the Sommerfeld Integrals. The calculation results show that the present method greatly improved the computing efficiency while retaining high accuracy.

Author

Antenna Arrays; Bessel Functions; Dipole Antennas; Microstrip Antennas; Sommerfeld Approximation

20050241953 Michigan Univ., Ann Arbor, MI, USA

Adaptive Integral Method for Hybrid FE/BI Modeling of 3D Doubly Periodic Structures

Eibert, Thomas F.; Volakis, John L.; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1754-1757; In English; See also 20050241839; Copyright; Avail.: Other Sources

The application of hybrid finite element (FE) / boundary integral (BI) methods to infinite periodic structures (antennas or frequency selective surfaces) is very attractive because it provides full 3D modeling flexibility. Basically, the finite element method is used to model the dielectric section of the unit cell, whereas the boundary integral provides for a rigorous mesh truncation at the upper and/or lower surfaces of the unit cell. Most practical problems can be analyzed by using planar BI surfaces and the corresponding half space periodic Green's function. However, for large unit cell apertures, the resulting BI matrix still becomes the most CPU intensive portion of the method. To alleviate the CPU and memory bottleneck, in this paper we present an acceleration and memory reduction scheme far the BI portion of a hybrid FE/BI method. The approach is based on the adaptive integral method (AIM) and is adapted here to periodic structures. For the given problem, AIM results in low O(sub ns) storage and O(sub ns log ns) CPU time requirements for the execution of the matrix vector or products in the applied iterative solver (ns = number of surface unknowns). The paper focuses especially on AIM issues related to infinite periodic structures. Also, we present CPU time and storage comparisons with the more conventional implementation of the FE/BI method.

Author

Periodic Functions; Finite Element Method; Frequencies; Matrices (Mathematics); Selective Surfaces

20050241954 New Mexico State Univ., Las Cruces, NM, USA

NONUNIFORM FAST FOURIER TRANSFORM (NUFFT) ALGORITHM and ITS APPLICATIONS

Qing Huo, Lin; Nhu, Nguyen; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1782-1785; In English; See also 20050241839

Contract(s)/Grant(s): CR-825225-010; ECS-9702195; Copyright; Avail.: Other Sources

Fast Fourier transform (FFT) has been enjoying widespread application in numerical analysis and other arena of applied mathematics since Cooley and Tukey [1] established, in the 1960s, a powerful fast algorithm for calculating discrete Fourier transforms. The requirement for using FFT algorithm is that the input data must be equally spaced. In many practical situationals, however, the input data is not equally spaced, and hence the regular FFT does not apply. To overcome this difficulty Dutt and Rokhlin [2] and Beylkin [3] studied the problem of FFT for nonuniform (unequally spaced) data. We propose a new approach to achieve the fast Fourier transform for nonuniform data by using a new class of matrices, the regular Fourier matrices [4,5]. This algorithm,also with a complexity of O(N log2N) where N is the number of data points, is more accurate than that proposed in [2] because our approximation error is minimized in the least-square sense. One of the important applications of this NUFFT algorithm is to enhance the newly developed pseudospectral time-domain (PSTD) method [6], which requires only two cells per minimum wavelength, with the capability of having a nonuniform grid.
Author
Algorithms; Discrete Functions; Fast Fourier Transformations; Fourier Transformation

20050241955 New Mexico State Univ., Las Cruces, NM, USA
CG-FFT for Nonuniform Inverse Fast Fourier Transforms (NU-IFFT's)
Xue Yuan, Tang; Qiug Huo, Liu; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1786-1789; In English; See also 20050241839
Contract(s)/Grant(s): CR-825-225-010; ECS-9702195; Copyright; Avail.: Other Sources

Fast Fourier Transform (FFT) has become a popular computational tool in the study of physics and engineering since its development in 1960's. The condition of using FFT algorithm is that the data acquisition must be equispaced. However, in some cases, the data acquisition is not uniformly spaced. Dott and Rokhlin and Beylkin presented some algorithms for the problems of FFT for nonuniform data. Their idea in solving the problems by a regular FFT is to approximate a function F(x) = c(sup -b(sq x)), by a small number of uniform points on the unit circle. Recently, a more accurate algorithm was developed by using the regular Fourier matrices for the nonuniform forward FFT (NUFFT). Instead of F(x), it uses F(j) = s, e(sup i2xcj/N),where j - -N/2, ..., N/2 - 1, and s, are chosen to minimize the approximation error. In this work, we use the conjugate-gradient method and regular FFT (CG-FFT) together with the NUFFT algorithm to develop an accurate algorithm for nonuniform inverse fast Fourier transform (NU-IFFT).
Author
Fourier Transformation; Fast Fourier Transformations; Conjugate Gradient Method

20050242992 Minnesota Univ., Minneapolis, MN USA
Efficient Closed Pattern Mining in the Presence of Tough Block Constraints
Gade, Krishna; Wang, Jianyong; Karypis, George; Nov. 25, 2003; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439408; TR-03-045; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In recent years, various constrained frequent pattern mining problem formulations and associated algorithms have been developed that enable the user to specify various itemset based constraints that better capture the underlying application requirements and characteristics. In this paper we introduce a new class of block constraints that determine the significance of an itemset pattern by considering the dense block that is formed by the pattern's items and its associated set of transactions. Block constraints provide a natural framework by which a number of important problems can be specified and make it possible to solve numerous problems on binary and real-valued datasets. However, developing computationally efficient algorithms to find these block constraints poses a number of challenges as unlike the different itemset-based constraints studied earlier, these block constraints are tough as they are neither anti-monotone, monotone, nor convertible. To overcome this problem, we introduce a new class of pruning methods that can be used to significantly reduce the overall search space and make it possible to develop computationally efficient block constraint mining algorithms. We present an algorithm called CBMiner that takes advantage of these pruning methods to develop an algorithm for finding the closed itemsets that satisfy the block constraints. Our extensive performance study shows that CBMiner generates more concise result set and can be order(s) of magnitude faster than the traditional frequent closed itemset mining algorithms.
DTIC
Algorithms; Data Mining

20050242995 Minnesota Univ., Minneapolis, MN USA

THETO - A Fast and High-Quality Partitioning Driven Global Placer

Selvakkumaran, Navaratnasothie; Karypis, George; Nov. 25, 2003; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-2-0014

Report No.(s): AD-A439412; TR-03-046; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Partitioning driven placement approaches are often preferred for fast and scalable solutions to large placement problems. However, due to the inaccuracy of representing wirelength objective by cut objective the quality of such placements often trails the quality of placements produced by pure wirelength driven placements. In this paper we present THETO, a new partitioning driven global placement algorithm that retains the speed associated with traditional partitioning driven placement algorithms but incorporates a number of novel ideas that allows it to produce solutions whose quality is better than those produced by more sophisticated and computationally expensive algorithms. The keys to THETO's success are a new terminal propagation method that allows the partitioner to better capture the characteristics of the various cut nets and a new post-bisectioning refinement step that enhances the effectiveness of the new terminal propagation. Experiments on the ISPD98 benchmarks shows that THETO produces global placement solutions that are 6% better in terms of the half perimeter wirelength than Dragon while requiring significantly less time.

DTIC

Algorithms; Integrated Circuits

20050242997 Minnesota Univ., Minneapolis, MN USA

Multi-Resource Aware Partitioning Algorithms for FPGAs With Heterogeneous Resources

Nov. 25, 2003; 8 pp.; In English

Report No.(s): AD-A439414; TR-03-047; No Copyright; Avail.: CASI: A02, Hardcopy

As FPGA densities increase, partitioning-based FPGA placement approaches are becoming increasingly important as they can be used to provide high-quality and computationally scalable solutions. However, modern FPGA architectures incorporate heterogeneous resources, which place additional requirements on the partitioning algorithms because they now need to not only minimize the cut and balance the partitions, but also they must ensure that none of the resources in each partition is oversubscribed. In this paper, we present a number of multilevel multi-resource partitioning algorithms that are guaranteed to produce solutions that balance the utilization of the different resources across the partitions. We evaluate our algorithms on twelve industrial benchmarks ranging in size from 5,236 to 140,118 vertices and show that they achieve minimal degradation in the min-cut while balancing the various resources. Comparing the quality of the solution produced by some of our algorithms against that produced by hMETIS, we show that our algorithms are capable of balancing the different resources while incurring only a 3.3% 5.7% higher cut.

DTIC

Algorithms; Heterogeneity; Integrated Circuits; Resources

20050243000 Minnesota Univ., Minneapolis, MN USA

Partitioning Algorithms for Simultaneously Balancing Iterative and Direct Methods

Moulitsas, Irene; Karypis, George; Mar. 3, 2004; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-2-0014

Report No.(s): AD-A439418; TR-04-014; No Copyright; Avail.: CASI: A03, Hardcopy

This paper focuses on domain decomposition-based numerical simulations whose sub problems corresponding to the various subdomains are solved using sparse direct factorization methods (e.g., FETI). Effective load-balancing of such computations requires that the resulting partitioning simultaneously balances the amount of time required to factor the local subproblem using direct factorization, and the number of elements assigned to each processor. Unfortunately, existing graph-partitioning algorithms cannot be used to load-balance these type of computations as they can only compute partitionings that simultaneously balance numerous constraints defined a priori on the vertices and optimize different objectives defined locally on the edges. To address this problem, we developed an algorithm that follows a predictor- corrector approach that first computes a high-quality partitioning of the underlying graph, and then modifies it to achieve the desired balancing constraints. During the corrector step we compute a fill reducing ordering for each partition, and then we modify the initial partitioning and ordering so that our objectives are satisfied. Experimental results show that the proposed algorithm is able to reduce the fill-in of the overweight sub-domains and achieve a considerably better balance.

DTIC

Algorithms; Balancing; Iterative Solution; Parallel Processing (Computers)

20050243006 Minnesota Univ., Minneapolis, MN USA
Soft Clustering Criterion Functions for Partitional Document Clustering
Zhao, Ying; Karypis, George; May 26, 2004; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439425; TR-04-022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recently published studies have shown that partitional clustering algorithms that optimize certain criterion functions, which measure key aspects of inter- and intra-cluster similarity, are very effective in producing hard clustering solutions for document datasets and outperform traditional partitional and agglomerative algorithms. In this paper we study the extent to which these criterion functions can be modified to include soft membership functions and whether or not the resulting soft clustering algorithms can further improve the clustering solutions. Specifically, we focus on four of these hard criterion functions, derive their soft-clustering extensions, present a comprehensive experimental evaluation involving twelve different datasets, and analyze their overall characteristics. Our results show that introducing softness into the criterion functions tends to lead to better clustering results for most datasets and consistently improve the separation between the clusters.
DTIC
Algorithms; Criteria

20050243014 Minnesota Univ., Minneapolis, MN USA
GREWA Scalable Frequent Subgraph Discovery Algorithm
Kuramochi, Michihiro; Karypis, George; Jun. 22, 2004; 15 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439436; TR-04-024; No Copyright; Avail.: CASI: A03, Hardcopy

Existing algorithms that mine graph datasets to discover patterns corresponding to frequently occurring subgraphs can operate efficiently on graphs that are sparse, contain a large number of relatively small connected components, have vertices with low and bounded degrees, and contain well-labeled vertices and edges. However, there are a number of applications that lead to graphs that do not share these characteristics, for which these algorithms highly become unscalable. In this paper we propose a heuristic algorithm called GREW to overcome the limitations of existing complete or heuristic frequent subgraph discovery algorithms. GREW is designed to operate on a large graph and to find patterns corresponding to connected subgraphs that have a large number of vertex-disjoint embeddings. Our experimental evaluation shows that GREW is efficient, can scale to very large graphs, and find non-trivial patterns that cover large portions of the input graph and the lattice of frequent patterns.
DTIC
Algorithms; Classifications; Heuristic Methods; Mining

20050243015 Minnesota Univ., Minneapolis, MN USA
SUMMARY: Efficiently Summarizing Transactions for Clustering
Wang, Jianyong; Karypis, George; Jun. 22, 2004; 11 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439440; TR-04-025; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Frequent itemset mining was initially proposed and has been studied extensively in the context of association rule mining. In recent years, several studies have also extended its application to the transaction (or document) classification and clustering. However, most of the frequent-itemset based clustering algorithms need to first mine a large intermediate set of frequent itemsets in order to identify a subset of the most promising ones that can be used for clustering. In this paper, we study how to directly find a subset of high quality frequent itemsets that can be used as a concise summary of the transaction database and to cluster the categorical data. By exploring some properties of the subset of itemsets that we are interested in, we proposed several search space pruning methods and designed an efficient algorithm called SUMMARY. Our empirical results have shown that SUMMARY runs very fast even when the minimum support is extremely low and scales very well with respect to the database size, and surprisingly, as a pure frequent itemset mining algorithm it is very effective in clustering the categorical data and summarizing the dense transaction databases.
DTIC
Classifications; Data Bases

20050243034 Minnesota Univ., Minneapolis, MN USA
Multi-Objective Hypergraph Partitioning Algorithms for Cut and Maximum Subdomain Degree Minimization
Selvakkumaran, Navaratnasothie; Karypis, George; Sep. 29, 2004; 25 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439471; TR-04-036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we present a family of multi-objective hypergraph partitioning algorithms based on the multilevel paradigm, which are capable of producing solutions in which both the cut and the maximum subdomain degree are simultaneously minimized. This type of partitionings are critical for existing and emerging applications in VLSI CAD as they allow to both minimize and evenly distribute the interconnects across the physical devices. Our experimental evaluation on the ISPD98 benchmark show that our algorithms produce solutions that when compared against those produced by hMETIS have a maximum subdomain degree that is reduced by up to 36% while achieving comparable quality in terms of cut.
DTIC
Algorithms; Computer Aided Design; Cutting; Optimization

20050243039 Texas Univ., Austin, TX USA
Multiscale and Stabilized Methods
Hughes, Thomas J.; Scovazzi, Guglielmo; Franca, Leopoldo P.; Jan. 1, 2004; 103 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-1-0263
Report No.(s): AD-A439478; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This article presents an introduction to multiscale and stabilized methods, which represent unified approaches to modeling and numerical solution of fluid dynamic phenomena. Finite element applications are emphasized but the ideas are general and apply to other numerical methods as well. (They have been used in the development of finite difference, finite volume, and spectral methods, in addition to finite element methods.) The analytical ideas are first illustrated for time-harmonic wave-propagation problems in unbounded fluid domains governed by the Helmholtz equation. This leads to the well-known Dirichlet-to-Neumann formulation. A general treatment of the variational multiscale method in the context of an abstract Dirichlet problem is then presented which is applicable to advective-diffusive processes and other processes of physical interest. It is shown how the exact theory represents a paradigm for subgrid-scale models and posteriori error estimation. Hierarchical p-methods and bubble function methods are examined in order to understand and, ultimately, approximate the 'fine-scale Green's function' which appears in the theory. Relationships among so-called residual-free bubbles, element Green's functions, and stabilized methods are exhibited. These ideas are then generalized to a class of non-symmetric, linear evolution operators formulated in space-time. The variational multiscale method also provides guidelines and inspiration for the development of stabilized methods which have attracted considerable interest and have been extensively utilized in engineering and the physical sciences. An overview of stabilized methods for advective-diffusive equations is presented. A variational multiscale treatment of incompressible viscous flows, including turbulence is also described. This represents an alternative formulation of Large Eddy Simulation which provides simplified theoretical framework of LES with potential for improved modeling.
DTIC
Fluid Dynamics; Numerical Analysis

20050243042 Minnesota Univ., Minneapolis, MN USA
Discovering Frequent Geometric Subgraphs
Kuramochi, Michihiro; Karypis, George; Oct. 21, 2004; 32 pp.; In English
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439484; TR-04-039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Data mining-based analysis methods are increasingly being applied to datasets derived from science and engineering domains that model various physical phenomena and objects. In many of these datasets, a key requirement for their effective analysis is the ability to capture the relational and geometric characteristics of the underlying entities and objects. Geometric graphs, by modeling the various physical entities and their relationships with vertices and edges, provide a natural method to represent such datasets. In this paper we present gFSG, a computationally efficient algorithm for finding frequent patterns corresponding to geometric subgraphs in a large collection of geometric graphs. gFSG is able to discover geometric subgraphs that can be rotation, scaling, and translation invariant, and it can accommodate inherent errors on the coordinates of the vertices. We evaluated its performance using a large database of over 20,000 chemical structures, and our results show that

it requires relatively little time, can accommodate low support values, and scales linearly with the number of transactions.
DTIC
Exploration

20050243043 Minnesota Univ., Minneapolis, MN USA
An Efficient Parallel Finite-Element-Based Domain Decomposition Iterative Technique With Polynomial Preconditioning
Liang, Yu; Kanapady, Ramdev; Tamma, Kumar; Jan. 18, 2005; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAH04-96-C-0086; DAAD19-01-2-0014
Report No.(s): AD-A439487; TR-05-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An efficient parallel finite element-based domain decomposition iterative technique with polynomial preconditioning with particular attention to the GMRES solver is presented. Unlike the standard row-oriented partitioning of a matrix, finite element based domain decomposition with polynomial preconditioning circumvents the assembly of matrix, reordering of matrix, redundant computations associated with the interface elements, numerical problems associated with local preconditioner, and costly global preconditioner construction. A dramatic reduction in parallel overhead both in terms of computation and communication results in a highly scalable solver. The parallel performance results for large-scale static and dynamic problems on the IBM SP2 and the SGI Origin are presented.
DTIC
Decomposition; Finite Element Method; Parallel Processing (Computers); Polynomials

20050243054 Minnesota Univ., Minneapolis, MN USA
Prediction of Contact Maps Using Support Vector Machines
Zhao, Ying; Karypis, George; Dec. 9, 2002; 13 pp.; In English
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439501; TR-02-039; No Copyright; Avail.: CASI: A03, Hardcopy

Contact map prediction is of great interests for its application in fold recognition and protein 3D structure determination. In particular, we focusd on predicting non-local interactions in this paper. We employed Support Vector Machines (SVMs) as the machine learning tool and incorporated AAindex to extract correlated mutation analysis (CMA) and sequence profile (SP) features. In addition, we evaluated the effectiveness of different features for various fold classes. On average, our predictor achieved an prediction accuracy of 0.2238 with an improvement over a randompredictor of a factor 11.7, which is better than reported studies. Our study showed that predicted secondary structure features play an important roles for the proteins containing beta structures. Models based on secondary structure features and CMA features produce different sets of predictions. Our study also suggests that models learned separately for different protein fold families may achieve better performance than a unified model.
DTIC
Nonlinear Systems; Predictions; Proteins

20050243062 Maryland Univ., College Park, MD USA
Geometric Cooperative Control of Formations
Zhang, Fumin; Jan. 1, 2004; 241 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-97-1-0114; DAAD19-01-1-0465
Report No.(s): AD-A439514; ISR-PHD-2004-4; CDCSS-PHD-2004-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Robots in a team are modeled as particles which obey simple, second order dynamics. The whole team can be viewed as a deformable body with changing shape and orientation. Jacobi shape theory is applied to model such a formation. The configuration space of the whole formation is then viewed as a fiber bundle on Jacobi shape space. Applications of shape theory to analyze problems, such as the sequential pursuit, provide insights on body motion and shape changes. We derive the controlled system equations using the Lagrange-D'Alembert principle. In the resulting Lagrangian equations, the motion of the center of mass of the formation is decoupled from the rotation and shape dynamics. Furthermore, control forces on each robot are combined and reorganized as controls for the center, for rotation and for shape changes. From a shape-theoretic point of view, general feedback control laws are designed to achieve desired formations. This class of feedback control laws induces interactions that can be computed in a distributed manner. When communication links and GPS are available to each robot, we use Jacobi vectors as feedback for control. We show that formations are set up asymptotically. The system equations on

shape space provide possibilities for achieving formations without communication links between team members, under the assumption that each robot uses its sensors to measure shape and rotation of the formation. We allow each robot freedom to establish a coordinate system in which shape dynamics of the whole formation is computed. Without knowing such coordinate systems of other robots, each robot is able to perform cooperative control. This is made possible by a class of gauge covariant control laws. Using Lyapunov functions, we prove that controlled dynamics converges to an invariant set where desired shape is achieved. We argue that this freedom of choosing gauge frame helps to improve controller performance in a noisy environment.
DTIC
Control Theory; Robots; Shapes

20050243067 Maryland Univ., College Park, MD USA
Lyapunov-Based Feedback Control of Border Collision Bifurcations in Piecewise Smooth Systems
Hassouneh, Munther A.; Abed, Eyad H.; Jan. 1, 2004; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439520; ISR-TR-2004-37; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Feedback control of piecewise smooth discrete time systems that undergo border collision bifurcations is considered. These bifurcations occur when a fixed point or a periodic orbit of a piecewise smooth system crosses or collides with the border between two regions of smooth operation as a system parameter is quasi-statically varied. The goal of the control effort in this work is to modify the bifurcation so that the bifurcated steady state is locally attracting and locally unique. To achieve this, Lyapunov-based techniques are used. A sufficient condition for nonbifurcation with persistent stability in piecewise smooth maps of dimension n that depend on a parameter is derived. The derived condition is in terms of linear matrix inequalities. This condition is then used as a basis for the design of feedback controls to eliminate border collision bifurcations in piecewise smooth maps and to produce desirable behavior.
DTIC
Collisions; Control; Feedback; Feedback Control

20050243086 Evolving Logic, Topanga, CA USA
Pre-Conflict Anticipation and Shaping (PCAS): Models-2-Shaping Integration
Bankes, Steven; Lempert, Robert J.; Popper, Steven W.; Sep. 1, 2005; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-04-C-0215; DARPA ORDER-T430-00; Proj-T438
Report No.(s): AD-A439553; AFRL-IF-RS-TR-2005-338; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The project investigated techniques of computational support for devising shaping strategies and 'fusing', or jointly using, multiple different models representing relevant information and knowledge. A demonstration problem involving actions the US might take regarding Pakistan's Northwestern Territories and utilizing an assembled suite of models was developed. The models were placed in Evolving Logic's Computer Assisted Reasoning system (CARs) software environment and provided the basis for compound computational experiments to demonstrate that the use of multiple models (both alternative model variants, and complementary models of different type) can provide more insight and better decisions than any one model could and that the suite of models together with the technology can provide a basis for devising shaping strategies. The analytical outcome suggests that a useful definition of a shaping strategy is one involving near-term actions that are robust to the uncertainties and satisfies a series of goals, in both the short and long term.
DTIC
Military Operations; Models; Multisensor Fusion; Strategy; Warfare

20050243104 Minnesota Univ., Minneapolis, MN USA
Multi-Objective Hypergraph Partitioning Algorithms for Cut and Maximum Subdomain Degree Minimization
Selvakkumaran, Navaratnasothie; Karypis, George; Apr. 17, 2003; 10 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439577; TR-03-019; No Copyright; Avail.: CASI: A02, Hardcopy

In this paper we present a family of multi-objective hypergraph partitioning algorithms based on the multilevel paradigm, which are capable of producing solutions in which both the cut and the maximum subdomain degree are simultaneously minimized. This type of partitionings are critical for existing and emerging applications in VLSI CAD as they allow to both minimize and evenly distribute the interconnects across the physical devices. Our experimental evaluation on the ISPD98 benchmark show that our algorithms produce solutions that when compared against those produced by hMETIS have a

maximum subdomain degree that is lower by 5% to 54% while achieving comparable quality in terms of cut.
DTIC
Algorithms; Cutting; Optimization

20050243107 Villanova Univ., PA USA
Digital Watermarking of Autonomous Vehicles Imagery and Video Communication
Mobasseri, Bijan G.; Zhang, Yimin; Amin, Moeness; Dogahe, Behzad M.; Fleming, Christopher; Oct. 1, 2005; 182 pp.; In English
Contract(s)/Grant(s): N00014-04-1-0630
Report No.(s): AD-A439582; 5-27729; No Copyright; Avail.: CASI: A09, Hardcopy

Digital media is incredibly easy to create, store, copy and manipulate. For these reasons it is desirable to authenticate, trace and otherwise fingerprint digital media at the point of origination. These objectives can be accomplished by digital watermarking whereby a digital signature is embedded in imperceptible portions of cover media. Since the marked media may undergo friendly operations such as filtering, compression and scaling the watermark must be robust. One of the more difficult operations that the digital watermark must survive is geometric manipulation. In this paper we present a digital watermarking algorithm that can survive the combined compression/rotation attack and still remain detectable.
DTIC
Algorithms; Autonomy; Digital Systems; Imagery; Video Communication

20050243131 Space and Naval Warfare Systems Center, San Diego, CA USA
Multiobjective Optimization on Function Spaces: A Kolmogorov Approach
Allen, J. C.; Acero, D.; Jul. 1, 2005; 63 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439625; SSC-TR-1930; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report makes explicit that the Kolmogorov Criterion can specialize with sufficient detail to yield concrete and computationally viable tests that identify solutions to difficult optimization problems. Specifically, the classical equal-ripple characterization of best polynomial approximation is generalized to nonlinear polynomial optimization, and then generalized again to multiobjective polynomial optimization. Thus, results in polynomial optimization stretching over this last century readily fit into a single framework and are illustrated with applications in filter design and control theory. In addition to the finite-dimensional polynomials, the Kolmogorov Criterion also applies to the infinite-dimensional disk algebra. The disk algebra is basic to signal processing and control theory. Many engineering problems in these disciplines are optimization problems on the disk algebra. The Kolmogorov Criterion readily characterizes the minimizers of these nonlinear optimization problems. By making explicit the Kolmogorov Criterion and working specific examples, this report equips researchers with a general approach to optimization on spaces of functions and a collection of accessible research problems.
DTIC
Criteria; Kolmogorov Theory; Optimization

20050243132 Minnesota Univ., Minneapolis, MN USA
Better Kernels and Coding Schemes Lead to Improvements in SVM-Based Secondary Structure Prediction
Karypis, George; Jul. 29, 2005; 9 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439626; TR-05-028; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The accurate prediction of a protein's secondary structure plays an increasingly critical role in predicting its function and tertiary structure, as it is utilized by many of the current state-of-the-art methods for remote homology, fold recognition, and ab initio structure prediction. Methods: We developed a new secondary structure prediction algorithm called YASSPP that uses a pair of cascaded models constructed from two sets of binary SVM-based models. YASSPP uses an input coding scheme that combines both position-specific and nonposition specific information, utilizes a kernel function designed to capture the sequence conservation signals around the local window of each residue, and constructs a second-level model by incorporating both the three-state predictions produced by the first-level model and information about the original sequence. Experiments on three standard datasets (RS126, PB513, and EVA common subset 4) show that YASSPP is capable of producing the highest Q3 and SOV scores than that achieved by existing widely used schemes such as PSIPRED, SSPro 4.0, SAM-T99sec, as well as previously developed SVM-based schemes. On the EVA dataset it achieves a Q3 and SOV score of 79.34% and 78.65%,

which are considerably higher than the best reported scores of 77.64% and 76.05%, respectively.
DTIC
Coding; Kernel Functions

20050243137 Maryland Univ., Baltimore, MD USA
In Reputation We Believe: Query Processing in Mobile Ad-Hoc Networks
Perich, Filip; Undercoffer, Jeffrey; Kagal, Lalana; Joshi, Anupam; Finin, Timothy; Yesha, Yelena; Jan. 1, 2005; 10 pp.; In English
Contract(s)/Grant(s): F30602-00-2-0591
Report No.(s): AD-A439635; No Copyright; Avail.: CASI: A02, Hardcopy

Research on data management in mobile ad-hoc networks focuses on discovering sources and acquiring information. Mobile devices assume answers to be correct and do not verify the veracity of the information or the providers. This assumption is suitable for most client-server environments; however, peer-to-peer environments lack the intrinsic stability of 'anchored' sources. In mobile ad-hoc networks, sources may provide faulty information, which can lead to incorrect conclusions. Consequently, devices need a mechanism to evaluate the integrity of their peers and the accuracy of peer provided information. To address this problem we propose a query processing model that relies on distributed trust and belief. Each device maintains and shares beliefs regarding the degree of trust it has for its peers - where trust is determined by experience and reputation. Additionally, each device associates a value indicating its belief in the accuracy of the information it holds. This knowledge is used by devices to determine the reliability of query responses. We implement our model in GloMoSim and provide experimental results for different combinations of trust and accuracy algorithms.
DTIC
Accuracy; Algorithms; Data Processing; Networks

20050243157 Maryland Univ., College Park, MD USA
Computation for Nonlinear Balancing
Newman, Andrew J.; Krishnaprasad, P. S.; Jan. 1, 1998; 4 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-97-1-0114
Report No.(s): AD-A439664; ISR-TR-98-40; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper illustrates a computational approach to practical nonlinear balancing via the forced damped pendulum example. The authors have illustrated a computational approach for practical implementation of Scherpen's nonlinear balancing procedure via application to the forced damped pendulum system. A monte-Carlo approach provides an estimate of the controllability energy function. The observability energy function is computed via numerical integration and also is suitable as an empirical method. Numerical implementation of the Morse-Palais lemma is achieved using a successive approximation algorithm for an operator square root which appears in Palais' proof. The corresponding convergence criterion gives an estimate of the neighborhood in which the given function is locally quadratic. The balanced realization for the pendulum system results in one state having roughly double the input-output influence as the other state.
DTIC
Balancing; Computation; Control; Mathematical Models; Nonlinear Systems; Nonlinearity

20050243158 Universidad Politecnica de Madrid, Madrid, Spain
A Novel 3D Hybrid FEM-PO Technique for the Analysis of Scattering Problems
Gomez-Revuelto, Ignacio; Garcia-Castillo, Luis E.; de Adana, F. S.; Salazar-Palma, Magdalena; Sarkar, Tapan K.; Apr. 23, 2004; 9 pp.; In English
Report No.(s): AD-A439666; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A novel three-dimensional hybrid Finite Element Method (FEM) and Physical Optics (PO) technique for the efficient analysis of scattering problems is presented. It makes use of FEM for the regions with small and complex features and PO for the analysis of the electrically large objects of the structure taking into account mutual interactions between the FEM domains and the objects analyzed with PO. The hybrid method proposed makes use of an iterative FEM for open region problems that allows the FEM domain to be truncated with a minimum number of unknowns while retaining the original sparse and banded structure of the FEM matrices and also an easy hybridization with other numerical techniques (as PO in this paper). Several numerical results are given showing some of the features of the method.
DTIC
Finite Element Method; Physical Optics; Scattering

20050243166 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
Theory and Algorithms for Global/Local Design Optimization
Watson, Layne T.; Guerdal, Zafer; Haftka, Raphael T.; Sep. 29, 2005; 15 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0090
Report No.(s): AD-A439678; AFRL-SR-AR-TR-05-0480; No Copyright; Avail.: CASI: A03, Hardcopy

The motivating application for this research is the global/local optimal design of composite aircraft structures such as wings and fuselages, but the theory and algorithms are more widely applicable in engineering design. Research is proposed on three distinct topics. (1) Rigorous mathematical theory will be developed supporting a decomposition strategy for global/local optimization. Advanced computational and numerical approximation techniques, such as massively parallel computing and surrogate functions, will be used in the decomposition. (2) Local panel optimization algorithms that can handle both discrete and continuous variables efficiently will be investigated. Several different strategies for blending local composite panel designs to improve manufacture will be developed and tested. (3) Mathematical theory and parallel computing paradigms for cellular automata applied to structural design will be developed and validated on a variety of structural design problems. Comparison to standard FEM-based optimization will be done.
DTIC
Algorithms; Design Optimization; Numerical Analysis

20050243188 Texas Univ., Austin, TX USA
Convergence Analysis of a Discontinuous Finite Element Formulation Based on Second Order Derivatives
Romkes, Albert; Prudhomme, Serge; Oden, J. T.; Nov. 1, 2004; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-99-1-0124
Report No.(s): AD-A439718; No Copyright; Avail.: CASI: A03, Hardcopy

A new Discontinuous Galerkin Formulation is introduced for the elliptic reaction-diffusion problem that incorporates local second order distributional derivatives. The corresponding bilinear form satisfies both coercivity and continuity properties on the broken Hilbert space of H(sup 2) functions. For piecewise polynomial approximations of degree p \g/= 2, optimal uniform h and p convergence rates are obtained in the broken H(sup 1) and H(sup 2) norms. Convergence in L(sup 2) is optimal for p \g/= 3, if the computational mesh is strictly rectangular. If the mesh consists of skewed elements, then optimal convergence is only obtained if the corner angles satisfy a given regularity condition. For p = 2, only suboptimal h convergence rates in L(sup 2) are obtained and for linear polynomial approximations the method does not converge.
DTIC
Boundary Value Problems; Convergence; Derivation; Error Analysis; Finite Element Method; Galerkin Method

20050243189 Maryland Univ., College Park, MD USA
Efficient Location Tracking of Mobile Nodes for Situation Awareness
Tassiulas, L.; Anjum, F. M.; Jan. 1, 1997; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAL01-96-2-0002
Report No.(s): AD-A439719; CSHCN-TR-97-15; No Copyright; Avail.: CASI: A02, Hardcopy

Mobile user tracking is the function of collecting, updating and maintaining information about the location of a mobile user based on situational awareness information. The tracking and connectivity information maintenance mechanism proposed by us is in the form of registration schemes which are of two types?single layer overlapping and multi-layer over-lapping. Both types are static, simple to implement in a scenario such as that of a battlefield and under which overlapping registration areas of various sizes are allowed. The availability of various registration area sizes allow the mobile to pick the one that its better to its message/mobility pattern. An algorithm is obtained which given an heterogeneous mobile population with a variety of message/mobility patterns and a registration scheme, determines an allocation of mobiles to registration areas such that the resulting aggregate registration and paging rates are below certain target values, whenever the target values are achievable.
DTIC
Position (Location); Situational Awareness

20050243222 Maryland Univ., College Park, MD USA
Optimal Control of Hysteresis in Smart Actuators: A Viscosity Solutions Approach
Tan, Xiaobo; Baras, John S.; Jan. 1, 2002; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-97-1-0114
Report No.(s): AD-A439782; CDCSS-TR-2002-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hysteresis in smart materials hinders their wider applicability in actuators. The low dimensional hysteresis models for these materials are hybrid systems with both controlled switching and autonomous switching. In particular, they belong to the class of Duhem hysteresis models and can be formulated as systems with both continuous and switching controls. In this paper, we study the control methodology for smart actuators through the example of controlling a commercially available magnetostrictive actuator. For illustrative purposes, an infinite horizon optimal control problem is considered. We show that the value function satisfies a Hamilton-Jacobi-Bellman equation (HJB) of a hybrid form in the viscosity sense. We further prove uniqueness of the viscosity solution to the (HJB), and provide a numerical scheme to approximate the solution together with a sub-optimal controller synthesis method. Numerical and experimental results based on this approach are presented.
DTIC
Actuators; Feedback Control; Hysteresis; Optimal Control; Viscosity

20050243225 Maryland Univ., College Park, MD USA
Control of Hysteresis: Theory and Experimental Results
Tan, Xiaobo; Venkataraman, Ram; Krishnaprasad, P. S.; Jan. 1, 2001; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-97-1-0114
Report No.(s): AD-A439786; TR-2001-30; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hysteresis in smart materials hinders the wider applicability of such materials in actuators. In this paper, a systematic approach for coping with hysteresis is presented. The method is illustrated through the example of controlling a commercially available magnetostrictive actuator. We utilize the low-dimensional model for the magnetostrictive actuator that was developed in earlier work. For low frequency inputs, the model approximates to a rate-independent hysteresis operator, with current as its input and magnetization as its output. Magnetostrictive strain is proportional to the square of the magnetization. In this paper, we use a classical Preisach operator for the rate-independent hysteresis operator. In this paper, we present the results of experiments conducted on a commercial magnetostrictive actuator, the purpose of which was the control of the displacement/strain output. A constrained least-squares algorithm is employed to identify a discrete approximation to the Preisach measure. We then discuss a nonlinear inversion algorithm for the resulting Preisach operator, based on the theory of strictly-increasing operators. This algorithm yields a control input signal to produce a desired magnetostrictive response. The effectiveness of the inversion scheme is demonstrated via an open-loop trajectory tracking experiment.
DTIC
Control; Control Theory; Hysteresis; Inversions

20050243229 Maryland Univ., College Park, MD USA
Control of Smart Actuators: A Viscosity Solutions Approach
Tan, Xiaobo; Baras, John S.; Jan. 1, 2001; 28 pp.; In English
Report No.(s): AD-A439792; CDCSS-TR-2001-8; No Copyright; Avail.: CASI: A03, Hardcopy

Hysteresis in smart materials hinders their wider applicability in actuators. In this report we investigate control of smart actuators through the example of controlling a commercially available magnetostrictive actuator. At low frequencies, the magnetostriction can be related to the bulk magnetization through a square law, thus control of the magnetization amounts to control of the magnetostriction. The model we use is the low dimensional Jiles-Atherton model for ferromagnetic hysteresis, which is a hybrid system. For illustrative purpose, we consider an infinite horizon control problem. The approach we take features dynamic programming and Hamilton-Jacobi equations. In particular, we show that the value function of the control problem satisfies a Hamilton-Jacobi-Bellman equation (HJB) of some hybrid form in the viscosity sense. We further prove uniqueness of solutions to the (HJB), and provide a numerical scheme to approximate the solution together with a suboptimal controller synthesis method.
DTIC
Actuators; Viscosity

20050243234 Maryland Univ., College Park, MD USA
Approximate Nonlinear Filtering with Applications to Navigation
Azimi-Sadjadi, Babak; Jan. 1, 2001; 131 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439809; ISR-PHD-2001-5; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This dissertation addresses nonlinear techniques in filtering, estimation, and detection that arise in satellite-based navigation. The author first introduces particle filtering for an exponential family of densities. He proves that under certain conditions the approximated conditional density converges to the true conditional density. For the case in which the

conditional density does not lie in an exponential family but stays close to it, he shows that under certain assumptions the error of the estimate given by this approximate nonlinear filtering, projection particle filtering, is bounded. He gives similar results for a family of mixture densities. The author then uses projection particle filtering for an exponential family of densities to estimate the position of a mobile platform that has a combination of inertial navigation system (INS) and global positioning system (GPS). He shows via numerical experiments that projection particle filtering exceeds regular particle filtering methods in navigation performance. Using carrier phase measurements enables the differential GPS to reach centimeter-level accuracy. The phase lock loop of a GPS receiver cannot measure the full cycle part of the carrier phase. This unmeasured part is called integer ambiguity, and it should be resolved through other means. Here, the author presents a new integer ambiguity resolution method. Reliability of a positioning system is of great importance for navigation purposes. Failures or changes due to malfunctions in sensors and actuators should be detected and repaired to keep the integrity of the system intact. Since in most practical applications, sensors and actuators have nonlinear dynamics, this nonlinearity should be reflected in the corresponding change detection methods. In this dissertation, the author presents a change detection method for nonlinear stochastic systems based on projection particle filtering.
DTIC
Approximation; Change Detection; Global Positioning System; Inertial Navigation; Navigation; Nonlinear Filters; Nonlinear Systems

20050243349 Minnesota Univ., Minneapolis, MN USA
A Hierarchical Approach to Context-Sensitive Interprocedural Alias Analysis
Zheng, Bixia; Yew, Pen-chung; Apr. 21, 1999; 19 pp.; In English
Report No.(s): AD-A439459; TR-99-018; No Copyright; Avail.: CASI: A03, Hardcopy

In this paper, we present a hierarchical flow-sensitive alias analysis algorithm which parameterizes the context-sensitive level. Our approach groups the pointers in a program by their maximum possible dereference levels. It then orders the analysis of each pointer group by its pointer level, starting from the highest level down to the lowest level. During the analysis of each pointer group, a bottom-up traversal of a program call graph is followed by a top-down traversal with the necessary interprocedural information propagated along the way. The interprocedural information is tagged with call-chains, which are the program call graph paths, to achieve context-sensitivity. We also provide empirical results to quantify how different context-sensitive levels affect the precision and the efficiency of the algorithm. Our studies show that (1) the precision improvement achieved by increasing the context-sensitive level of the analysis varies significantly depending on the programs analyzed; (2) increasing the maximum call-chain length for a higher degree of context sensitivity may trigger the exponential complexity problem 15, 10, 23. Thus, it is very desirable for an algorithm to allow users to select an appropriate context-sensitive level that works best for a particular program. By parameterizing the maximum call-chain length used in tagging the interprocedural information, our approach provides this type of flexibility.
DTIC
Algorithms; Hierarchies; Sensitivity

20050243374 Minnesota Univ., Minneapolis, MN USA
Improve Precategorized Collection Retrieval by Using Supervised Term Weighting Schemes
Zhao, Ying; Karypis, George; Dec. 10, 2001; 10 pp.; In English
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439628; TR-01-043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The emergence of the world-wide-web has led to an increased interest in methods for searching for information. A key characteristic of many of the online document collections is that the documents have predefined category information, for example, the variety of scientific articles accessible via digital libraries (e.g., ACM, IEEE, etc.), medical articles, news-wires, and various directories (e.g., Yahoo, Open Directory Project, etc.). However, most previous information retrieval systems have not taken the pre-existing category information into account. In this paper, we proposed weight adjustment schemes based upon the category information in the vector-space model, which are able to select the most content specific and discriminating features. Our experimental results on TREC data sets show that the pre-existing category information does provide additional beneficial information to improve retrieval. The proposed weight adjustment schemes perform better than the vector-space model with the inverse document frequency (IDF) weighting scheme when queries are less specific. The proposed weighting schemes can also benefit retrieval when clusters are used as an approximation to categories.
DTIC
Information Retrieval; On-Line Systems; Weighting Functions

20050243397 Minnesota Univ., Minneapolis, MN USA
Finding Frequent Patterns Using Length-Decreasing Support Constraints
Seno, Masakazu; Karypis, George; Jan. 27, 2003; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; NSF CCR-99-72519; NSF EIA-99-86042; NSF ACI-99-82274; ACI-01-33464
Report No.(s): AD-A439583; TR-03-004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Finding prevalent patterns in large amount of data has been one of the major problems in the area of data mining. Particularly, the problem of finding frequent itemset or sequential patterns in very large databases has been studied extensively over the years, and a variety of algorithms have been developed for each problem. The key feature in most of these algorithms is that they use a constant support constraint to control the inherently exponential complexity of these two problems. In general, patterns that contain only a few items will tend to be interesting if they have a high support, whereas long patterns can still be interesting even if their support is relatively small. Ideally, we want to find all the frequent patterns whose support decreases as a function of their length without having to find many uninteresting infrequent short patterns. Developing such algorithms is particularly challenging because the downward closure property of the constant support constraint cannot be used to prune short infrequent patterns. In this paper we present two algorithms, LPMiner and SLPMiner. Given a length-decreasing support constraint, LPMiner finds all the frequent itemset patterns from an itemset database, and SLPMiner finds all the frequent sequential patterns from a sequential database. Each of these two algorithms combines a well-studied efficient algorithm for constant-support-based pattern discovery with three effective database pruning methods that dramatically reduce the runtime. Our experimental evaluations show that both LPMiner and SLPMiner, by effectively exploiting the length decreasing support constraint, are up to two orders of magnitude faster, and their runtime increases gradually as the average length of the input patterns increases.
DTIC
Data Processing; Data Mining; Information Retrieval; Sequencing

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20050240955 Bureau of Labor Statistics, Washington, DC, USA, Bureau of the Census, Washington, DC, USA
Personal Assessments of Minimum Income and Expenses: What Do They Tell Us About 'Minimum Living' Thresholds and Equivalence Scales
Garner, T. I.; Short, K.; Mar. 2005; 70 pp.; In English
Report No.(s): PB2006-101331; BLS/WP-379; No Copyright; Avail.: CASI: A04, Hardcopy

Subjective minimum income (MIQ) and minimum spending (MSQ) are the study focus. Basic Needs Module (1995) data from the U.S. Survey of Income and Program Participation are analyzed. A regression intersection approach is used to estimate household thresholds. MIQ thresholds are higher than MSQ thresholds. Both are higher than U.S. official poverty thresholds, and thresholds based on a National Academy of Sciences (NAS) methodology. Subjective threshold based equivalence scales imply greater economies of scale than those in the other two measures but are similar to behavioral scales. This finding suggests that families make trade-offs to meet their minimum needs.
NTIS
Equivalence; Income; Mathematical Models; Regression Analysis

20050240962 Bureau of Labor Statistics, Washington, DC, USA
Alternative Consumer Price Index Aggregations: Plutocratic and Democratic Approaches
Kokoski, M.; Dec. 2003; 22 pp.; In English
Report No.(s): PB2006-101321; BLS/WP-370; No Copyright; Avail.: CASI: A03, Hardcopy

Price indices are constructed to represent a population by using a sample of household expenditure information as weights. This expenditure information must be aggregated across households. In most cases, including the U.S. Consumer Price Index (CPI), the aggregation method used corresponds to a plutocratic index. Other types of aggregation, such as the democratic index, are also possible, and, in terms of economic theory, equally valid. In practice, the plutocratic approach is much more practicable, but it may provide a different measure of price change than the democratic index. This paper provides an empirical analysis of the differences between the plutocratic and democratic price indices, using data from the Consumer Expenditure Survey and the CPI for the periods 1987-1997, and for simulated price change scenarios. The results show that

there is very little difference between the two types of index, and that one index need not always exceed the other. In the simulated scenarios, even the extreme cases where prices changed only for expenditure-inelastic goods and services, the difference between the democratic and plutocratic indices was only about one point for every ten percent increase in the relative prices of these goods.
NTIS
Consumers; Cost Analysis; Populations; Surveys

20050240966 Bureau of Labor Statistics, Washington, DC, USA
Estimating Linear Regressions with Mismeasured, Possibly Endogenous, Binary Explanatory Variables
Frazis, H.; Loewenstein, M. A.; Sep. 2002; 52 pp.; In English
Report No.(s): PB2006-101160; BLS/WP-355; No Copyright; Avail.: CASI: A04, Hardcopy

This paper is concerned with mismeasured binary explanatory variables in a linear regression. Modification of a technique in Hausman et al. (1998) allows simple computation of bounds under relatively weak assumptions. When one has instruments, we show how to obtain consistent parameter estimates using GMM. We show how to incorporate the estimated measurement error bounds into the GMM estimates, and we develop a specification test based on the compatibility of the GMM estimates with the measurement error bounds. When the mismeasured variable is endogenous, the IV estimate and the measurement error bounds can be used to bound the mismeasured variable's coefficient.
NTIS
Estimating; Statistical Analysis

20050243040 Thessaly Univ., Volos, Greece
Asymptotic Optimality of the Round--Robin Policy in Multipath Routing with Resequencing
Tsoukatos, Konstantinos P.; Makowski, Armand M.; Jan. 1, 2005; 33 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0011
Report No.(s): AD-A439481; CSHCN-TR-2005-2; ISR-TR-2005-79; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We consider a model of a multipath routing system, where arriving customers are routed to a set of identical, parallel, single server queues, according to balancing policies operating without state information. After completion of service. customers are required to leave the system in their order of arrival, thus incurring an additional resequencing delay. We are interested in minimizing the end-to-end delay (including time at the resequencing buffer) experienced by arriving customers. To that end, we establish optimality of the Round-Robin routing assignment in two asymptotic regimes. namely heavy and light traffic: In heavy traffic, Round-Robin customer assignment is shown to achieve the smallest (in the increasing convex stochastic ordering) end-to- end delay amongst all routing policies operating without queue state information. In light traffic, and for the special case of Poisson arrivals, we show that Round-Robin is again an optimal (in the strong stochastic ordering) routing policy. We illustrate these and suggest other stochastic comparison results in a number of simulation examples.
DTIC
Asymptotic Methods; Client Server Systems; Multipath Transmission; Normality; Optimization; Policies; Statistical Analysis; Stochastic Processes

20050243059 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Development of 2-Dimensional Cloud Rise Model to Analyze Initial Nuclear Cloud Rise
Sandman, Karson A.; Mar. 1, 2005; 109 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439509; AFIT/GNE/ENP/05-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this research is to create a two-dimensional cloud rise model that could be used instead of the current 1-D cloud rise model in the Defense Land Fallout Intepretive Code (DELFIC) option of the Hazard Prediction and Assessment Capability (HPAC). The model includes numerical analysis of partial differential equations involving pressure, potential temperature, horizontal and vertical winds, and specific humidity. The 2-D model developed provides a much more detailed definition of the physical properties within the mushroom cloud than the 1-D DELFIC option. This is particularly useful in fallout studies on particle formation, fractionation, and particle location within the rising/risen cloud. The analysis model created for this study is the result of modifications to a convective cloud simulation. The primary modification to the convective cloud model is the incorporation of initial conditions for a nuclear cloud similar to those used in DELFIC's initial conditions module.
DTIC
Atmospheric Models; Cloud Cover; Clouds (Meteorology); Fallout; Nuclear Meteorology; Numerical Analysis

20050243121 Qualcomm, Inc., San Diego, CA USA
On the Behavior of ECN/RED Gateways Under a Large Number of TCP Flows: Limit Theorems
Tinnakornsrisuphap, Peerapol; Makowski, Armand M.; Jan. 1, 2005; 39 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0011; N66001-00-C-8063
Report No.(s): AD-A439602; CSHCN-TR-2005-3; ISR-TR-2005-80; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We consider a stochastic model of an ECN/RED gateway with competing TCP sources sharing the capacity. As the number of competing flows becomes large, the asymptotic queue behavior at the gateway can be described by a simple recursion and the throughput behavior of individual TCP flows becomes asymptotically independent. In addition, a Central Limit Theorem complement is presented, yielding a more accurate characterization of the asymptotic queue. These results suggest a scalable yet accurate model of the complex large-scale stochastic feedback system, and crisply reveal the sources of queue fluctuations.
DTIC
Congestion; Internets; Mathematical Models; Stochastic Processes; Theorems; Traffic

20050243174 Maryland Univ., Baltimore, MD USA
A Bayesian Network Approach to Ontology Mapping
Pan, Rong; Ding, Zhongli; Yu, Yang; Peng, Yun; Jan. 1, 2005; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-1-0215
Report No.(s): AD-A439697; No Copyright; Avail.: CASI: A03, Hardcopy

This paper presents our ongoing effort on developing a principled methodology for automatic ontology mapping based on BayesOWL, a probabilistic framework we developed for modeling uncertainty in semantic web. In this approach, the source and target ontologies are first translated into Bayesian networks (BN); the concept mapping between the two ontologies are treated as evidential reasoning between the two translated BNs. Probabilities needed for constructing conditional probability tables (CPT) during translation and for measuring semantic similarity during mapping are learned using text classification techniques where each concept in an ontology is associated with a set of semantically relevant text documents, which are obtained by ontology guided web mining. The basic ideas of this approach are validated by positive results from computer experiments on two small real-world ontologies.
DTIC
Bayes Theorem; Mapping; Networks; Probability Theory; Semantics

20050243177 Naval Underwater Systems Center, Newport, RI USA
Second-Order Statistics of Spectral and Correlation Estimates Obtained by Means of Weighted Overlapped FFT Processing
Nuttall, Albert H.; Sep. 30, 2005; 41 pp.; In English
Contract(s)/Grant(s): PR-A101576
Report No.(s): AD-A439705; NUWC-NPT-TR-11711; No Copyright; Avail.: CASI: A03, Hardcopy

Closed-form relations have been obtained for the covariances of the spectral estimates, as well as the correlation estimates, that result from weighted overlapped FFT processing of a stationary process with Gaussian characteristics. In particular, estimates that result from time-displaced overlapped data segments and different frequency bins have been considered. The effects of wraparound in the time-delay domain of the correlation estimates have also been incorporated. The fundamental parameters of the study are the weighting segment length K, the amount of lag L, and the FFT size N, as well as the input data correlation function C(k) and the particular weighting sequence w(k).
DTIC
Estimates; Fast Fourier Transformations; Spectral Correlation; Statistical Analysis; Statistical Correlation

20050243215 Maryland Univ., College Park, MD USA
Jointly Optimal Quantization, Estimation, and Control of Hidden Markov Chains
Baras, John S.; Tan, Xiaobo; Xi, Wei; Jan. 1, 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0465
Report No.(s): AD-A439765; CSHCN-TR-2003-9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is of interest to understand the tradeoff between the communication resource consumption and the achievable system performance in networked control systems. In this paper we explore a general framework for trade-off analysis and decision

making in such systems by studying joint quantization, estimation, and control of a hidden Markov chain. We first formulate the joint quantization and estimation problem, where vector quantization with variable-block length is considered. Dynamic programming (DP) is used to find the optimal quantization scheme that minimizes a weighted combination of the estimation error, the communication cost, and the delay due to block coding. The DP equation is solved numerically and simulation shows that this approach is able to capture the tradeoff among competing objectives by adjusting the cost weights. We then study the joint quantization and control problem. An example problem is solved analytically, which provides interesting insight into the approach. In both the joint quantization/estimation problem and the joint quantization/control problem, we show that the separation principle holds. The approaches to solving these two problems share the same spirit, and can be combined and extended to accommodate more objectives.
DTIC
Control; Estimating; Markov Chains; Markov Processes; Measurement; Optimization

20050243223 Maryland Univ., College Park, MD USA
Intrusion Detection With Support Vector Machines and Generative Models
Baras, John S.; Rabi, Maben; Jan. 1, 2002; 18 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0494
Report No.(s): AD-A439783; TR-2002-22; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper addresses the task of detecting intrusions in the form of malicious attacks on programs running on a host computer system by inspecting the trace of system calls made by these programs. We use 'attack-tree' type generative models for such intrusions to select features that are used by a Support Vector Machine Classifier. Our approach combines the ability of an HMM generative model to handle variable-length strings, i.e. the traces, and the non-asymptotic nature of Support Vector Machines that permits them to work well with small training sets.
DTIC
Detection; Models; Warning Systems

20050243224 Maryland Univ., College Park, MD USA
HMM Sequential Hypothesis Tests for Intrusion Detection in MANETs Extended Abstract
Cardenas, Alvaro A.; Ramezani, Vahid; Baras, John S.; Jan. 1, 2003; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0494
Report No.(s): AD-A439785; No Copyright; Avail.: CASI: A03, Hardcopy

Most of the work for securing the routing protocols of mobile ad hoc wireless networks has been done in prevention. Intrusion detection systems play a complimentary role to that of prevention for dealing with malicious insiders, incorrect implementation and attack models. We present a statistical framework that allows the incorporation of prior information about the normal behavior of the network and of network attacks in a principled way for the detection of known and unknown attacks. For detecting an attack as soon as possible we use quickest change detection algorithms. We use hidden Markov models (HMMs) as a generative view of the dynamic evolution of the hop count distribution. Our results show that simple attacks can be detected by an anomaly detection framework. However, detection of more complex attacks requires incorporation of prior knowledge in the HMMs.
DTIC
Detection; Hypotheses; Markov Processes; Networks; Statistical Tests; Warning Systems

20050243352 Minnesota Univ., Minneapolis, MN USA
Design and Implementation of a Framework for Integrating Front-End and Back-End Compilers
Yew, Pen-chung; Li, Zhiyuan; Song, Younghong; Tsai, Jenn-yuan; Zheng, Bixia; Apr. 20, 1999; 27 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MIP-9610379; CDA-9502979
Report No.(s): AD-A439468; TR99-016; No Copyright; Avail.: CASI: A03, Hardcopy

We propose a new universal High-Level Information (HLI) format to effectively integrate front-end and back-end compilers by passing front-end information to the back-end compiler. Importing this information into an existing back-end leverages the state-of-the-art analysis and transformation capabilities of existing front-end compilers to allow the back-end greater optimization potential than it has when relying on only locally-extracted information. A version of the HLI has been implemented in the SUIF parallelizing compiler and the GCC back-end compiler. Experimental results with the SPEC benchmarks show that HLI can provide GCC with substantiallymore accurate data dependence information than it can obtain

on its own. Our results show that the number of dependence edges in GCC can be reduced substantially for the benchmark programs studied, which provides greater flexibility to GCC's code scheduling pass, common subexpression elimination pass, loop invariant code removal pass and register local allocation pass. Even with GCC's optimizations limited to basic blocks, the use of HLI produces moderate speedups compared to using only GCC's dependence tests when the optimized programs are executed on a MIPS R10000 processor.
DTIC
Compilers; Education; Systems Integration

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20050242977 Naval Postgraduate School, Monterey, CA USA
Virtual Military Markets
Burth, Angela J.; Sep. 1, 2005; 143 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439346; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis explores the utility of market mechanisms for Department of Defense (DoD) command, control, communication and collaboration (C4). Shortfalls in current C4 systems found by the Defense Science Board, Office of Force Transformation, and Command and Control Research Program are presented. Alternative C4 internal market structures that can help achieve the principles of Network-Centric Operations are illustrated. Then, using the principles of mathematical model development, the author builds a testable 'E-Bay' type model for applying markets in the DoD. The model is not validated or tested in the space of this thesis and should undergo experimentation. Next, the thesis walks through an intelligence use case and presents a number of testable hypotheses for model validation. Two appendices are included. The first appendix discusses decision making in markets by using existing decision-making tools to show how the cycle of information can be improved for the decision-making commander in market transaction space. The second appendix is a briefing consisting of 60 briefing charts that highlights the key points of the Virtual Military Market (VMM) and the intelligence use case. The thesis concludes that 'practiced adhocracy' and improved decision making can be achieved by the VMM and that DoD should explore this concept further.
DTIC
Command and Control; Decision Making; Intelligence; Market Research; Marketing; Mathematical Models

20050243089 Naval Postgraduate School, Monterey, CA USA
Optimizing the Distribution of USA Army Officers
McElroy, Jeremy S.; Sep. 1, 2005; 47 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439557; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army distributes its 51,000 competitive category officers among manning targets specified by location, rank, and skill that change over time in response to changing requirements. The officer inventory also changes over time and does not exactly match the manning target requirements. The Army responds to imbalances by redistributing officers to provide each location with the minimum required officers while minimizing the number of unfilled targets and excess officers at each location. This thesis focuses on branch officers, branch targets, and generalist targets with ranks from Branch Qualified Captain to Colonel. Using data provided by the Army, the author formulates an integer programming model called DISTRIBUTOR. When DISTRIBUTOR allows all officers in the inventory to move, it finds only 340 unfilled targets, but this requires 4, 688 or 28% of the inventory to move. He reduces the number of moves by using DISTRIBUTOR in two sequential steps. The first step optimally distributes officers at each location and identifies the excess officers and unfilled targets at each location. The second step takes the excess officers and distributes them to unfilled targets at other locations. The two-step process leaves 346 targets unfilled (6 more), but requires only 1,373 or 8% of the inventory to move. By allowing rank substitution DISTRIBUTOR can reduce the unfilled targets to 70.
DTIC
Allocations; Geographic Distribution; Manpower; Military Personnel; Optimization; Personnel; United States

20050243091 Minnesota Univ., Minneapolis, MN USA
Load Balancing Across Near-Homogeneous Multi-Resource Servers
Lienberger, William; Karypis, George; Kumar, Vipin; Biswas, Rupak; Feb. 16, 2000; 14 pp.; In English
Contract(s)/Grant(s): DAAH04-95-2-0003; DAAH04-95-C-0008
Report No.(s): AD-A439559; TR-00-013; No Copyright; Avail.: CASI: A03, Hardcopy

An emerging model for computational grids interconnects similar multi-resource servers from distributed sites. A job submitted to the grid can be executed by any of the servers; however, resource size or balance may be different across servers. One approach to resource management for this grid is to layer a global load distribution system on top of the local job management systems at each site. Unfortunately, classical load distribution policies fail on two aspects when applied to a multi-resource server grid. First, simple load indices may not recognize that a resource imbalance exists at a server. Second, classical job selection policies do not actively correct such a resource imbalanced state. We show through simulation that new policies based on resource balancing perform consistently better than the classical load distribution strategies.
DTIC
Balancing; Client Server Systems; Loads (Forces); Resources; Tasks

20050243101 Naval Postgraduate School, Monterey, CA USA
Dynamic Escape Routes for Naval Ships
Villalonga, Francisco J.; Sep. 1, 2005; 121 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439572; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis addresses the problem of optimal evacuation of a naval ship. We propose the use of a dynamic escape-route system which employs a signaling system to adapt the emergency egress process to the instigating contingency. The evacuation process is represented by a nonlinear network optimization model with an objective function that integrates two conflicting goals: the average evacuation time and the ship's integrity. The nonlinearity in the model results from (a) speed being a nonlinear function of concurrent flow on passageways, and (b) delays caused by opening closures. We also account for counter-flows and passageways used by repair parties. The problem is heuristically solved through an iterative process that updates speeds and delays as it proceeds, and dynamically adds valid inequalities to avoid counter-flows. A bound on the solution quality is obtained by solving the problem under optimistic conditions. Compared to static routes in a modern frigate, model solutions show that dynamic routes can improve the average evacuation time by 20%, reduce the time of the last evacuee by 25%, and improve ship integrity. We also demonstrate that even greater improvements are achievable with minor design changes in the ship.
DTIC
Escape Systems; Network Analysis; Nonlinearity; Routes

20050243102 Minnesota Univ., Minneapolis, MN USA
Multi-Constraint Mesh Partitioning for Contact/Impact Computations
Karypis, George; May 5, 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439573; TR-03-022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a novel approach for decomposing contact/impact computations in which the mesh elements come in contact with each other during the course of the simulation. Effective decomposition of these computations poses a number of challenges as it needs to both balance the computations and minimize the amount of communication that is performed during the finite element and the contact search phase. Our approach achieves the first goal by partitioning the underlying mesh such that it simultaneously balances both the work that is performed during the finite element phase and that performed during contact search phase, while producing subdomains whose boundaries consist of piecewise axes-parallel lines or planes. The second goal is achieved by using a decision tree to decompose the space into rectangular or box-shaped regions that contain contact points from a single partition. Our experimental evaluation on a sequence of 100 meshes, shows that this new approach can significantly reduce the communication overhead over existing algorithms.
DTIC
Algorithms; Decision Theory; Finite Element Method

20050243115 Duke Univ., Durham, NC USA
Real-Time Task Scheduling for Energy-Aware Embedded Systems
Swaminathan, Vishnu; Chakrabarty, Krishnendu; Jan. 1, 2005; 5 pp.; In English
Contract(s)/Grant(s): N66001-00-1-8946
Report No.(s): AD-A439593; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a new approach for scheduling workloads containing periodic tasks in real-time systems. The proposed approach minimizes the total energy consumed by the task set and guarantees that the deadline for every periodic task is met. As embedded software becomes a larger component of system-on-a-chip design, energy management using the operating system becomes increasingly important. We present a mixed-integer linear programming model for the NP-complete scheduling problem and solve it for moderate-sized problem instances using a public-domain solver. For larger task sets, we present a novel low-energy earliest-deadline-first (LEDF) scheduling algorithm and apply it to two real-life task sets.
DTIC
Energy Consumption; Real Time Operation; Scheduling; Workloads (Psychophysiology)

20050243117 Duke Univ., Durham, NC USA
Energy-Aware Fault Tolerance in Fixed-Priority Real-Time Embedded Systems
Zhang, Ying; Chakrabarty, Krishnendu; Swaminathan, Vishnu; Jan. 1, 2005; 6 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0504
Report No.(s): AD-A439596; No Copyright; Avail.: Defense Technical Information Center (DTIC)
We investigate an integrated approach to fault tolerance and dynamic power management in real-time embedded systems. Fault tolerance is achieved via checkpointing and power management is carried out using dynamic voltage scaling (DVS). We present feasibility-of-scheduling tests for checkpointing schemes for a constant processor speed as well as for variable processor speeds. DVS is then carried out on the basis of these feasibility analyses. Experimental results show that compared to fault-oblivious methods, the proposed approach significantly reduces power consumption and guarantees timely task completion in the presence of faults.
DTIC
Energy Consumption; Fault Tolerance; Priorities; Real Time Operation

20050243118 Duke Univ., Durham, NC USA
Task Feasibility Analysis and Dynamic Voltage Scaling in Fault-Tolerant Real-Time Embedded Systems
Zhang, Ying; Chakrabarty, Krishnendu; Jan. 1, 2004; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0504
Report No.(s): AD-A439598; No Copyright; Avail.: Defense Technical Information Center (DTIC)
We investigate dynamic voltage scaling (DVS) in realtime embedded systems that use checkpointing for fault tolerance. We present feasibility-of-scheduling tests for checkpointing schemes for a constant processor speed as well as for variable processor speeds. DVS is then carried out on the basis of the feasibility analysis. We incorporate practical issues such as faults during checkpointing and state restoration, rollback recovery time, memory access time and energy, and DVS overhead. Simulation results are presented for real-life checkpointing data and embedded processors.
DTIC
Computer Systems Design; Electric Potential; Fault Tolerance; Feasibility; Feasibility Analysis; Real Time Operation; Workloads (Psychophysiology)

20050243155 Naval Postgraduate School, Monterey, CA USA
Comparison of a Distributed Operations Force to a Traditional Force in Urban Combat
Babilot, Michael; Sep. 1, 2005; 188 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439662; No Copyright; Avail.: CASI: A09, Hardcopy
Two motivations drove this study of the Distributed Operations Platoon (DO) in urban combat: (1) the Marine Corps Warfighting Lab (MCWL) is developing the concepts to apply to a DO in the Sea Viking 2006 experiment and (2) Marines are engaged daily in urban combat in support of the Iraq reconstruction efforts. This thesis explores whether a DO is suitable for urban combat operations by analyzing the results of simulations created in Map Aware Non-uniform Automata (MANA). The employment of a DO is compared to employment of a traditional Marine infantry platoon in an urban combat scenario based upon data obtained from Operation al-Fajr, conducted in Fallujah, Iraq, in November 2004. The study also examines the effects caused by varying the terrain to that of Range 200, constructed at the Marine Air Ground Training Command, Twentynine Palms, California. Modeling insights, obtained by surveying Marines with urban combat experience in Iraq, tie into the research effort. This research indicates that the DO is marginally more effective than a Traditional Platoon in urban combat. DO also shows a greater sensitivity to combat outcomes due to urban density, and produced significantly better results in terrain with a lesser density of urban structures.
DTIC
Cities; Combat

20050243178 Maryland Univ., Baltimore, MD USA
A Multilevel ON/OFF Model for Multifractal Internet Traffic
Jou, Jia-Shiang; Baras, John S.; Jan. 1, 2002; 11 pp.; In English
Contract(s)/Grant(s): N66001-00-C-8063
Report No.(s): AD-A439706; CSHCN-TR-2002-5; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper, an open-loop multilevel ON/OFF model is proposed to capture the multifractal behavior of the HTTP traffic on the Internet. It is assumed that the life time of a TCP session and the active time of a burst within a TCP session have a heavy-tail type distribution. The aggregate traffic of this model is shown to be multifractal. We analyze its second and higher order statistics by the wavelet analysis and develop a simple method to estimate the model parameters from a real Internet trace. We show that real and synthesized traffic produce the same Logscale Diagram with accuracy, for proper selection of the model parameter. Finally, we compare using the NS-2 simulator the queueing behavior of FIFO queues fed by real and synthetic traffic demands.
DTIC
Fractals; Internets; Models; Traffic

20050243181 Maryland Univ., Baltimore, MD USA
A Parallel Virtual Queue Structure for Active Queue Management
Jou, Jia-Shiang; Baras, John S.; Jan. 1, 2003; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N66001-00-C-8063
Report No.(s): AD-A439709; CSHCN-TR-2003-4; No Copyright; Avail.: CASI: A02, Hardcopy

The Adaptive RED proposed by Feng et al. is shown to have small packet delay and queue length variation for long-life TCP traffic such as FTP connection with a large file size. However, a great portion of Internet traffic is shortlife web and UDP traffic. Most web traffic has a small file size and its TCP session is mainly operated in the slow start phase with a small congestion window size. Since the file size is small, dropping short-life TCP (and UDP) packets is not very effective in alleviating congestion level at a bottleneck router. From the viewpoint of TCP, one or several packet losses in its slow start phase lead to extra delay for retransmission and even cause TCP timeout. This delay severely degrades the performance of delivering short messages such as web pages and web browsers experience a long waiting time even with a high speed network. We first show that the Adaptive RED is vulnerable to these shortlife TCP traffic and propose a virtual parallel queue structure as a new active queue management scheme (AQM). The idea is to separate the long-life and short-life (including UDP) traffic into two different virtual queues. The first queue is to run the droptail policy and work for the short-life TCP and UDP packets. In order to have a small mean delay, the service rate of this drop-tail queue is dynamically determined by its virtual queue length. The remaining long-life traffic is directed to an Adaptive RED virtual queue. Even the available bandwidth is shared with the drop-tail queue, the simulation results show that the queue length variation of the RED queue is still located in a desired region. Note that both virtual queues share the same physical buffer memory. Those packets in the drop-tail queue will not be dropped unless the shared buffer is overflowed. This parallel virtual queue structure not only keeps the benefits of RED such as high utilization and small delay, but also greatly reduces the packet loss rate at the router.
DTIC
Adaptation; Parallel Processing (Computers)

20050243182 Maryland Univ., Baltimore, MD USA
Dynamical Properties of TCP System with AQM Routers
Chen, Huigang; Baras, John S.; Liu, Nelson X.; Jan. 1, 2003; 18 pp.; In English
Contract(s)/Grant(s): N66001-00-C-8063
Report No.(s): AD-A439711; CSHCN-TR-2003-45; No Copyright; Avail.: CASI: A03, Hardcopy

In this report we discuss the dynamics of heterogeneous TCP systems with propagation delays. Instead of studying the local linearized TCP dynamics, we study the global stability conditions and obtain the stability regions. Also we provide proof of periodic behavior of a single TCP connection when stability conditions are not met.
DTIC
Computer Networks; Congestion; Protocol (Computers); Stability

20050243185 Maryland Univ., College Park, MD USA
Negotiating Access Control Policies Between Autonomous Domains
Bharadwaj, Vijay G.; Baras, John S.; Jan. 1, 2002; 9 pp.; In English
Contract(s)/Grant(s): F30602-00-2-0510
Report No.(s): AD-A439714; CSHCN-TR-2002-3; No Copyright; Avail.: CASI: A02, Hardcopy

Autonomous policy domains often need to share resources to accomplish a common task. To do this they must negotiate a common access control policy to the shared resources. We use mathematical techniques from game theory to show that the outcome of such negotiations can often be predicted from the distribution of power among the participants, independent of the actual mechanics of negotiation. We discuss the axiomatic derivation of some game theoretic solution concepts, and illustrate our techniques with examples.
DTIC
Access Control; Autonomy; Domains; Policies

20050243206 Naval Postgraduate School, Monterey, CA USA
First Responder Readiness: A Systems Approach to Readiness Assessment Using Model Based Vulnerability Analysis Techniques
Mayer, Harry A.; Sep. 1, 2005; 139 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439745; No Copyright; Avail.: CASI: A07, Hardcopy

This thesis reviews various readiness assessment tools used by military units and the civilian First Responder community. Most civilian readiness assessment tools have fallen short of adequately predicting a response team's probability of mission success or failure. This thesis will explore the use of model-based vulnerability analysis techniques and FT++ software as potential tools that could be adopted by first response organizations to predict a unit's operational performance.
DTIC
Civil Defense; Emergencies; Maintainability; Responses; Security; Transponders; Vulnerability

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20050243061 Maryland Univ., College Park, MD USA
Almost Symplectic Runge-Kutta Schemes for Hamiltonian Systems
Tan, Xiaobo; Jan. 1, 2004; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-97-1-0114; DAAD19-01-1-0465
Report No.(s): AD-A439513; ISR-TR-2004-1; CDCSS-TR-2004-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Symplectic Runge-Kutta schemes for the integration of general Hamiltonian systems are implicit. In practice one has to solve the implicit algebraic equations using some iterative approximation method, in which case the resulting integration scheme is no longer symplectic. In this paper we first analyze the preservation of the symplectic structure under two popular approximation schemes, fixed-point iteration and Newton's method, respectively. Error bounds for the symplectic structure are established when N fixed-point iterations or N iterations of Newton's method are used. The implications of these results for the implementation of symplectic methods are discussed and then explored through extensive numerical examples. Numerical comparisons with non-symplectic Runge-Kutta methods and pseudo-symplectic methods are also presented.
DTIC
Hamiltonian Functions; Runge-Kutta Method

20050243217 Society for Industrial and Applied Mathematics, Philadelphia, PA USA
SIAM Conference on Applications of Dynamical Systems (8th) Held in Snowbird, Utah on 22-26 May 2005
Crowley, D.; Kuske, Rachel; Sandstede, Bjorn; Sep. 30, 2005; 8 pp.; In English
Contract(s)/Grant(s): FA9550-05-1-0260
Report No.(s): AD-A439771; AFRL-SR-AR-TR-05-0449; No Copyright; Avail.: CASI: A02, Hardcopy

The Snowbird 2005 conference was the eighth of a series of highly successful meetings organized by SIAM through its Activity Group on Dynamical Systems. The biannual Snowbird conference is arguably one of the broadest and most important meetings for mathematicians, engineers and scientists interested in nonlinear dynamics and its interdisciplinary applications.
DTIC
Conferences; Dynamical Systems; Nonlinearity; Topology

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*.

20050240861 Lawrence Livermore National Lab., Livermore, CA USA
Including Dislocation Flux in a Continuum Crystal Plasticity Model to Produce Size Scale Effects
Schiller, A.; Voinobv, A.; Agvaanluvsan, U.; Algin, E.; Mar. 12, 2004; 8 pp.; In English
Report No.(s): DE2005-15013915; UCRL-CONF-202880; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Nuclei; Radiation; Continuum Modeling; Crystals

20050240878 Lawrence Livermore National Lab., Livermore, CA USA
Simulated (n,f) Cross Section of Isomeric 235m-U
Younes, W.; Britt, H. C.; Becker, J. A.; Dec. 18, 2003; 14 pp.; In English
Report No.(s): DE2005-15013764; UCRL-CONF-201697; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Neutrons; Uranium

20050240880 Lawrence Livermore National Lab., Livermore, CA USA
Evaluation of the Difference Formulation for Photon Transport in a Two Level System
Daffin, F. C.; McKinley, M. S.; Brooks, E. D.; Szoke, A.; Nov. 30, 2004; 36 pp.; In English
Report No.(s): DE2005-15011787; UCRL-PROC-208255; No Copyright; Avail.: Department of Energy Information Bridge
In this paper we extend the difference formulation for radiation transport to the case of a single atomic line. We examine the accuracy, performance and stability of the difference formulation within the framework of the Symbolic Implicit Monte Carlo method. The difference formulation, introduced for thermal radiation by some of the authors, has the unique property that the transport equation is written in terms that become small for thick systems. We find that the difference formulation has a significant advantage over the standard formulation for a thick system. The correct treatment of the line profile, however, requires that the difference formulation in the core of the line be mixed with the standard formulation in the wings, and this may limit the advantage of the method. We bypass this problem by using the gray approximation. We develop three Monte Carlo solution methods based on different degrees of implicitness for the treatment of the source terms, and we find only conditional stability unless the source terms are treated fully implicitly.
NTIS
Photons; Radiation Transport; Thermal Radiation

20050240888 Lawrence Livermore National Lab., Livermore, CA USA
Dynamics of Collisions Revealed by Classical Methods
Olson, R. E.; Fiol, J.; Perez, J.; Beiersdorfer, P.; Oct. 19, 2004; 24 pp.; In English
Report No.(s): DE2005-15011809; UCRL-PROC-207338; No Copyright; Avail.: Department of Energy Information Bridge
Single ionization of helium by impact of 3.6 MeV/u Au(sup 53+) ions is investigated by means of quantum and classical methods. Calculation of fully-differential cross sections are compared to recently published data for ionization of low-energy electrons as a function of the momentum transferred by the projectile to the target system. The results show that inclusion of the resolution and uncertainties present in the experiment has a major influence on both the shape and magnitude of the calculated cross sections. The effect of using a two-electron model for the helium target along with including electron-electron correlation are also investigated. However, after incorporating all the experimental conditions within the calculations, the one- and two-electron results present similar behavior.
NTIS
Collisions; Ionic Collisions

20050240892 Lawrence Livermore National Lab., Livermore, CA USA
Effect of Vacuum on the Occurrence of UV-Induced Surface Photoluminescence, Transmission Loss, and Catastrophic Surface Damage
Burnham, A. K.; Runkel, M.; Demos, S. G.; Jul. 20, 2000; 16 pp.; In English
Report No.(s): DE2005-15013166; UCRL-JC-137123; No Copyright; Avail.: Department of Energy Information Bridge

Vacuum degrades the transmittance and catastrophic damage performance of fused-silica surfaces, both bare and silica-sol anti-reflective coated. These effects may be important in certain space application of photonics devices. When exposed to hundreds of 355-nm, 10-ns laser pulses with fluences in the 2-15 J/cm(sup 2) range, transmittance loss is due to both increased reflectance and absorption at the surface. Spectroscopic measurements show that the absorbed light induces broadband fluorescence from the visible to infrared and that the peak photoluminescence wavelength depends cumulative fluence.
NTIS
Damage; Losses; Photoluminescence; Transmission Loss; Transmittance; Vacuum Effects

20050240894 Lawrence Livermore National Lab., Livermore, CA USA
Beam Simulations for IRE and Driver Status and Strategy
Friedman, A.; Grote, D. P.; Lee, E. P.; Mar. 13, 2001; 26 pp.; In English
Report No.(s): DE2005-15013202; UCRL-JC-137974; No Copyright; Avail.: Department of Energy Information Bridge
The methods and codes employed in the U.S. Heavy Ion Fusion program to simulate the beams in an Integrated Research Experiments (IRE) facility and a fusion driver are presented in overview. A new family of models incorporating accelerating module impedance, multi-beam, and self-magnetic effects is described, and initial WARP3d particle simulations of beams using these models are presented. Finally, plans for streamlining the machine-design simulation sequence, and for simulating beam dynamics from the source to the target in a consistent and comprehensive manner, are described.
NTIS
Simulation; Magnetic Effects; Particle Beams

20050240897 Lawrence Livermore National Lab., Livermore, CA USA
Measurement of the Relative Intensity of the Ly-(Alpha) Lines in Fe 23+
Wong, K. L.; Beiersdorfer, P.; Reed, K. J.; Osterheld, A. L.; Jun. 18, 2002; 14 pp.; In English
Report No.(s): DE2005-15013420; UCRL-JC-146634; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Measurement; Polarization; Electron Beams; Lyman Spectra

20050240898 Lawrence Livermore National Lab., Livermore, CA USA
235U(n,2n(gamma)) Yrast Partial Gamma-Ray Cross Sections: A Report on the 1998 - 1999 GEANIE Data and Analysis Techniques Appendix
Younes, W.; Sep. 01, 2000; 104 pp.; In English
Report No.(s): DE2005-15013509; UCRL-ID-130313-APP; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Gamma Rays; Uranium 235

20050240904 Lawrence Livermore National Lab., Livermore, CA USA
Introduction to Proceedings of SPIE: Optical Engineering at the Lawrence Livermore National Laboratory II
Lane, M. A.; Wuest, C. R.; Feb. 26, 2004; 8 pp.; In English
Report No.(s): DE2005-15013752; UCRL-PROC-202575; No Copyright; Avail.: Department of Energy Information Bridge
The second annual conference on optical engineering at Lawrence Livermore National Laboratory (LLNL) focused entirely on National Ignition Facility (NIF) activities. NIFs 192-beam UV laser system is the worlds largest optical and optomechanical system. This past year, a decade-long design, construction, fabrication, and installation effort culminated in the commissioning of the first four laser beams in this 30,000 square meter facility. This flashlamp-pumped Nd:glass laser system is built on a scale unprecedented in laser R&D. Nearly every aspect of the NIF design is unconventional, from the 40 x 40-cm-square size of each beam, to the 40 varieties of telephone-booth-size modular optical assemblies, to the elevated configuration of the 200-m-long, class-100 beamlines that converge on a 10-m-diameter target chamber. A large technical staff and many industrial partners were needed to reach the current state of accomplishment, including development of a number of advanced optical materials and fabrication technologies.
NTIS
Conferences; Laser Beams; Optical Materials

20050240906 Lawrence Livermore National Lab., Livermore, CA USA

Population Kinetics Modeling for Non-Lte and Non-Maxwellain Plasmas Generated in Finite Temperature Dense Matter Experiments Arising from Short Pulse X-Ray Source

Chung, H. K.; Leed, R. W.; Morgan, W. L.; Dec. 29, 2003; 10 pp.; In English

Report No.(s): DE2005-15013763; UCRL-PROC-201626; No Copyright; Avail.: Department of Energy Information Bridge

The short pulse x-ray sources will provide a major advance in dense matter studies important to understand implosion physics for ICF as a generator of warm dense matter or a probe of nite temperature dense matter. The interaction of such a high-energy photon pulse with the initially solid matter creates highly transient states of plasmas initially whose relaxation processes are of interest to the equation of states or spectral properties of these matter. For these plasmas, assumptions such as LTE population distributions or Maxwellian electron energy distributions should be tested by employing a method that does not make these assumption a priori. Our goal is to present a model that can be used to simulate the electron distributions, the ionization balance and the spectral output of transient systems generated in the future ICF experiments. We report on the progress in developing a non- LTE atomic population kinetics code integrated with Boltzmann equation solver to provide a self-consistent time-dependent solution of the level populations and the particle energy distributions.

NTIS

Inertial Confinement Fusion; Kinetics; Local Thermodynamic Equilibrium; Plasmas (Physics); Populations; X Ray Sources

20050240967 Lawrence Livermore National Lab., Livermore, CA USA

Modeling Electron-Cloud Effects in Heavy-Ion Accelerators

Cohen, R. H.; Friedman, A.; Lund, S. M.; Molvik, A. W.; Sep. 23, 2004; 12 pp.; In English

Report No.(s): DE2005-15014518; UCRL-PROC-206744; No Copyright; Avail.: Department of Energy Information Bridge

Stray electrons can arise in positive-ion accelerators for heavy ion fusion or other applications as a result of ionization of ambient gas or gas released from walls due to halo-ion impact, or as a result of secondary- electron emission. We summarize results from several studies undertaken in conjunction with an effort to develop a self-consistent modeling capability: (1) Calculation of the electron cloud produced by electron desorption from computed beam-ion loss, which illustrates the importance of retaining ion reflection at the walls; (2) Simulation of the effect of specified electron cloud distributions on ion beam dynamics; and (3) analysis of an instability associated with a resonance between the beam-envelope ‘breathing’ mode and the electron perturbation. We also report first results from a long-timestep algorithm for electron dynamics, which holds promise for efficient simultaneous solution of electron and ion dynamics. One conclusion from study (2) is that heavy-ion beams are surprisingly robust to electron clouds, compared to a priori expectations.

NTIS

Electron Clouds; Ion Accelerators

20050240973 Lawrence Livermore National Lab., Livermore, CA USA

Comparison of Two Up-Scaling Methods in Poroelasticity and Its Generalizations

Berryman, J. G.; Mar. 03, 2005; 14 pp.; In English

Report No.(s): DE2005-15014045; UCRL-PROC-202969; No Copyright; Avail.: Department of Energy Information Bridge

Two methods of up-scaling coupled equations at the microscale to equations valid at the mesoscale and/or macroscale for fluid-saturated and partially saturated porous media are discussed, compared, and contrasted. The two methods are: (1) two-scale and multiscale homogenization, and (2) volume averaging. Both these methods have advantages for some applications and disadvantages for others. For example, homogenization methods can give formulas for coefficients in the up-scaled equations, whereas volume averaging methods give the form of the up-scaled equations but generally must be supplemented with physical arguments and/or data in order to determine the coefficients. Homogenization theory requires a great deal of mathematical insight from the user in order to choose appropriate scalings for use in the resulting power-law expansions, while volume averaging requires more physical insight to motivate the steps needed to find coefficients. Homogenization often is performed on periodic models, while volume averaging does not require any assumption of periodicity and can therefore be related very directly to laboratory and/or field measurements. Validity of the homogenization process is often limited to specific ranges of frequency - in order to justify the scaling hypotheses that must be made - and therefore cannot be used easily over wide ranges of frequency. However, volume averaging methods can quite easily be used for wide band data analysis.

NTIS

Homogenizing; Scaling Laws

20050240974 Lawrence Livermore National Lab., Livermore, CA USA
Electronic Properties of Carbon at Extreme Conditions from ab Initio Simulations
Correa, A. A.; Bonev, S. A.; Galli, G.; Falcone, R. W.; Mar. 30, 2004; 24 pp.; In English
Report No.(s): DE2005-15014043; UCRL-PROC-203257; No Copyright; Avail.: National Technical Information Service (NTIS)

Summary -Energy Gap of Carbon is very sensitive to crystal symmetry. -BC8 Gap decreases with pressure. -Diamond Gap increases with pressure. but decreases continuously as temperature is raised. -Diamond at High pressure does not become conducting before melting.
NTIS
Carbon; Electrical Properties; Simulation

20050240976 Lawrence Livermore National Lab., Livermore, CA USA
Improved Pinhole-Apertured Point-Projection Backlighter Geometry
Blue, B.; Robey, H. F.; Hansen, J. F.; Mar. 03, 2005; 16 pp.; In English
Report No.(s): DE2005-15014112; UCRL-CONF-203624; No Copyright; Avail.: Department of Energy Information Bridge

Pinhole-apertured point-projection x-ray radiography is an important diagnostic technique for obtaining high resolution, high contrast, and large field-of-view images used to diagnose the hydrodynamic evolution of high energy density experiments. In this technique, a pinhole aperture is placed between a laser irradiated foil (x-ray source) and an imaging detector. In this document, we present an improved backlighter geometry that utilizes a tilted pinhole for debris mitigation and a front-side illuminated backlighter foil for improved photon statistics.
NTIS
Lasers; Pinholes; Radiography; X Rays

20050240980 Lawrence Livermore National Lab., Livermore, CA USA
Interferometric Resolution Boosting for Spectrographs
Erskine, D. J.; Edelstein, J.; Jun. 28, 2004; 16 pp.; In English
Report No.(s): DE2005-15014172; UCRL-PROC-204704; No Copyright; Avail.: Department of Energy Information Bridge

Externally dispersed interferometry (EDI) is a technique for enhancing the performance of spectrographs for wide bandwidth high resolution spectroscopy and Doppler radial velocimetry. By placing a small angle-independent interferometer near the slit of a spectrograph, periodic fiducials are embedded on the recorded spectrum. The multiplication of the stellar spectrum times the sinusoidal fiducial net creates a moire pattern, which manifests high detailed spectral information heterodyned down to detectably low spatial frequencies. The latter can more accurately survive the blurring, distortions and CCD Nyquist limitations of the spectrograph. Hence lower resolution spectrographs can be used to perform high resolution spectroscopy and radial velocimetry. Previous demonstrations of approx. 2.5OE resolution boost used an interferometer having a single fixed delay. We report new data indicating approx. 6OE Gaussian resolution boost (140,000 from a spectrograph with 25,000 native resolving power), taken by using multiple exposures at widely different interferometer delays.
NTIS
Interferometers; Interferometry; Spectrographs; Spectroscopy

20050241679 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Digital Beam Position Monitor for the HAPPEX Experiment
Dong, H.; Freyberger, A.; Kauffman, S.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840079; No Copyright; Avail.: Department of Energy Information Bridge

The proposed HAPPEX experiment at CEBAF employs a three cavity monitor system for high precision (1um), high bandwidth (100 kHz) position measurements. This is performed using a cavity triplet consisting of two TM110-mode cavities (one each for X and Y planes) combined with a conventional TM010-mode cavity for a phase and magnitude reference. Traditional systems have used the TM010 cavity output to directly down convert the BPM cavity signals to base band. The multi-channel HAPPEX digital receiver simultaneously I/Q samples each cavity and extracts position using a CORDIC algorithm. The hardware design consists of a RF receiver daughter board and a digital processor motherboard that resides in a VXI crate. The daughter board down converts 1.497 GHz signals from the TM010 cavity and X and Y signals from the TM110 cavities to 3 MHz and extracts the quadrature digital signals. The motherboard processes this data and computes beam

intensity and X-Y positions with resolution of 1um, 100 kHz output bandwidth, and o verall latency of 1us. The results are available in both the analog and digital format.
NTIS
Beams (Radiation); Monitors

20050241681 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Testing of the New Tuner Design for the CEBAF 12 GEV Upgrade SRF Cavities
Daly, E. F.; Davis, G. K.; Hicks, W. R.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840078; No Copyright; Avail.: Department of Energy Information Bridge
The new tuner design for the 12 GeV Upgrade SRF cavities consists of a coarse mechanical tuner and a fine piezoelectric tuner. The mechanism provides a 30:1 mechanical advantage, is pre-loaded at room temperature and tunes the cavities in tension only. All of the components are located in the insulating vacuum space and attached to the helium vessel, including the motor, harmonic drive and piezoelectric actuators. The requirements and detailed design are presented. Measurements of range and resolution of the coarse tuner are presented and discussed.
NTIS
Cavities; Linear Accelerators; Superconducting Cavity Resonators; Tuners; Tuning

20050241683 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
CEBAF Control Room Renovation
Spata, M.; Oren, T.; January 2004; 8 pp.; In English
Report No.(s): DE2005-840077; No Copyright; Avail.: Department of Energy Information Bridge
The Machine Control Center (MCC) at Jefferson Lab's Continuous Electron Beam Accelerator Facility (CEBAF) was initially constructed in the early 1990s and based on proven technology of that era. Through our experience over the last 15 years and in our planning for the facility's 12 GeV upgrade we reevaluated the control room environment to capitalize on emerging visualization and display technologies and improve workflow processes and ergonomic attributes. This effort also sets the foundation for the redevelopment of the accelerator's control system to deliver high reliability performance with improvements in beam specifications management and information flow. The complete renovation was performed over a three-week maintenance period with no interruption to beam operations. We present the results of this effort.
NTIS
Ground Based Control; Integrated Mission Control Center; Linear Accelerators; Maintenance

20050241686 Lawrence Livermore National Lab., Livermore, CA USA
Level Densities and Gamma-Ray Strength Functions in 170, 171, 172-Yb
Agvaanluvsan, U.; Schiller, A.; Becker, J. A.; Bernstein, L. A.; Garrett, P. E.; Aug. 04, 2004; 20 pp.; In English
Report No.(s): DE2005-15014599; UCRL-TR-205726; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Gamma Rays; Nuclear Structure

20050241688 Lawrence Livermore National Lab., Livermore, CA USA
Actinide Cross Section Evaluations
Brown, D. A.; Loyola, B.; McNabb, D.; Sep. 21, 2004; 12 pp.; In English
Report No.(s): DE2005-15014595; UCRL-PROC-206702; No Copyright; Avail.: Department of Energy Information Bridge
The Livermore Computational Nuclear Physics group is charged with producing updated neutron incident cross section evaluations for all the actinides in the coming year, concentrating on neutron induced fission, neutron capture and (n,2n) cross sections. We attack this daunting task either by adopting other recent evaluations or by performing our own. Owing to the large number of nuclei involved, we seek to automate this process as much as possible. For this purpose, we have developed a series of computer codes: x4i, an interface to the EXFOR database, fete, a code that translates ENDF/B formatted evaluations into a computationally convenient form, and da(underline)fit, a fitting code that takes all relevant EXFOR data for a reaction or set of reactions and performs a generalized least square fit to them, subject to various constraints and other prior information.
NTIS
Actinide Series; Absorption Cross Sections; Neutron Cross Sections

20050241970 Ohio Univ., Athens, OH, USA
Experimental Evidence for the Pentaquark
Carman, D. S.; January 2005; 12 pp.; In English
Report No.(s): DE2005-840163; No Copyright; Avail.: National Technical Information Service (NTIS)

The present experimental evidence for the existence of light pentaquarks is reviewed, including both positive and null results. I also discuss the CLAS experiments at Jefferson Laboratory that are forthcoming in the near future to address questions regarding existence, mass, width, and other quantum numbers of these five-quark baryon states.
NTIS
Baryons; Quantum Numbers

20050241977 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Effects of Electric and Magnetic Fields on the Performance of a Superconducting Cavity
Ciovati, G.; Kneisel, P.; January 2005; 8 pp.; In English
Report No.(s): DE2005-839998; No Copyright; Avail.: National Technical Information Service (NTIS)

A special two-cell cavity was designed to obtain surface field distributions suitable for investigation of electric and magnetic field effects on cavity performance. The cavity design and preliminary results were presented in a previous contribution. The bulk niobium cavity was heat-treated in a vacuum furnace at 1250 deg C to improve thermal conductivity. Three seamless hydroformed Nb/Cu cavities of the same design were fabricated to investigate the role of the electron beam welds located in high field areas. This paper will present RF test results at 2 K for the bulk niobium and one of the seamless cavities.
NTIS
Cavities; Electric Fields; Magnetic Effects; Magnetic Fields; Superconductivity

20050241978 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Testing of HOM Coupler Designs on a Single Cell Niobium Cavity
Kneisel, P.; Ciovati, G.; Wu, G.; January 2005; 8 pp.; In English
Report No.(s): DE2005-839999; No Copyright; Avail.: National Technical Information Service (NTIS)

Coaxial higher order mode (HOM) couplers were developed initially for HERA cavities and subsequently for TESLA cavities. They were adopted later for SNS and Jlab upgrade cavities. The principle of operation is the rejection of the fundamental mode by the tunable filter and the transmission of the HOMs. It has been recognized recently that for continuous wave or high duty factor applications of the TESLA coupler the output pick-up probe must stay superconducting in order to avoid its heating by the fundamental mode residual magnetic field leading to deterioration of the cavity quality factor. In addition, the thermal conduction of existing rf feedthrough designs is only marginally sufficient to keep even the niobium probe tip superconducting in cw operation. We have equipped a single-cell niobium cavity with the modified HOM couplers and tested the new designs by measuring Q vs E(sub acc) behavior at 2 K for different feedthroughs and probe tip materials.
NTIS
Cavities; Couplers; Niobium

20050241981 Jefferson (Thomas) National Accelerator Facility, Newport News, VA, USA, Reference Metals Co., Inc., Bridgeville, PA, USA
Influence of Ta Content in High Purity Niobium on Cavity Performance
Kneisel, P.; Ciovati, G.; Myneni, G. R.; Singer, W.; Singer, X.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840005; No Copyright; Avail.: National Technical Information Service (NTIS)

In a previous paper we have reported about initial tests of single cell 1500 MHz cavities made from high purity niobium with three different Ta contents of 160 ppm , (approx) 600 ppm and (approx) 1400 ppm. These cavities had been treated by buffered chemical polishing several times and 100 (micro)m, 200 (micro)m and 300 (micro)m of material had been removed from the surfaces. This contribution reports about subsequent tests following post purification heat treatments with Ti and 'in situ' baking. As a result, all cavities exhibited increased quench fields due to the improved thermal conductivity after the heat treatment. After the 'in situ' baking at 120 C for (approx) 40 hrs the always present Q-drop at high fields disappeared and further improvements in accelerating gradient could be realized. Gradients as high as E(sub acc) = 35 MV/m were achieved and there were no clear indications that the cavity performance was influenced by the Ta content in the material. A multi-cell

cavity from the high Ta content material has been fabricated and initial results are reported.
NTIS
Cavities; Niobium; Purity; Tantalum

20050241982 Jefferson (Thomas) National Accelerator Facility, Newport News, VA, USA
Simulation Study of Electronic Damping of Microphonic Vibrations in Superconducting Cavities
January 2005; 8 pp.; In English
Report No.(s): DE2005-840008; No Copyright; Avail.: Department of Energy Information Bridge

Electronic damping of microphonic vibrations in superconducting rf cavities involves an active modulation of the cavity field amplitude in order to induce ponderomotive forces that counteract the effect of ambient vibrations on the cavity frequency. In lightly beam loaded cavities, a reduction of the microphonics-induced frequency excursions leads directly to a reduction of the rf power required for phase and amplitude stabilization. Jefferson Lab is investigating such an electronic damping scheme that could be applied to the JLab 12 GeV upgrade, the RIA driver, and possibly to energy-recovering superconducting linacs. This paper discusses a model and presents simulation results for electronic damping of microphonic vibrations.
NTIS
Cavities; Damping; Simulation; Superconductivity; Vibration

20050242050 Lawrence Livermore National Lab., Livermore, CA USA
Diagnostic X Multi-Axis Beamline
Paul, A.; Apr. 05, 2000; 116 pp.; In English
Report No.(s): DE2005-15013503; UCRL-ID-139218; No Copyright; Avail.: Department of Energy Information Bridge

Tomographic reconstruction of explosive events require time resolved multipal lines of sight. Considered here is a four (or eight) line of sight beam layout for a nominal 20 MeV 2000 Ampere 2 microsecond electron beam for generation of x-rays 0.9 to 5 meters from a given point, the ‘firing point’. The requirement of a millimeter spatial x-ray source requires that the electron beam be delivered to the converter targets with sub-millimeter precision independent of small variations in beam energy and initial conditions. The 2 usec electron beam pulse allows for four bursts in each line, separated in time by about 500 microseconds. Each burst is divided by a electro-magnetic kicker into four (or eight) pulses, one for each beamline. The arrival time of the four (or eight) beam pulses at the x-ray target can be adjusted by the kicker timing and the sequence that the beams of each burst are switched into the different beamlines. There exists a simple conceptual path from a four beamline to a eight beamline upgrade.
NTIS
Electron Beams; Monitors

20050242051 Department of Energy, Washington, DC USA
Science and Technology Review: Simulating Quantum Molecular Activity
Apr. 2002; 36 pp.; In English
Report No.(s): DE2005-15013297; No Copyright; Avail.: National Technical Information Service (NTIS)

As we enter a new century, geometric growth in computing power--also engendered by modern physics--has positioned physicists to address the complexities of many particles interacting to produce the bulk properties of materials. Using Advanced Simulation and Computing (ASCI) supercomputers to simulate the quantum mechanics of matter being shocked, researchers can now see in detail the dynamic activity of the atoms and molecules in the sample.
NTIS
Research and Development; Simulation; Technologies

20050242055 Lawrence Livermore National Lab., Livermore, CA USA
Computed Tomoraphy Analysis of NASA BSTRA Balls
Perry, R. L.; Schneberk, D. J.; Nov. 09, 2004; 44 pp.; In English
Report No.(s): DE2005-15011812; UCRL-TR-207818; No Copyright; Avail.: Department of Energy Information Bridge

Fifteen 1.25 inch BSTRA balls were scanned with the high energy computed tomography system at LLNL. This system has a resolution limit of approximately 210 microns. A threshold of 238 microns (two voxels) was used, and no anomalies at or greater than this were observed. At the request of NASA personnel, we performed digital radiography/computed tomography scanning on fifteen BSTRA Balls. All BSTRA Ball specimens were scanned on the same HECAT (high energy

computed tomography) system as used for all previous BSTRA scans (some 45 units total). This report addresses the scan of serial numbers 6-92-003 to 6-92-017. This particular system employs a 9 meV LINAC as the x-ray source and a THALES 12 x 16 inch 14-bit Amorphous Silicon panel as the detector.
NTIS
Linear Accelerators; Amorphous Silicon; Radiography

20050242057 Lawrence Livermore National Lab., Livermore, CA USA
Envelope Modes of Beams with Angular Momentum
Barnard, J. J.; Losic, B.; Aug. 21, 2000; 14 pp.; In English
Report No.(s): DE2005-15013246; UCRL-JC-140251; No Copyright; Avail.: Department of Energy Information Bridge

For a particle beam propagating in an alternating gradient focusing system, envelope equations are often employed to describe the evolution of the beam radii in the two directions transverse to the direction of propagation, and aligned with the principle axes of the alternating gradient system. When the beams have zero net angular momentum and when the alternating gradient focusing is approximated by a continuous focusing system, there are two normal modes to the envelope equations: the 'breathing' mode and a 'quadrupole' mode. In the former, the two radii oscillate in phase, and in the latter the radii oscillate 180 degrees out of phase. In this paper, we extend the analysis to include beams that have a finite angular momentum. We perturb the moment equations of ref. (1), wherein it was assumed that space charge is a distributed in a uniform density ellipse. Two additional modes are obtained. The breathing mode remains, but the quadrupole mode is split into two modes, and a new low frequency mode appears. We calculate the frequencies and eigenmodes of these four modes as a function of tune depression and a dimensionless net angular momentum.
NTIS
Angular Momentum; Particle Beams; Low Frequencies

20050242063 Lawrence Livermore National Lab., Livermore, CA USA
Observation of a Laser-Driven Shock-Induced Phase Transition in KTP
Eggert, J. H.; Celliers, P. M.; Bradley, D. K.; Moon, S. J.; Hicks, D. G.; Aug. 2004; 18 pp.; In English
Report No.(s): DE2005-15014029; UCRL-CONF-203095; No Copyright; Avail.: National Technical Information Service (NTIS)

KTP (Potassium Titanyl Phosphate) may be an appropriate material for high quality phase transition study using laser shocks.
NTIS
Lasers; Phase Transformations; Potassium Phosphates

20050242065 Lawrence Livermore National Lab., Livermore, CA USA
Heavy Meson Production at a Low-Energy Photon Collider
Asztalos, S.; Apr. 26, 2004; 20 pp.; In English
Report No.(s): DE2005-15014096; UCRL-PROC-203766; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available
Mesons; Photons

20050242066 Lawrence Livermore National Lab., Livermore, CA USA
Dante Soft X-ray Power Diagnostic for NIF
Dewald, E. L.; Campbell, K. M.; Turner, R. E.; Holder, J. P.; Apr. 16, 2004; 12 pp.; In English
Report No.(s): DE2005-15014120; UCRL-CONF-203612; No Copyright; Avail.: National Technical Information Service (NTIS)

Soft x-ray power diagnostics are essential for measuring spectrally resolved the total x-ay flux, radiation temperature, conversion efficiency and albedo that are important quantities for the energetics of indirect drive hohlraums. At the Nova or Omega Laser Facilities, these measurements are performed mainly with Dante, but also with DMX and photo-conductive detectors (PCD's). The Dante broadband spectrometer is a collection of absolute calibrated vacuum x-ray diodes, thin filters and x-ray mirrors used to measure the soft x-ray emission for photon energies above 50 eV. Compared to NOVA and Omega laser facilities, the National Ignition Facility is designed to achieve indirect drive ignition and to provide a considerably extended range of laser drive flux and thus higher radiation temperatures in the target. Figure 1 shows the range of laser driven

soft x-ray flux and the predicted radiation temperatures for different target designs. The flattop hohlraum curves shows the range of soft x-ray flux that can be obtained in hohlraum experiments for full NIF laser power and variable hohlraum size and the NEL (NIF early light) curve shows the similar dependence obtained for full power of the first NIF quad only. The Ignition hohlraum curve gives the range of flux and radiation temperature emitted through the hohlraum laser entrance hole (LEH) during the ICF ignition Haan laser pulse. The NIF and NEL peak power curves are obtained for the peak NIF and NEL laser power considering a variable open source size that is smaller than the Dante field of view for 100% conversion efficiency from laser energy into soft x-rays.
NTIS
Diagnosis; Ignition; Spectrometers; X Rays

20050242971 Dartmouth Coll., Hanover, NH USA
Fundamental Mode Approach to Forward Problem Solutions in EMI Scattering --Inferring Fundamental Solutions from Training Data
Sun, K.; O'Neill, K.; Shubitidze, F.; Shamatava, I.; Paulsen, K. D.; Apr. 23, 2004; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A438917; No Copyright; Avail.: CASI: A02, Hardcopy

Electromagnetic induction is the leading technology for discrimination of subsurface metallic targets such as unexploded ordnance (UXO). The cleanup problem requires solution of remote sensing inverse problem inevitably based on some very fast forward algorithms for calculating EMI. The forward model must determine responses of arbitrarily complicated metallic objects. Here a very fast and complete forward solution system is presented, based on fundamental mode excitations. For a given target (or a set of targets), the EMI responses to fundamental modes are obtained from training data and saved. Any realistic excitation field is then decomposed into a limited number of constituent fundamental modes and the scatterer's EMI response is obtained by superposition of the fundamental mode solutions. In this paper we define the fundamental excitations explicitly and consider their rationale; show how to construct any particular solutions from solutions to the fundamental excitations; and focus particularly on how to obtain, retain, express responses to the fundamental solutions in the face of inherent ill-conditioning.
DTIC
Education; Electromagnetic Scattering; Magnetic Induction; Scattering

20050243002 Boeing Co., Seattle, WA USA
High Temperature Magnetics for Power Conversion
Brockschmidt, A.; Mehdi, I.; Jun. 1, 2005; 43 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-01-C-2192; Proj-3145
Report No.(s): AD-A439421; AFRL-PR-WP-TR-2005-2146; No Copyright; Avail.: CASI: A03, Hardcopy

A high temperature ferrite material has been developed capable of operation at over 300C and at switching frequencies of up to 1MHz. A transformer was built using this ferrite and operated for over 600 hours while supplying 1,500 W of 28 V from a 250 kHz switched 270 Vdc bus.
DTIC
High Temperature; Magnetic Materials; Magnetic Properties

20050243011 North Carolina State Univ., Raleigh, NC USA
A Homogenized Energy Model for the Direct Magnetomechanical Effect
Smith, Ralph C.; Dapino, Marcelo J.; Jan. 1, 2005; 24 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0107; FA9550-04-1-0203
Report No.(s): AD-A439432; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper focuses on the development of a homogenized energy model which quantifies certain facets of the direct magnetomechanical effect. In the first step of the development, Gibbs energy analysis at the lattice level is combined with Boltzmann principles to quantify the local average magnetization as a function of input fields and stresses. A macroscopic magnetization model, which incorporates the effects of polycrystallinity, material nonhomogeneities, stress-dependent interaction fields, and stress-dependent coercive behavior, is constructed through stochastic homogenization techniques based on the tenet that local coercive and interaction fields are manifestations of underlying distributions rather than constants. The resulting framework incorporates previous ferromagnetic hysteresis theory as a special case in the absence of applied stresses.

Attributes of the framework are illustrated through comparison with previously published steel and iron data.
DTIC
Homogeneity; Hysteresis; Magnetic Properties; Magnetomechanics (Physics); Mechanical Properties

20050243190 Army Research Lab., Adelphi, MD USA
Bandwidth Allocation to Interactive Users in DBS-Based Hybrid Internet
Stagarescu, M.; Jan. 1, 1998; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439721; CSHCN-MS-98-3; No Copyright; Avail.: CASI: A05, Hardcopy

We are motivated by the problem of bandwidth allocation to Internet users in DBS-based Hybrid Internet, where the Network Operations Center (NOC)-scheduler controls the amount of service provided to each user, by using packet scheduling and better management. Such a system exploits the ability of satellites to other high bandwidth connections to large geographical areas, and it delivers low-cost hybrid (satellite-terrestrial) high-speed services to interactive Internet users. In this system, it is important to reduce the delay that users experience.We analyze several bandwidth allocation policies at the Network Operations Center (NOC) of a DBS-based hybrid Internet network. We consider the problem of optimal scheduling of the services of interactive users in the DBS-based hybrid Internet con guration. We show that, for the interactive Internet users, the Most Delayed Queue First (MDQF) policy, which serves the queues starting with the most delayed queue, is providing the minimum delay, when compared with the Equal Bandwidth (EB) and Fair Share (FS) allocation policies. The MDQF policy is shown to be optimal with respect to a performance metric of packet loss due to queuing time constraints. The impact of the scheduling policies on the Hybrid Internet system's performance, is analyzed in the context of the interplay between the NOC queuing system (and its bandwidth allocation policies) and the underlying transport protocol (TCP), and we show the effectiveness of the MDQF policy in the presence of TCP congestion control algorithm. We also present simulations in which the Internet server sources send selfsimilar (
DTIC
Allocations; Bandwidth; Internets

20050243191 Air Force Research Lab., Edwards AFB, CA USA
Multi-Scale Approach to Investigate the Tensile and Fracture Behavior of Nano Composite Materials
Liu, C. T.; Aug. 30, 2005; 40 pp.; In English
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A439722; No Copyright; Avail.: CASI: A03, Hardcopy

This program is concerned with the effects of nano size particles on the tensile and fracture behavior of particulate composite materials. The program's basic approach involves a blend of experimental and analytical studies. In general, mechanisms and mechanics involved in the damage process and cohesive fracture are emphasized. Special issues that will be addressed are: (1) To what extent and by what mechanism do the nano size particles affect damage initiation and evolution processes, deformation processes, and crack growth behavior? (2) What are the deformation and failure mechanisms on the meso and the macro levels? (3) How do the nano size particles affect the characteristics of the interphase between the particle and binder? and (4) what is the role of the interphase properties in damage initiation and evolution processes? The objectives of the proposed research are to (1) obtain a fundamental understanding of the effects of nano size aluminum particles on the constitutive and crack growth behavior of particulate composite materials, (2) investigate the effects of aluminum particle size on deformation mechanism, damage process, hysteresis, and fracture strength under a constant strain rate condition, (3) determine the role of the interphase in damage initiation and evolution processes, (4) determine the deformation and failure mechanisms on meso and macro scales, (5) develop a statistical based technology to evaluate the inherent material quality, and (6) provide guidance for developing high strength solid propellants containing nano size particles.
DTIC
Composite Materials; Damage Assessment; Fracture Mechanics; Nanotechnology; Tensile Properties

20050243195 Maryland Univ., College Park, MD USA
Buffer Engineering for M/G/infinity Input Processes
Parulekar, Minothi; Jan. 1, 2000; 211 pp.; In English
Report No.(s): AD-A439728; No Copyright; Avail.: CASI: A10, Hardcopy

We suggest the M/G/infinity input process as a viable model for representing the heavy correlations observed in network traffic. Originally introduced by Cox, this model represents the busy?server process of an M/G/ infinity with Poisson inputs and general service times distributed according to G, and provides a large and versatile class of traffic models. We examine

various properties of the M/G/infinity process, focusing particularly on its rich correlation structure. The process is shown to effectively portray short or long-range dependence simply by controlling the tail of the distribution G. In an effort to understand the dynamics of a system supporting M/G/infinity traffic, we study the large butter asymptotics of a multiplexer driven by an M/ G/infinity input process.
DTIC
Broadband; Networks

20050243208 Maryland Univ., College Park, MD USA
Control of Hysteresis in Smart Actuators. Part 1. Modeling, Parameter Identification, and Inverse Control
Tan, Xiaobo; Baras, John S.; Jan. 1, 2002; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-97-1-0114
Report No.(s): AD-A439750; CDCSS-TR-2002-8; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hysteresis in smart actuators presents a challenge in control of these actuators. A fundamental idea to cope with hysteresis is inverse compensation. In this paper we study modeling, identification and inverse control of hysteresis in smart actuators through the example of controlling a commercially available magnetostrictive actuator. The (rate-independent) Preisach operator has been used extensively to model the hysteresis in smart actuators. We present efficient inversion algorithms for the Preisach operator that are implementable in real-time. The magnetostrictive hysteresis is rate-dependent at high frequencies. For this we propose a novel dynamic hysteresis model by coupling a Preisach operator to an ordinary differential equation. This model can capture the dynamic and hysteretic behavior of the magnetostrictive actuator, and it provides insight into modeling of rate-dependent hysteresis in other smart materials. The effectiveness of the identification and inverse control schemes is demonstrated through extensive experimental results.
DTIC
Actuators; Hysteresis; Models; Parameter Identification

20050243209 Maryland Univ., College Park, MD USA
Control of Hysteresis in Smart Actuators. Part 2. A Robust Control Framework
Tan, Xiaobo; Baras, John S.; Jan. 1, 2002; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-91-1-0114
Report No.(s): AD-A439751; CDCSS-TR-2002-9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hysteresis in smart actuators presents a challenge in control of these actuators. A fundamental idea to cope with hysteresis is inverse compensation. But due to the open loop nature of inverse compensation, its performance is susceptible to model uncertainties and to errors introduced by inverse schemes. In this paper we develop a robust control framework for smart actuators by combining inverse control with the iota1 robust control theory. We show that, for both the rate independent hysteresis model and the rate-dependent one, the inversion error can be bounded in magnitude and the bound is quantifiable in terms of parameter uncertainties and the inversion scheme. Hence we can model the inversion error as an exogenous disturbance and attenuate its impact by robust control techniques. Through the example of controlling a magnetostrictive actuator, we present a systematic controller design method which guarantees robust stability and robust trajectory tracking while taking actuator saturation into account. Simulation and experimental results are provided.
DTIC
Actuators; Hysteresis

20050243227 Maryland Univ., College Park, MD USA
Characterization of an ETREMA MP 50/6 Magnetostrictive Actuator
Venkataraman, R.; Rameau, J.; Krishnaprasad, P. S.; Jan. 1, 1998; 13 pp.; In English
Contract(s)/Grant(s): DAAG55-97-1-0114
Report No.(s): AD-A439788; CDCSS-TR-98-1; ISR-TR-98-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents the Displacement (Strain) - Current characteristic of an ETREMA MP 50/6 magnetostrictive actuator. This actuator is made of Terfenol-D and displays giant magnetostriction. The displacement - current characteristic shows significant hysteresis behaviour that depends on the rate at which the input is applied. Another important property of ferromagnetic hysteresis - the wiping out property, was also observed in the experiments.
DTIC
Actuators; Magnetostriction

20050243231 Army Research Lab., Aberdeen Proving Ground, MD USA
Analytical Prediction of Trajectories for High-Velocity Direct-Fire Munitions
Weinacht, Paul; Cooper, Gene R.; Newell, James F.; Aug. 1, 2005; 72 pp.; In English
Contract(s)/Grant(s): Proj-IL1612618AH
Report No.(s): AD-A439796; ARL-TR-3567; No Copyright; Avail.: CASI: A04, Hardcopy

An analysis of the velocity-time-range equations for direct-fire munitions has been performed. The analysis characterizes these munitions in terms of three parameters: muzzle velocity, muzzle retardation (or velocity fall-off), and a single parameter defining the shape of the drag curve. Using firing tables drag data for a variety of munitions, the expected range of values of the single parameter defining the shape of the drag curve in the supersonic flight regime has been determined. From the simplified analysis, many important flight characteristics can be determined. These include the velocity-time-range relationships, change in impact velocity due to change in muzzle velocity, gravity drop, change in impact location due to muzzle velocity and muzzle retardation variability, and crosswind deflection. The analysis shows that the muzzle velocity and muzzle retardation are the dominant terms defining these relationships. The shape of the drag curve is shown to be a higher-order effect which, in some cases, can be neglected. To validate these relationships, comparisons are made with numerical trajectory predictions for fielded direct-fire munitions using the measured drag data.
DTIC
Aerodynamic Characteristics; Ammunition; Fires; Trajectories

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*.

20050241725 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Determination of the Reflection Loss of Multi Layer Sound Absorbing Materials based on DMTA
Driessen, F. P. G.; May 2005; 44 pp.; In English; Original contains color illustrations
Report No.(s): TD2005-0292; TNO-DV1-2005-A019; Copyright; Avail.: Other Sources; Abstract Only

The Reflection Loss of six two layer samples of Sound Absorbing Material were determined based on DMTA measurements followed by WLF conversions and Multilayer calculations. The calculated Reflection Loss was compared with the results of previous results measured with the TNO-FEL water-filled acoustic interferometer. A good match was observed between both results, indicating both that the measured values by the interferometer were reliable, and that the WLF approach has been successfully implemented in software. WLF results can be unreliable without proper validation. However, when validated different parameters can be easily changed in software to study the absorbing properties of the material (such as effect of layer thickness, different ambient temperature, different backing media, and even the Transmission Loss).
Author
Underwater Acoustics; Acoustic Impedance; Absorbers (Materials); Transmission Loss

20050241886 China Univ. of Science and Technology, Anhui, China
Recovery of Signal from Transient Responses Contaminated by Gaussian White Noise Based on Orthogonal Bases of Compactly Supported Wavelets in Frequency Domain
Dan, Jiao; Shanjia, Xu; Xianllang, Wu; Shixiong, Li; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1736-1739; In English; See also 20050241839; Copyright; Avail.: Other Sources

Identification of radar targets based on their transient responses is demanding on the accuracy of the measured responses. However, for a practical scattering measurement system, the received response is unavoidably interfered by many kinds of noises. As a consequence, how to remove noise, especially the most frequent Gaussian white noise, from contaminated transient responses is of great importance to the accomplishment of target identification.
Derived from text
Signal Analysis; Transient Response; White Noise; Random Noise

20050243036 Woods Hole Oceanographic Inst., MA USA
Dynamic Behavior of Towed Cable Systems During Ship Turning Maneuvers
Grosenbaugh, Mark A.; Oct. 13, 2005; 6 pp.; In English
Contract(s)/Grant(s): N00014-04-1-0030; N00014-04-1-0261
Report No.(s): AD-A439473; No Copyright; Avail.: CASI: A02, Hardcopy

We compared WHOI Cable simulations with results from other studies involving towed arrays (Ablow and Schecter, 1983). The towed array results were incorporated into a manuscript about the WHOI Cable numerical scheme, which was submitted this year and is now in press (Gobat and Grosenbaugh, 2005). We are preparing a new manuscript on simulation results of towed vehicles undergoing circular maneuvers and the comparison with pervious studies (Chapman, 1984). We continue to work on incorporating VIVA software into WHOI Cable so that we can calculate the normal drag coefficient as a function of instantaneous vibration amplitude. We performed a comparative study on the use of thruster control mounted on a towed vehicle undergoing two-dimensional maneuvers. These results were published in Grosenbaugh and Bowen (2005). We presented a workshop on the use of the WHOI Cable software with emphasis on towed sonar arrays to engineers at SACLANT Undersea Research Centre in October 2004.
DTIC
Cables (Ropes); Dynamic Characteristics; Dynamic Response; Ships; Towing

20050243093 Naval Postgraduate School, Monterey, CA USA
Undersea Navigation of a Glider UUV Using an Acoustic Communications Network
Ouimet, Sean P.; Sep. 1, 2005; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439563; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The US Navy is developing Seaweb undersea acoustic networking technology to enable distributed autonomous ocean sensors. An Unmanned Undersea Vehicle (UUV) can operate as a mobile node among the grid in the conduct of its own mission, using the fixed nodes as navigation reference points. The fixed grid provides a cellular communications infrastructure for command & control and data telemetry. In turn, the UUV can support the fixed grid by physically redistributing large quantities of data throughout the network or for breaching the sea surface and acting as a mobile gateway node, communicating via satellite to a command center ashore. Assimilating UUVs as network nodes significantly enhances undersea network
DTIC
Acoustics; Communication; Communication Networks; Gliders; Navigation; Sound Transmission; Underwater Vehicles

20050243096 Naval Postgraduate School, Monterey, CA USA
The Effects of Quality and Timeliness of Targeting Information on Submarine Employment of Long Range Anti-Ship Cruise Missiles
Parashak, Paul M., III; Sep. 1, 2005; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439566; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Anti-ship cruise missiles (ASCMs) are proliferating throughout the world, with some nations gaining the potential to launch them from submarines. The long range of these missiles implies that the submarine would rely on target detections from other forces. Communication delays and accuracy of locating data influence shot accuracy. This thesis uses a maneuvering target statistical tracker model (MTST) of target motion and indicates that the submarine can conduct an effective launch with accurate locating information even with long communications delays. The analysis shows that significant degradation of the probability of target intercept occurs for an alerted or evading target. The analysis then determines how this is affected by the presence of other potential targets for the missile. Two assumptions are made about the performance of the ASCM seeker. A simplistic seeker that selects a target at random performs very poorly if other naval escorts and random neutral shipping are encountered. A more intelligent seeker that uses information about the relative size of the ships and attacks the performance.
DTIC
Antiship Missiles; Cruise Missiles; Detection; Ships; Target Acquisition; Traffic

20050243156 Naval Postgraduate School, Monterey, CA USA
Wavelet Analysis of Bioacoustic Scattering and Marine Mammal Vocalizations
Scheidecker, Elizabeth M.; Sep. 1, 2005; 115 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439663; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wavelets have been used in numerous geophysical studies but few have examined their applicability to underwater

acoustic signals. Wavelet transforms can remove noise from a given time series and allow data analysis at multiple levels of resolution. This unique ability is exercised as a feasible application to the signals in this thesis: a reflected scattered signal from a swimbladder-bearing fish, alewife (Alosa pseudoharengus), and several Odontocetes vocalizations. Both studies reveal that wavelet-based techniques show potential in providing viable information for these acoustic signals despite the lack of statistical analysis. The alewife portion shows a reasonable first order approximation to the absolute target strength and to the time delay correlation caused by the spatial separation of scattering features in the fish. The marine mammal application shows a possible real time method to estimate the mammal's range using the root mean square (RMS) energy of the decomposed signal. Because of wavelet function mismatch, both studies conclude that more extensive research is necessary to develop these techniques into systematic processes.
DTIC
Acoustic Scattering; Animals; Bioacoustics; Mammals; Marine Biology; Marine Mammals; Scattering; Wavelet Analysis

20050243162 Naval Postgraduate School, Monterey, CA USA
Detection and Resolvability of Pulsed Acoustic Signals Through the South China Sea Basin: A Modeling Analysis
Schneck-Scott, Adria R.; Sep. 1, 2005; 45 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439670; No Copyright; Avail.: CASI: A03, Hardcopy

Sponsored by the office of Naval Research (ONR), the Windy Islands Soliton Experiment (WISE) is designed to measure acoustic propagation and physical oceanography commencing April 2005-2006. As part of this experiment, two deep water moorings with acoustic transceivers (source-receiver combinations) will be placed in the South China Sea deep basin 160 km apart. These transceivers will transmit and receive phase-modulated signals (pulses after signal processing) over the year attempting to (1) capture multi-scale variability in transmission loss and (2) examine the progression of internal tides within the basin through tomographic inverse techniques. Acoustic arrival structure modeling was conducted to discern whether a detectable and resolvable signal was to be expected and for signal design. Using a stochastic inverse approach, the inversion was used to determine vertical structure, spatial resolution, and uncertainty associated with the tomographic mapping of the internal tide.
DTIC
China; Mooring; Seas; Signal Detection; Signal Processing; Signal Transmission; Sound Waves

20050243220 Washington Univ., Seattle, WA USA
Sonar Simulation Toolset: Clutter Modeling and Support
Goddard, Robert P.; Mar. 1, 2005; 3 pp.; In English
Contract(s)/Grant(s): N00014-01-G-0460-0029; Proj-3987
Report No.(s): AD-A439779; No Copyright; Avail.: CASI: A01, Hardcopy

The primary objective of this project was to develop an algorithm for time-series simulation of target-like bottom clutter, and add it to the Sonar Simulation Toolset (SST). Toward that end, we added location-dependent bottom types to SST, added bottom-slope corrections to the scattering strengths and reflection coefficients, and made several of the algorithms sensitive to the locations of surface and bottom reflections. We also made several changes to improve SST's efficiency, usability, completeness, and correctness. The primary deliverables were two releases of SST; we also pushed through publication a major report and a JUA(USN) invited paper reviewing SST's science and math.
DTIC
Clutter; Computerized Simulation; Simulation; Software Development Tools; Sonar

20050243237 Naval Postgraduate School, Monterey, CA USA
Implementing a Patternless Intrusion Detection System; A Methodology for Zippo
Olsavsky, Vonda L.; Sep. 1, 2005; 125 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439818; No Copyright; Avail.: CASI: A06, Hardcopy

A methodology for the implementation of Zippo, a patternless intrusion detection system is presented in this thesis. This methodology approaches the implementation in a holistic manner to include the administrative and operational tasks necessary for ensuring proper preparation for Zippo's use. Prior to implementing and using Zippo, a basic understanding of TCP/IP and intrusion detection systems is needed and these topics are presented in broad detail. The origin of Zippo starts with the creation of Therminator, which is discussed in detail. The architecture and configuration of Zippo are based on those of Therminator and understanding the ideas of buckets and balls, thermal canyons and towers, decision trees, slidelength and windowlength and initial and boundary conditions are paramount to understanding the Zippo application. To successfully implement Zippo,

other network factors must be attended to including the topology, organizational policies and the security plan. Once these factors are addressed, Zippo can be optimally configured to successfully be installed on a network. Finally, previous research done on Zippo yielded decision trees and thermal canyons pertaining to protocol specific threats that are presented to familiarize the reader with Zippo's visual representation of malicious or anomalous behavior.
DTIC
Detection; Intrusion; Thermodynamic Properties; Warning Systems

20050243406 Wyle Labs., Inc., Arlington, VA, USA
Noise Model Simulation (NMSim) User's Manual
Jun. 2005; 134 pp.; In English
Contract(s)/Grant(s): NPS-1443-CX2000-98-038
Report No.(s): PB2005-102747; WR-03-09; No Copyright; Avail.: National Technical Information Service (NTIS)

The Noise Model Simulation (NMSim) is a computer model that generates time histories of noise from moving sources accounting for the effects of real terrain on sound propagation. This document is the User's Manual that is included with the computer model, PB2005-500157. NMSim has existed as a single event aircraft noise model since the mid-1900's and was originally developed in support of noise propagation studies and ran on a PC under MS-DOS. This model has become part of a growing trend toward simulation models for complex situations not adequately addressed by traditional integrated airport noise models and provides both quantitative analysis in terms of spectra and loudness metrics and descriptive display in the format of color renditions and animations of noise. NMSim has been developed into general purpose noise capabilities of earlier versions of NMSim. It also includes ground noise sources and is capable of analyzing multiple-source noise environments.
NTIS
Simulation; Sound Propagation; Noise Propagation; User Manuals (Computer Programs)

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*.

20050242964 Savannah River National Lab., Aiken, SC, USA
Activity Estimates of Various Radionuclides in Saltstone Vapor Phase
Denham, M.; Crapse, K.; Jan. 2005; 16 pp.; In English
Report No.(s): DE2005-838833; WSRC-TR-2005-00046; No Copyright; Avail.: Department of Energy Information Bridge

Savannah River National Laboratory estimated activities of various radionuclides in vapor phase associated with saltstone. These radionuclides, as well as the estimated activity and concentration of each in the gases phase are listed. Some of the activities are so low they should be considered zero. In particular, activity of the antimony and tin isotopes in the gas phase correspond to less than a molecule of gas per 340 m(sup 3) of vapor volume. Equilibrium calculations of the partitioning of each radionuclide between vapor and dissolved phases were done using the Geochemists Workbench (R). The conceptual model used was that 1 curie of each constituent was available to partition between vapor and dissolved phases. The overall assumption is that exposure would come from a single release of the vapor phase from a saltstone vault.
NTIS
Estimates; Radioactive Isotopes; Vapor Phases; Research and Development

20050242965 Electric Power Research Inst., Palo Alto, CA, USA
BWRVIP-123, Revised 1 NP: BWR Vessel and Internals Project Removal and Analysis of Material Samples from Core shroud and Top guide at Susquehanna Unit. Top Guide
January 2005; 144 pp.; In English
Report No.(s): DE2005-839512; No Copyright; Avail.: National Technical Information Service (NTIS)

In a unique industry opportunity, EPRI and the U.S. Department of Energy under the Nuclear Energy Plant Optimization (NEPO) Program sponsored the removal of material samples from the core shroud and top guide at the Susquehanna Unit 2 nuclear power plant. Analysis of these samples revealed the fluence and helium content at the time of removal as well as the estimated initial boron content at the time of fabrication. Helium and boron concentrations are important indicators of the

weldability of irradiated steels, while fluence is a critical parameter for estimating material toughness and crack growth rates. This report describes tooling development and qualification, technical justification, sampling, and results of helium and fluence analyses.
NTIS
Nuclear Reactors; Reactor Materials

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*.

20050240875 Lawrence Livermore National Lab., Livermore, CA USA
X-Ray Polarization Measurements at Relativistic Laser Intensities
Beiersdorfer, P.; Shepherd, R.; Mancini, R. C.; Chen, H.; Mar. 20, 2004; 14 pp.; In English
Report No.(s): DE2005-15014034; UCRL-PROC-203242; No Copyright; Avail.: National Technical Information Service (NTIS)

Plasma polarization spectroscopy (PPS) has been employed to verify and study the existence of non-thermal, fast electrons in laser-plasma interaction since the first experiments by Kieffer et al.. The laser intensity in these measurements has been in the range 10(sup 14)-10(sup 16) W/cm (sup 2). Measurements of laser absorption at higher intensities less than or equal to 10(sup 18) W/cm(sup 2) have been made, but without employing x-ray polarimetry. Theoretical studies of fast-electron generation and their effect on the x-ray linear polarization have been made, which considered laser intensities as high as 10(sup 18) W/cm(sup 2). Here we describe a planned effort to use PPS as a diagnostic for determining fast electron generation and energy partition of short pulse lasers interacting with matter at relativistic laser intensities up to 10(sup 21) W/cm(sup 2.)
NTIS
Lasers; Plasmas (Physics); Spectroscopy; X Rays

20050240890 Lawrence Livermore National Lab., Livermore, CA USA
Absorptance Measurements of Optical Coatings A Round Robin
Chow, R.; Taylor, J. R.; Wu, Z. L.; Boccara, C. A.; Oct. 26, 2000; 20 pp.; In English
Report No.(s): DE2005-15013171; UCRL-JC-139527; No Copyright; Avail.: Department of Energy Information Bridge

An international round robin study was conducted on the absorption measurement of laser-quality coatings. Sets of optically coated samples were made by a reactive DC magnetron sputtering and an ion beam sputtering deposition process. The sample set included a high reflector at 514 nm and a high reflector for the near infrared (1030 to 1318 nm), single layers of silicon dioxide, tantalum pentoxide, and hafnium dioxide. For calibration purposes, a sample metalized with hafnium and an uncoated, superpolished fused silica substrate were also included. The set was sent to laboratory groups for absorptance measurement of these coatings. Whenever possible, each group was to measure a common, central area and another area specifically assigned to the respective group. Specific test protocols were also suggested in regards to the laser exposure time, power density, and surface preparation.
NTIS
Absorptance; Antireflection Coatings

20050240895 Lawrence Livermore National Lab., Livermore, CA USA
Activation of the Mercury Laser: A Diode-Pumped Solid-State Laser Driver for Inertial Fusion
Bayramian, A. J.; Bibeau, C.; Beach, R. J.; Chanteloup, J. C.; Mar. 07, 2001; 12 pp.; In English
Report No.(s): DE2005-15013216; UCRL-JC-140526-REV-1; No Copyright; Avail.: National Technical Information Service (NTIS)

Initial measurements are reported for the Mercury laser system, a scalable driver for rep-rated high energy density physics research. The performance goals include 10% electrical efficiency at 10 Hz and 100 J with a 2-10 ns pulse length. This laser is an angularly multiplexed 4-pass gas-cooled amplifier system based on image relaying to minimize wavefront distortion and

optical damage risk at the 10 Hz operating point. The efficiency requirements are fulfilled using diode laser pumping of ytterbium doped strontium fluorapatite crystals.
NTIS
Diodes; Laser Pumping; Solid State Lasers

20050240979 Lawrence Livermore National Lab., Livermore, CA USA
Spectroscopic Monitoring of Kidney Tissue Ischemic Injury
Fitzgerald, J.; Michalopoulou, A.; Troppmann, C.; Demos, S. G.; Mar. 03, 2005; 12 pp.; In English
Report No.(s): DE2005-15014134; UCRL-PROC-203878; No Copyright; Avail.: Department of Energy Information Bridge
Noninvasive evaluation of tissue viability of donor kidneys used for transplantation is an issue that current technology is not able to address. In this work, we explore optical spectroscopy for its potential to assess the degree of ischemic damage in kidney tissue. We hypothesized that ischemic damage to kidney tissue will give rise to changes in its optical properties which in turn may be used to asses the degree of tissue injury. The experimental results demonstrate that the autofluorescence intensity of the injured kidney is decreasing as a function of time exposed to ischemic injury. Changes were also observed in the NIR light scattering intensities most probably arising from changes due to injury and death of the tissue.
NTIS
Infrared Imagery; Injuries; Ischemia; Kidneys; Near Infrared Radiation; Spectroscopy

20050241678 Lawrence Livermore National Lab., Livermore, CA USA
Design and Progress Toward a Multi-Conjugate Adaptive Optics System for Distributed Aberration Correction
Baker, K.; Oliver, S.; Tucker, J.; Silva, D.; Gavel, D.; Aug. 18, 2004; 32 pp.; In English
Report No.(s): DE2005-15014791; UCRL-PROC-206126; No Copyright; Avail.: Department of Energy Information Bridge
This article investigates the use of a multi-conjugate adaptive optics system to improve the field-of-view for the system. The emphasis of this research is to develop techniques to improve the performance of optical systems with applications to horizontal imaging. The design and wave optics simulations of the proposed system are given. Preliminary results from the multi-conjugate adaptive optics system are also presented. The experimental system utilizes a liquid-crystal spatial light modulator and an interferometric wave-front sensor for correction and sensing of the phase aberrations, respectively.
NTIS
Aberration; Adaptive Optics; Conjugates; Laser Beams

20050241684 Lawrence Livermore National Lab., Livermore, CA USA, International Society for Optical Engineering, Denver, CO, USA
Adaptive Compensation of Atmospheric Turbulence Utilizing an Interferometric Wave-front Sensor and a High Resolution MEMS-based Spatial Light Modulator
Baker, K.; Stappaerts, E.; Gavel, D.; Tucker, J.; Silva, D.; Aug. 13, 2004; 24 pp.; In English
Report No.(s): DE2005-15014601; UCRL-CONF-206035; No Copyright; Avail.: Department of Energy Information Bridge
Horizontal path correction of optical beam propagation presents a severe challenge to adaptive optics systems due to the short transverse coherence length and the high degree of scintillation incurred by propagation along these paths. The system presented operates with nearly monochromatic light. It does not require a global reconstruction of the phase, thereby eliminating issues with branch points and making its performance relatively unaffected by scintillation. The systems pixel count, 1024, and relatively high correction speed, in excess of 800 Hz, enable its use for correction of horizontal path beam propagation. We present results from laboratory and field tests of the system in which we have achieved Strehl ratios greater than 0.5.
NTIS
Adaptive Optics; Atmospheric Turbulence; High Resolution; Interferometry; Light Modulators; Microelectromechanical Systems

20050241687 Lawrence Livermore National Lab., Livermore, CA USA
X-Ray Transport Optics and Diagnostics Commissioning Report
Bionta, R. M.; Oct. 23, 2004; 18 pp.; In English
Report No.(s): DE2005-15014823; UCRL-PROC-207494; No Copyright; Avail.: Department of Energy Information Bridge
We discuss commissioning work funded through LCLS WBS element 1.5: X-ray Transport Optics and Diagnostics (XTOD.) A short description of the XTOD commissioning diagnostics hardware is followed by a brief discussion of FEL

induced damage considerations. The remainder discusses simulation work on the response of the Direct Imager camera to a mix of spontaneous and FEL radiation and a Monte Carlo Calculation of the reflections of the spontaneous radiation in the undulator vacuum tube.
NTIS
Diagnosis; X Ray Optics; X Rays

20050241894 Nearfield Systems, Inc., Carson, CA, USA
The Alignment of a Spherical Near-Field Measurement System using Electrical Measurements
Newell, Allen C.; Hindman, Greg; IEEE Antennas and Propagation Society International Symposium 1998 Digest. Antennas: Gateways to the Global Network, Volume 3; [1998], pp. 1327-1330; In English; See also 20050241839; Copyright;
Avail.: Other Sources

The mechanical rotators must be correctly aligned and the probe placed in the proper location when performing spherical near-field measurements. This alignment is usually accomplished using optical instruments. In some cases it may be impractical to place the alignment mirrors on the AUT or optical instrument may not be available. In these and other cases, it is desirable to check alignment with electrical measurements on the actual AUT and probe. Such tests have recently been developed and verified. Appropriate comparison and analysis of two near-field measurements that should be identical or have a known difference yields precise measures of some rotator and probe alignment errors. While these tests are independent of the AUT pattern, judicious choice or placement of the antenna can increase the sensitivity of the test. Typical measurements will be presented using analysis recently included in NSI software.
Author
Alignment; Electrical Measurement; Near Fields; Optical Equipment

20050242053 Pacific Northwest National Lab., Richland, WA, USA
Chemical Sensing Using Infrared Cavity Enhanced Spectroscopy: Short Wave Infrared Cavity Ring Down Spectroscopy (SWIR CRDS) Sensor
Williams, R. M.; Thompson, J. S.; Harper, W. W.; Stewart, T. L.; Aker, P. M.; Oct. 2003; 40 pp.; In English
Report No.(s): DE2005-15010546; PNNL-14475; No Copyright; Avail.: Department of Energy Information Bridge

The principal goal of Pacific Northwest National Laboratory's (PNNL's) Remote Spectroscopy Project is to explore and develop the science and technology behind point and stand off infrared (IR) spectroscopic chemical sensors that are needed for detecting weapons proliferation activity and countering terrorism. Missions addressed include detecting chemical, biological, and nuclear weapons and their production; counterterrorism measures that involve screening luggage, personnel, and shipping containers for explosives, firearms, narcotics, chemical weapons and/or their residues; and mapping of contaminated areas. The science and technology developed in this program is dual use in that it additionally supports progress in a diverse set of agenda's that include chemical weapons defense programs, air operations activities, emissions monitoring, law enforcement, and medical diagnostics. Sensors for these missions require extremely low limits of detection because many of the targeted signature species are either present in low concentrations or have extremely low vapor pressures. The sensors also need to be highly selective as the environments that they will be operated in will contain a variety of interferent species and false positive detection is not an option. PNNL has been working on developing a class of sensors that draw vapor into optical cavities and use laser-based spectroscopy to identify and quantify the vapor chemical content.
NTIS
Cavities; Detection; Infrared Detectors; Infrared Radiation; Infrared Spectrometers; Infrared Spectroscopy

20050242955 Lawrence Livermore National Lab., Livermore, CA USA
Grazing Incidence Pumping for Efficient X-ray Lasers
Oct. 15, 2004; 14 pp.; In English
Report No.(s): DE2005-15014734; UCRL-PROC-204478; No Copyright; Avail.: Department of Energy Information Bridge

We report progress in developing efficient pumping of laser-driven x-ray lasers that opens new possibilities for both high average power x-ray lasers as well as producing progressively shorter wavelength lasers. The new scheme of grazing incidence pumping (GRIP) is described. In essence, a chosen electron density region of a pre-formed plasma column, produced by a longer pulse at normal incidence onto a slab target, is selectively pumped by focusing the short pulse laser at a determined grazing incidence angle to the target. The controlled use of refraction of the pumping laser in the plasma results in several

benefits: The pump laser path length is longer and there is an increase in the laser absorption in the gain region for creating a collisional Ni-like ion x-ray laser.
NTIS
Grazing Incidence; Laser Pumping; X Ray Lasers

20050243205 Air Force Research Lab., Edwards AFB, CA USA
A 90 GHz Phase-Bridge Interferometer for Plasma Density Measurements in the Near Field of a Hall Thruster
Cappelli, Mark; Hermann, Wes; Kodiak, Michael; Gascon, Nicolas; Hargus, William, Jr; Jan. 1, 2001; 9 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A439741; No Copyright; Avail.: CASI: A02, Hardcopy

Preliminary measurements are described of electron number density obtained in the near field of a 200W Busek Hall thruster. The approach taken is ultra-high high frequency (3.3 mm wavelength, 90 GHz) microwave interferometry that affords high spatial resolution suitable for studying the near exit region, where the plasma density can be as high as 10 (11)cm-3. A 90 GHz beam can be focused down to a waist of approximately 7 mm, and over a 50 mm plasma path length, a l0(11)cm-3 plasma density gives rise to an easily measurable 30 phase shift. The system is of a phase-bridge design, utilizing two signal anns split from a fixed frequency source (one passing through the plasma) that recombine at two balanced nuxers. A line-integrated electron density is obtained by comparing the two signals from the mixers, This interferometer is suitable for measuring time-dependent plasma density fluctuations offering unprecedented information about plasma turbulence in the near exit region, and the opportunity to study turbulence-enhanced electron transport in regions where the plasma is presumably collisionless and free of interactions with the channel wall.
DTIC
Density Measurement; Hall Thrusters; Interferometers; Near Fields; Plasma Density

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20050240881 Lawrence Livermore National Lab., Livermore, CA USA
Variation in Particle Pumping Due to Changes in Topology in High Performance DIII-D Plasmas
Petrie, T. W.; Brooks, N. H.; Fenstermacher, M. E.; Greenfield, C. M.; Groth, M.; Dec. 06, 2004; 24 pp.; In English
Report No.(s): DE2005-15011792; UCRL-CONF-208421; No Copyright; Avail.: Department of Energy Information Bridge

Recent experiments on DIII-D point to the importance of two factors in determining the rate at which deuterium particles can be pumped at the divertor target(s): (1) the divertor magnetic balance, i.e., the degree to which the divertor topology is single-null (SN) or double-null (DN), and (2) the direction of the of B x (del)B ion drift with respect to the X-point(s). Changes in divertor magnetic balance near the DN shape have a much stronger effect on the pumping rate at the inner divertor target(s) than on the pumping rate at the outer divertor target(s). The behavior in the particle pumping observed at the inner and outer divertor target(s) in the DN and near-DN shapes suggests a redistribution of particles that would be expected in the presence of B x (del)B and E x B ion particle drifts in the scrapeoff layer (SOL) and divertor(s).
NTIS
Plasmas (Physics); Topology

20050240889 Lawrence Livermore National Lab., Livermore, CA USA
Divertor Target Heat Load Reduction by Electrical Biasing, and Application to COMPASS-D
Fielding, S. J.; Cohen, R. H.; Mar. 07, 2001; 12 pp.; In English
Report No.(s): DE2005-15013158; UCRL-JC-142886; No Copyright; Avail.: Department of Energy Information Bridge

A toroidally-asymmetric potential structure in the scrape-off layer (SOL) plasma may be formed by toroidally distributed electrical biasing of the divertor target tiles. The resulting ExB convective motions should increase the plasma radial transport in the SOL and thereby reduce the heat load at the divertor. In this paper we develop theoretical modelling and describe the implementation of this concept to the COMPASS-D divertor. We show that strong magnetic shear near the X-point should cause significant squeezing of the convective cells preventing convection from penetrating above the X-point. This should result in reduced heat load at the divertor target without increasing the radial transport in the portion of the SOL in direct contact with the core plasma, potentially avoiding any confinement degradation. Implementation of divertor biasing is in hand

on COMPASS-D involving insulation of, and modifications to the present divertor tiles.
NTIS
Diverters; Loads (Forces); Plasma Sheaths; Targets

20050242048 Lawrence Livermore National Lab., Livermore, CA USA
NIF Project Quality Assurance Program Plan Revision E
Dun, C.; Brereton, S.; Yatabe, J.; Jun. 01, 2001; 42 pp.; In English
Report No.(s): DE2005-15013381; UCRL-ID-125435-REV-5; No Copyright; Avail.: Department of Energy Information Bridge

The National Ignition Facility (NIF) is a key constituent of the Department Energy's (DOE's) Stockpile Stewardship Program. The NIF will use inertial confinement fusion (ICF) to produce ignition and energy gain in ICF targets and will perform weapons physics, weapons effects, and high-energy-density experiments in support of national security and civilian objectives. The primary mission of the NIF Project is the design and construction of the facility and equipment, acceptance testing, and activation. To accomplish this mission, the LLNL Director created the NIF Programs Directorate, and within that Directorate, the NIF Project Office to organize and manage the Project. The NIF Project Office establishes this QA Program to ensure its success. This QA Program Plan (QAPP) defines and describes the program--the management system--for specifying, achieving, and assuring the quality of all NIF Project work consistent with the policies of LLNL and the NIF Programs Directorate.
NTIS
Ignition; Inertial Confinement Fusion; Laser Targets; Project Planning; Quality Control

20050242939 Princeton Univ., NJ USA
Numerical Study of Field-Reversed Configurations: The Formation and Ion Spin-Up
Belova, E. V.; Davidson, R. C.; Ji, H.; Yamada, M.; Jun. 2005; 38 pp.; In English
Report No.(s): DE2005-840784; PPPL-4075; No Copyright; Avail.: Department of Energy Information Bridge

Results of three-dimensional numerical simulations of field-reversed configurations (FRCs) are presented. Emphasis of this work is on the nonlinear evolution of magnetohydrodynamic (MHD) instabilities in kinetic FRCs, and the new FRC formation method by counter-helicity spheromak merging. Kinetic simulations show nonlinear saturation of the n = 1 tilt mode, where n is the toroidal mode number. The n = 2 and n = 3 rotational modes are observed to grow during the nonlinear phase of the tilt instability due to the ion spin-up in the toroidal direction. The ion toroidal spin-up is shown to be related to the resistive decay of the internal flux, and the resulting loss of particle confinement. Three-dimensional MHD simulations of counter-helicity spheromak merging and FRC formation show good qualitative agreement with results from the SSX-FRC experiment. The simulations show formation of an FRC in about 20-30 Alfven times for typical experimental parameters. The growth rate of the n = 1 tilt mode is shown to be significantly reduced compared to the MHD growth rate due to the large plasma viscosity and field-line-tying effects.
NTIS
Magnetic Field Configurations; Magnetohydrodynamic Stability; Plasmas (Physics); Magnetohydrodynamics

20050242968 Princeton Univ., NJ USA
Recent Liquid Lithium Limiter Experiments in CDX-U
Majeski, R.; Jardin, S.; Kaita, R.; Gray, T.; Marfuta, P.; May 2005; 24 pp.; In English
Report No.(s): DE2005-839533; PPPL-4068; No Copyright; Avail.: Department of Energy Information Bridge

Recent experiments in the Current Drive experiment-Upgrade (CDX-U) provide a first-ever test of large area liquid lithium surfaces as a tokamak first wall, to gain engineering experience with a liquid metal first wall, and to investigate whether very low recycling plasma regimes can be accessed with lithium walls. The CDX-U is a compact (R=34 cm, a=22 cm, B(sub toroidal)= 2 kG, I(sub P)=100 kA, T(sub e)(0) (approx)100 eV, n(sub e)(0) (approx)5 x 10(sup 19)m(sup -3)) spherical torus at the Princeton Plasma Physics Laboratory. A toroidal liquid lithium pool limiter with an area of 2000 cm(sup 2)(half the total plasma limiting surface) has been installed in CDX-U. Tokamak discharges which used the liquid lithium pool limiter required a fourfold lower loop voltage to sustain the plasma current, and a factor of 5-8 increase in gas fueling to achieve a comparable density, indicating that recycling is strongly reduced. Modeling of the discharges demonstrated that the lithium limited discharges are consistent with Z(sub effective)\h 1.2 (compared to 2.4 for the pre-lithium discharges), a

broadened current channel, and a 25% increase in the core electron temperature. Spectroscopic measurements indicate that edge oxygen and carbon radiation are strongly reduced.
NTIS
Liquid Lithium; Liquid Metals; Plasmas (Physics)

20050242969 Princeton Univ., NJ USA
Kinetic Damping of Toroidal Alfven Eigenmodes
Fu, G. Y.; Berk, H. L.; Pletzer, A.; May 2005; 40 pp.; In English
Report No.(s): DE2005-839535; PPPL-4069; No Copyright; Avail.: Department of Energy Information Bridge

The damping of Toroidal Alfven Eigenmodes in JET plasmas is investigated by using a reduced kinetic model. Typically no significant damping is found to occur near the center of the plasma due to mode conversion to kinetic Alfven waves. In contrast, continuum damping from resonance near the plasma edge may be significant, and when it is, it gives rise to damping rates that are compatible with the experimental observations.
NTIS
Magnetohydrodynamic Waves; Plasmas (Physics); Kinetics

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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*.

20050240932 Department of Energy, Washington, DC, USA
Snapshot View of High Temperature Superconductivity 2002
January 2002; 54 pp.; In English
Report No.(s): PB2006-101421; No Copyright; Avail.: National Technical Information Service (NTIS)

This report outlines the conclusions of a workshop on High Temperature Superconductivity held April 5-8, 2002 in San Diego. The purpose of this report is to outline and highlight some outstanding and interesting issues in the field of High Temperature Superconductivity. The range of activities and new ideas that arose within the context of High Temperature Superconductors is so vast and extensive that it is impossible to summarize it in a brief document. Thus this report does not pretend to be all-inclusive and cover all areas of activity. It is a restricted snapshot and it only presents a few viewpoints. The complexity and difficulties with high temperature superconductivity is well illustrated by the Buddhist parable of the blind men trying to describe experimentally an elephant. These very same facts clearly illustrate that this is an extremely active field, with many unanswered questions, and with a great future potential for discoveries and progress in many (sometimes unpredictable) directions.
NTIS
High Temperature; High Temperature Superconductors; Superconductivity

20050241975 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA, Hampton Univ., VA, USA
General Electron Induced Emission (Genie) System Proposal
Epps, M.; Kazimi, R.; Gueye, P.; January 2005; 8 pp.; In English
Report No.(s): DE2005-839992; No Copyright; Avail.: Department of Energy Information Bridge

A real time beam diagnostic system is proposed for the Jefferson lab injector region. The General ElectroN Induced Emission system (GENIE) consists of a package that includes both hardware (beam monitoring devices) and software (for 3D or 4D visualization of the beam transport). This beam diagnostic tool uses (very small) scintillating fibers placed in different planes to extract the: beam profile, beam position, beam current, and beam emittance in real time. Accuracies in position and angle could be at the sub- (micro)m and (micro)rad levels, respectively. The beam current could be reconstructed within a few percent. A combined Geant4/Parmela simulation will be developed for beam optic studies. While Parmela offers the power of beam transport with phase matching capabilities (among others), Geant4 provides secondary particles tracking, as well as 3D & 4D visualization, to name a few. A phase I investigation of GENIE using a 100 keV line in the test lab is discussed in this document.
NTIS
Electron Emission; Electron Beams; Linear Accelerators

20050241976 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
SRF Performance of CEBAF After Thermal Cycle to Ambient Temperature
Rimmer, R. A.; Benesch, J.; Preble, J.; Reece, C.; January 2005; 8 pp.; In English
Report No.(s): DE2005-839995; No Copyright; Avail.: Department of Energy Information Bridge

In September 2003, in the wake of Hurricane Isabel, JLab was without power for four days after a tree fell on the main power lines feeding the site. This was long enough to lose insulating vacuum in the cryomodules and cryogenic systems resulting in the whole accelerator warming up and the total loss of the liquid helium inventory. This thermal cycle stressed many of the cryomodule components causing several cavities to become inoperable due to helium to vacuum leaks. At the same time the thermal cycle released years of adsorbed gas from the cold surfaces. Over the next days and weeks this gas was pumped away, the insulating vacuum was restored and the machine was cooled back down and re-commissioned. In a testament to the robustness of SRF technology, only a small loss in energy capability was apparent, although individual cavities had quite different field-emission characteristics compared to before the event. In Summer 2004 a section of the machine was again cycled to room temperature during the long maintenance shutdown. We report on the overall SRF performance of the machine after these major disturbances and on efforts to characterize and optimize the new behavior for high-energy running.
NTIS
Ambient Temperature; Linear Accelerators; Particle Accelerators

20050241979 Jefferson (Thomas) National Accelerator Facility, Newport News, VA, USA, Deutsches Elektronen-Synchrotron, Hamburg, Germany, State Univ. of New York, Stony Brook, NY, USA
Preliminary Results from a Superconducting Photocathode Sample Cavity
Kneisel, P.; Sekutowicz, J.; Lefferts, R.; Lipski, A.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840001; No Copyright; Avail.: National Technical Information Service (NTIS)

Pure niobium has been proposed as a photocathode material to extract directly photo-currents from the surface of a RF-gun cavity. However, the quantum efficiency of niobium is(approx)3(center dot) 10(sup -4), whereas electro- or vacuum deposited lead has an(approx) 10 times higher quantum efficiency. We have designed and tested a photo-injector niobium cavity, which can be used to insert photo-cathodes made of different materials in the high electric field region of the cavity. Experiments have been conducted with niobium and lead, which show that neither the Q-values of the cavity nor the obtainable surface fields are significantly lowered. This paper reports about the results from these tests.
NTIS
Cavities; Injectors; Niobium; Photocathodes; Superconducting Cavity Resonators; Superconductivity

20050241980 Jefferson (Thomas) National Accelerator Facility, Newport News, VA, USA
Use of Integrated Electronic Data Capture and Analysis for Accelerator Construction and Commissioning: Pansophy from the SNS Towards the ILC
Brookwalter, V.; Madre, B.; Ozelis, J. P.; Reece, C.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840002; No Copyright; Avail.: Department of Energy Information Bridge

Jefferson Lab has extensively used a proprietary web-based system (Pansophy) that integrates commercial database, data analysis, document archiving and retrieval, and user interface software, as a coherent knowledge management product during the construction of the cryomodules for the SNS Superconducting Linac, providing elements of process and procedure control, data capture and review, and data mining and analysis. With near real-time and potentially global access to production data, process monitoring and performance analyses could be pursued in a timely manner, providing crucial feedback. The extensibility, portability, and accessibility of Pansophy via universally available software components provide the essential features needed in any information and project management system capable of meeting the needs of future accelerator construction efforts, requiring an unprecedented level of regional and international coordination and collaboration, to which Pansophy is well suited.
NTIS
Construction; Particle Accelerators

20050241983 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
CSR Interaction at the Cross-Over of the Full Compression Point
Li, R.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840016; No Copyright; Avail.: National Technical Information Service (NTIS)

In recent commissioning of the 10 kW FEL at Jefferson Lab, as one varies the energy chirp of the electron bunches at the entrance of the chicane to make the bunch more and more compressed at the exit of the chicane, a sudden increase in the energy spread is observed at the crossover of the full compression point. This phenomenon is accompanied simultaneously with a significant increase of the THz radiation from the electron beam. A similar observation was made earlier in the CTF II CSR experiment at CERN. For example, for 5 nC bunch charge, 'the mean momentum spread increased by a factor of 4 at full compression with respect to the initial spread, and decreased to a factor of 3 larger than the initial spread at overcompression'. There is also a sudden drop of mean momentum at the full compression, along with a sudden increase in the horizontal emittance. As a first step to understand this phenomenon, in this paper, we analyze the effective longitudinal CSR force using our recent formulation of CSR dynamics, and show there is a sudden increase in the magnitude of the effective longitudinal CSR force at the cross-over of the full compression point. A numerical example is given for an LCLS type chicane. The physical picture of this sudden increase is also discussed.
NTIS
Crossovers; Electron Bunching; Chirp; Free Electron Lasers

20050241984 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Doubling the Intensity of an ERL Based Light Source
Hutton, A.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840018; No Copyright; Avail.: Department of Energy Information Bridge
A light source based on an Energy Recovered Linac (ERL) consists of a superconducting linac and a transfer line that includes wigglers and undulators to produce the synchrotron light. The transfer line brings the electron bunches back to the beginning of the linac so that their energy can be recovered when they traverse the linac a second time, (lambda)/2 out of RF phase. There is another interesting condition when the length of the transfer line is (n (+-) 1/4) (lambda). In this case, the electrons drift through on the zero RF crossing, and make a further pass around the transfer line, effectively doubling the circulating current in the wigglers and undulators. On the third pass through the linac, they will be decelerated and their energy recovered. The longitudinal focusing at the zero crossing is a problem, but it can be canceled if the drifting beam sees a positive energy gradient for the first half of the linac and a negative gradient for the second half (or vice versa). This paper presents a proposal to use a double chicane at the center of the linac to provide this focusing inversion for the drifting beam while leaving the accelerating and decelerating beams on crest.
NTIS
Light Sources; Linear Accelerators; Particle Accelerators

20050241985 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Simulations of Parametric Resonance Ionization Cooling of Muon Beams
Beaard, K.; Bogacz, S. A.; Derbenev, Y.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840058; No Copyright; Avail.: Department of Energy Information Bridge
Parametric-resonance ionization cooling (PIC) is being developed to create small beams so that high muon collider luminosity can be achieved with fewer muons. In the linear channel that is studied in this effort, a half integer resonance is induced such that the normal elliptical motion of particles in phase space becomes hyperbolic, with particles moving to smaller and larger as they pass down the channel. Thin absorbers placed at the focal points of the channel then cool the angular divergence of the beam by the usual ionization cooling mechanism where each absorber is followed by RF cavities. Thus the phase space of the beam is compressed in transverse position by the dynamics of the resonance and its angular divergence is compressed by the ionization cooling mechanism. We report the first results of simulations of this process, a study of the compensation of chromatic aberration by using synchrotron oscillations.
NTIS
Cooling; Ionization; Muons; Particle Accelerators; Simulation

20050243013 North Carolina State Univ., Raleigh, NC USA
A Rate-Dependent Two-Dimensional Free Energy Model for Ferroelectric Single Crystals
Kim, Sang-Joo; Seelecke, Stefan; Ball, Brian L.; Smith, Ralph C.; Jan. 1, 2005; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0107; FA9550-04-1-0203
Report No.(s): AD-A439434; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The one-dimensional free energy model for ferroelectric materials developed by Smith et al. is generalized to two

dimensions. The two-dimensional free energy potential proposed in this paper consists of four energy wells that correspond to four variants of the material. The wells are separated by four saddle points, representing the barriers for 90-degree switching processes, and a local maximum, across which 180-degree switching processes take place. The free energy potential is combined with evolution equations for the variant fractions based on the theory of thermally activated processes. The model is compared to recent measurements on BaTiO3 single crystals by Burcsu et al., and predictions are made concerning the response to the application of in-plane multi-axial electric fields at various frequencies and loading directions. The kinetics of the 90-degree and 180-degree switching processes are discussed in detail.
DTIC
Crystals; Ferroelectricity; Free Energy; Models; Single Crystals; Two Dimensional Models

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*.

20050242962 Fermi National Accelerator Lab., Batavia, IL, USA
Development Plan for the Fermilab Proton Source
Holmes, S. D.; Sep. 1997; 44 pp.; In English
Report No.(s): DE2005-16220; FERMILAB-TM-2021; No Copyright; Avail.: Department of Energy Information Bridge

The purpose of this document is to describe a possible evolution of the Fermilab Proton Source over the next ten years. The goal is to outline a staged plan, with significant enhancements to the Fermilab research program evident at each step, and with minimal disruption to the ongoing program from required construction activities. As will be described in the body of this document we believe that such a plan would be constructed of some, or all, of the following components: Relocation of the Booster; Upgrading of the Linac energy; Construction of a new Booster with higher energy and larger aperture; and Construction of a new intermediate energy Pre-Booster.
NTIS
Linear Accelerators; Research Facilities; Protons

20050242963 Fermi National Accelerator Lab., Batavia, IL, USA
Searches for Charged Higgs Bosons and Supersymmetry at CDF
Bevensee, B.; Dec. 1997; 18 pp.; In English
Report No.(s): DE2005-16458; FERMILAB-CONF-97/405E; No Copyright; Avail.: Department of Energy Information Bridge

We present results of supersymmetric (SUSY) particle searches from the Collider Detector at Fermilab (CDF). First we describe searches for a charged Higgs boson and a stop squark, which could be produced in top quark decays. We also search for chargino-neutralino production using a trilepton signature. Finally, we investigate R-parity violating squark and LSP decay modes which have been proposed to accommodate the excess of high-Q2 events at HERA. No evidence for SUSY is found, and limits are placed on these processes.
NTIS
Higgs Bosons; Supersymmetry; Quarks

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*.

20050240867 Lawrence Livermore National Lab., Livermore, CA USA
Short Survey of Document Structure Similarity Algorithms
Buttler, D.; Mar. 05, 2004; 14 pp.; In English
Report No.(s): DE2005-15013935; UCRL-CONF-202728; No Copyright; Avail.: Department of Energy Information Bridge

This paper provides a brief survey of document structural similarity algorithms, including the optimal Tree Edit Distance algorithm and various approximation algorithms. The approximation algorithms include the simple weighted tag similarity

algorithm, Fourier transforms of the structure, and a new application of the shingle technique to structural similarity. We show three surprising results. First, the Fourier transform technique proves to be the least accurate of any of approximation algorithms, while also being slowest. Second, optimal Tree Edit Distance algorithms may not be the best technique for clustering pages from different sites. Third, the simplest approximation to structure may be the most effective and efficient mechanism for many applications.
NTIS
Algorithms; Analogies; Surveys

20050240927 Ohio State Univ., Columbus, OH, USA
Evaluating the Content of Web Sites: Guidelines for Educators
Nov. 1999; 40 pp.; In English
Report No.(s): PB2006-101117; No Copyright; Avail.: CASI: A03, Hardcopy

There is a tremendous amount of information available on the World Wide Web. Some of this information is good, sound research data; some is opinion. Some of the data are there for information; some for persuasion. When a person, whether a student, teacher, researcher, businessperson, or interested individual searches the World Wide Web, the sheer volume of information can be overwhelming. Further, any search may or may not lead the individual to the specific information source they seek. How can an individual determine the appropriateness or validity of the information they're Finding. This has been an issue of great discussion over the past few years. Much of the use of the Web in education has been criticized for allowing information from the Web to be used by students without critical consideration. Several projects, especially in libraries throughout the U.S., have focused on ways of evaluating web sites. This document is a reference tool for educators to use in preparing students to think critically on the use of the Web. The criteria laid out within this document come from a broad array of sources.
NTIS
Websites; World Wide Web; Education

20050242033 Wyle Labs., Inc., Arlington, VA, USA
Noise Model Simulation (NMSim) (Search and Retrieval on CD-ROM)
Jun. 2005; In English
Report No.(s): PB2005-500157; No Copyright; Avail.: National Technical Information Service (NTIS)

The Noise Model Simulation (NMSim) is a computer model that generates time histories of noise from moving sources accounting for the effects of real terrain on sound propagation. This document is provided on 2 CD-ROM discs, including open sources code, and a User's Manual is included with the installation program files in PDF format. NMSim has existed as a single event aircraft noise model since the mid-1900's and was originally developed in support of noise propagation studies and ran on a PC under MS-DOS. This model has become part of a growing trend toward simulation models for complex situations not adequately addressed by traditional integrated airport noise models and provides both quantitative analysis in terms of spectra and loudness metrics and descriptive display in the format of color renditions and animations of noise. NMSim has been developed into general purpose noise capabilities of earlier versions of NMSim. It also includes ground noise sources and is capable of analyzing multiple-source noise environments.
NTIS
Acoustic Simulation; CD-ROM; Models; Simulation; Computerized Simulation

20050242972 Geological Survey, Reston, VA USA
Bibliography of Ground-Water References for All 254 Counties in Texas, 1886-2001
Baker, E. T., Jr; Jan. 1, 2005; 333 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439180; USGS-2005-1270; No Copyright; Avail.: CASI: A15, Hardcopy

This bibliography comprises more than 10,000 citations of ground-water references involving all 254 counties in Texas. The reference citations date from 1886 and extend into 2001. Publications and reports from more than 30 agencies, universities, water districts, geological societies, cities, consultants, and private publication outlets are included in the bibliography. The bibliographic listing is, first, alphabetical by county and, second, chronological by date of the report, from oldest to most recent. The passing years have seen a proliferation in both published and unpublished reports, and such proliferation continues to expand at an accelerating pace. All 254 counties have had groundwater studies, either cursory or detailed. Investigation and development of the ground-water resources of the State of Texas resulted in reports that appear in a variety of formats, including Federal, State, and local agency reports; scholarly, professional, and trade journals; conference

proceedings; guidebooks; maps; and theses and dissertations. The end result for the person seeking ground-water information about specific Texas counties is the increasing difficulty in locating pertinent data among the many and diverse ground-water reports in which the information is recorded. This bibliography, covering a span of 115 years, should have considerable utility in guiding those individuals seeking ground-water information.
DTIC
Bibliographies; Ground Water

20050242988 Naval Postgraduate School, Monterey, CA USA
Performance Comparison of Relational and Native-XML Databases using the Semantics of the Land Command and Control Information Exchange Data Model (LC2IEDM)
Denny, Ian M.; Jahn, Dieter; Sep. 1, 2005; 315 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Efforts to improve the military decision and action cycle have centered on automating the command and control process and improving interoperability among joint and coalition forces. However, information automation by itself can lead to increased operator overload when the way this information is stored and presented is not structured and consistently filtered. The majority of messaging systems store information in a document-centric free-text format that makes it difficult for command and control systems, relational databases, software agents and web portals to intelligently search the information. Consistent structure and semantic meaning is essential when integrating these capabilities. Military-grade implementations must also provide high performance. A widely accepted platform-independent technology standard for representing document-centric information is the Extensible Markup Language (XML). XML supports the structured representation of information in context through the use of metadata. By using an XML Schema generated from MIP's Land Command and Control Information Exchange Data Model (LC2IEDM), it is feasible to compare the syntactic strength of human-readable XML documents with the semantics of LC2IEDM as used within a relational database.
DTIC
Command and Control; Data Bases; Data Management; Document Markup Languages; Semantics

20050242996 Massachusetts Univ., Amherst, MA USA
Deriving Concept Hierarchies From Text
Sanderson, Mark; Croft, Bruce; Jan. 1, 2005; 9 pp.; In English
Contract(s)/Grant(s): F19628-95-C-0235; ARPA ORDER-D468
Report No.(s): AD-A439413; No Copyright; Avail.: CASI: A02, Hardcopy

This paper presents a means of automatically deriving a hierarchical organization of concepts from a set of documents without use of training data or standard clustering techniques. Instead, salient words and phrases extracted from the documents are organized hierarchically using a type of co-occurrence known as subsumption. The resulting structure is displayed as a series of hierarchical menus. When generated from a set of retrieved documents, a user browsing the menus is provided with a detailed overview of their content in a manner distinct from existing overview and summarization techniques. The methods used to build the structure are simple, but appear to be effective: a smallscale user study reveals that the generated hierarchy possesses properties expected of such a structure in that general terms are placed at the top levels leading to related and more specific terms below. The formation and presentation of the hierarchy is described along with the user study and some other informal evaluations. The organization of a set of documents into a concept hierarchy derived automatically from the set itself is undoubtedly one goal of information retrieval. Were this goal to be achieved, the documents would be organized into a form somewhat like existing manually constructed subject hierarchies, such as the Library of Congress categories, or the Dewey Decimal system. The only difference being that the categories would be customized to the set of documents itself. For example, from a collection of media related articles, the category 'Entertainment' might appear near the top level; below it, (amongst others) one might find the category 'Movies', a type of entertainment; and below that, there could be the category 'Actors & Actresses', an aspect of movies. As can be seen, the arrangement of the categories provides an overview of the topic structure of those articles.
DTIC
Hierarchies; Information Retrieval; Texts

20050243003 Massachusetts Univ., Amherst, MA USA
Extracting Social Networks and Contact Information From Email and the Web
Culotta, Aron; Bekkerman, Ron; McCallum, Andrew; Jan. 1, 2005; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NBCHD030010
Report No.(s): AD-A439422; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present an end-to-end system that extracts a user's social network and its members' contact information given the user's email inbox. The system identifies unique people in email, finds their Web presence, and automatically fills the fields of a contact address book using conditional random fields a type of probabilistic model well-suited for such information extraction tasks. By recursively calling itself on new people discovered on the Web, the system builds a social network with multiple degrees of separation from the user. Additionally, a set of expertise-describing keywords are extracted and associated with each person. We outline the collection statistical and learning components that enable this system, and present experimental results on the real email of two user; we also present results with a simple method of learning transfer, and discuss the capabilities of the system for address book population, expert-finding, and social network analysis.
DTIC
Electronic Mail; Information Retrieval; Internets; Learning

20050243017 Air Force Research Lab., Wright-Patterson AFB, OH USA
Air Force Research Laboratory Wright Site Guide to Technical Publishing
Apr. 1, 2005; 75 pp.; In English
Report No.(s): AD-A439442; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This guide is prepared by the Air Force Research Laboratory (AFRL) Wright Site Technical Editing Office at Wright-Patterson Air Force Base (WPAFB), Ohio. The guide explains the process of editing and publishing scientific and technical reports and other documents. Instructions and examples of required forms and/or letters help in-house AFRL scientists, inhouse engineers, and contractors to the Department of Defense (DoD) in the preparation of technical publications. The primary goal of this guide is to provide information that aids in the creation of high quality publications. An effort is not complete until it is documented and the results distributed to the appropriate people.
DTIC
Editing; Laboratories; Military Technology; Research and Development; Sites; Technical Writing

20050243019 Massachusetts Univ., Amherst, MA USA
Collective Segmentation and Labeling of Distant Entities in Information Extraction
Sutton, Charles; McCallum, Andrew; Jul. 1, 2004; 8 pp.; In English
Contract(s)/Grant(s): NBCHD030010; IIS-0326249
Report No.(s): AD-A439444; TR-04-49; No Copyright; Avail.: CASI: A02, Hardcopy

In information extraction, we often wish to identify all mentions of an entity such as a person or organization. Traditionally a group of words is labeled as an entity based only on local information. But information from throughout a document can be useful; for example if the same word is used multiple times it is likely to have the same label each time. We present a CRF that explicitly represents dependencies between the labels of pairs of similar words in a document. On a standard information extraction data set we show that learning these dependencies leads to a 13.7% reduction in error on the field that had caused the most repetition errors.
DTIC
Extraction; Information Retrieval; Segments

20050243026 Naval Postgraduate School, Monterey, CA USA
An Analysis of Automated Solutions for the Certification and Accreditation of Navy Medicine Information Assets
Gonzales, Dominic V.; Sep. 1, 2005; 155 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439458; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study was to determine potential improvements in Navy Medicine's current Certification and Accreditation (C&A) process. The study examined whether Navy Medicine's C&A policies are in alignment with DoD, Navy and Federal Government requirements and whether the use of automated C&A tools could significantly improve Navy Medicine's current C&A security posture. The primary research reviewed C&A policy and included a comparative analysis of two cutting edge automated C&A tools namely, Xacta and eMASS. The findings of the analysis revealed that the use of automated C&A tools could significantly enhance Navy Medicine's C&A process and assist Navy Medicine's information assurance personnel who are responsible for the execution of the Navy Medicine C&A process and approval of Navy Medicine information systems. This study also provided valuable insight in verifying the evidence on how information assurance (IA) controls are addressed within the automated C&A tools regardless of the C&A process. The results of the analysis ultimately

led to the development of key recommendations that can assist Navy Medicine in selecting the appropriate automated C&A tool for its C&A process.
DTIC
Certification; Information Systems; Medical Services; Military Operations; Navy

20050243027 Minnesota Univ., Minneapolis, MN USA
Finding Functionally Related Genes by Local and Global Analysis of MEDLINE Abstracts
Nakken, Sigve; Kauffman, Christopher; Karypis, George; Jun. 29, 2004; 10 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439461; TR-04-028; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Discovery of biological relationships between genes is one of the keys to understanding the complex functional nature of the human genome. Currently, most of the knowledge about interrelating genes are found in immense amounts of various biomedical literature. Hence, extraction of biological contexts occurring in free text represents a valuable tool in gaining knowledge about gene interactions. We present a textual analysis of documents associated with pairs of genes, and describe how this approach can be used to discover and annotate functional relationships among genes. A study on a subset of human genes show that our analysis tool can act as a ranking mechanism for sets of genes based on their functional relatedness.
DTIC
Abstracts; Biomedical Data; Genes; Information Retrieval; Information Systems; Kernel Functions

20050243029 Naval Postgraduate School, Monterey, CA USA
Redefining E-3 Core Competencies for Dominant Battlespace Knowledge in Future Combat Operations
Kirkendall, David A.; Sep. 1, 2005; 73 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439463; No Copyright; Avail.: CASI: A04, Hardcopy

This thesis explores how E-3 Air Battle Managers train for and perform their duties on board the Airborne Warning and Control System. The study focuses on how E-3 training is driven by the maintenance of a set of battle management core competencies rooted in the basics of aircraft tactical fluid control force accountability and aerial refueling. The advent of a revolution in Information Management technology in the form of the 40/45 weapons system upgrade for the E-3 will drive the Air Force to rethink how training is accomplished with new capabilities and emerging missions in the battlespace. The current approach to block will not allow the Air Force to exploit the capabilities of the 40/45 airframe. Lessons from emerging areas such as knowledge management and sensemaking need to be assimilated into the way the Air Force trains E-3 Air Battle Managers to ensure future combat capability of aircrews in the increasingly technical and complex battlespace of future military operations. Existing core competencies need to be considered individual skill sets and knowledge management and sensemaking introduced to better prepare battle managers to effectively and efficiently interpret inputs in the battlespace and place information where it needs to be.
DTIC
Aircraft Control; Awacs Aircraft; Combat; Command and Control; Information Management; Military Operations; Refueling

20050243033 Minnesota Univ., Minneapolis, MN USA
HARMONY: Efficiently Mining the Best Rules for Classification
Wang, Jianyong; Karypis, George; Sep. 16, 2004; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439469; TR-04-032; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many studies have shown that rule-based classification algorithms perform well in classifying categorical and sparse high-dimensional databases. However, a fundamental limitation with many rule-based classifiers is that they find the classification rules in a coarse- grained manner. They usually use heuristic methods to prune the search space, and select the rules based on the sequential database covering paradigm. Thus, the so-mined rules may not be the globally best rules for some instances in the training database. To make worse, these algorithms fail to fully exploit some more effective search space pruning methods in order to scale to large databases. In this paper we propose a new classifier, HARMONY, which directly mines the final set of classification rules. HARMONY uses an instance-centric rule- generation approach in the sense that it can assure for each training instance, one of the highest-confidence rules covering this instance is included in the result set, which helps a lot in achieving high classification accuracy. By introducing several novel search strategies and pruning methods into the traditional frequent item- set mining framework, HARMONY also has high efficiency and good scalability. Our thorough performance study with some large text and categorical databases has shown that HARMONY outperforms many

well-known classifiers in terms of both accuracy and efficiency, and scales well w.r.t. the database size.
DTIC
Classifications; Mining; Texts

20050243035 Maryland Univ., Baltimore, MD USA
A Context Broker for Building Smart Meeting Rooms
Chen, Harry; Finin, Tim; Joshi, Anupam; Jan. 1, 2004; 9 pp.; In English
Contract(s)/Grant(s): F30602-97-1-0215; NSF-9875433
Report No.(s): AD-A439472; No Copyright; Avail.: CASI: A02, Hardcopy

Building smart meeting rooms requires the support of a computing system architecture. In this paper, we describe the Context Broker Architecture (CoBrA) , a broker-centric agent architecture for pervasive context-aware systems. CoBrA exploits the Web Ontology Language OWL for supporting knowledge sharing and data fusion, uses logic inferences for resolving and detecting inconsistent context knowledge, and provides users with a policy language to control their private information. Center to CoBrA is an intelligent broker agent that maintains a share model of a context for all agents, services, and devices in the space, and protects users' privacy by enforcing the policy rules that they have defined. We also describe the use of CoBrA ontologies, context reasoning mechanisms, and privacy protection in a smart meeting room system called EasyMeeting.
DTIC
Architecture (Computers); Multisensor Fusion; Rooms

20050243044 Minnesota Univ., Minneapolis, MN USA
Profile Based Direct Kernels for Remote Homology Detection and Fold Recognition
Rangwala, Huzefa; Karypis, George; Mar. 31, 2005; 12 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A439489; TR-05-007; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Remote homology detection between protein sequences is a central problem in computational biology. Supervised learning algorithms based on support vector machines are currently the most effective method for remote homology detection. The performance of these methods depends on how the protein sequences are modeled and on the method used to compute the kernel function between them. We introduce new classes of kernel functions that are constructed by directly combining automatically generated sequence profiles with new and existing approaches for determining the similarity between pairs of protein sequences, which employ effective schemes for scoring the aligned profile positions. Experiments with remote homology detection and fold recognition problems show that these kernels are capable of producing results that are substantially better than those produced by all of the existing state-of-the-art SVM-based methods. In addition, the experiments show that these kernels, even when used in the absence of profiles, produce results that are better than those produced by existing nonprofile- based schemes.
DTIC
Algorithms; Classifications; Detection; Homology; Kernel Functions; Remote Sensing; Vector Analysis

20050243050 Minnesota Univ., Minneapolis, MN USA
An Efficient Algorithm for Discovering Frequent Subgraphs
Kuramochi, Michihiro; Karypis, George; Jun. 25, 2002; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439497; TR-02-026; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over the years, frequent itemset discovery algorithms have been used to find interesting patterns in various application areas. However, as data mining techniques are being increasingly applied to non-traditional domains, existing frequent pattern discovery approach cannot be used. This is because the transaction framework that is assumed by these algorithms cannot be used to effectively model the datasets in these domains. An alternate way of modeling the objects in these datasets is to represent them using graphs. Within that model, the problem of finding frequent patterns becomes that of discovering subgraphs that occur frequently over the entire set of graphs. In this paper we present a computationally efficient algorithm, called FSG, for finding all frequent subgraphs in large graph databases. We experimentally evaluate the performance of FSG using a variety of real and synthetic datasets. Our results show that despite the underlying complexity associated with frequent

subgraph discovery, FSG is effective in finding all frequently occurring subgraphs in datasets containing over 100,000 graph transactions and scales linearly with respect to the size of the database.
DTIC
Algorithms; Exploration

20050243051 Minnesota Univ., Minneapolis, MN USA
Automated Approaches for Classifying Structures
Deshpande, Mukund; Kuramochi, Michihiro; Karypis, George; Jun. 26, 2002; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-05-C-0008
Report No.(s): AD-A439498; TR-02-027; No Copyright; Avail.: CASI: A03, Hardcopy

In this paper we study the problem of classifying chemical compound datasets. We present an algorithm that first mines the chemical compound dataset to discover discriminating sub-structures; these discriminating sub-structures are used as features to build a powerful classifier. The advantage of our classification technique is that it requires very little domain knowledge and can easily handle large chemical datasets. We evaluated the performance of our classifier on two widely available chemical compound datasets and have found it to give good results.
DTIC
Chemical Composition; Classifications

20050243055 Minnesota Univ., Minneapolis, MN USA
Comparison of Agglomerative and Partitional Document Clustering Algorithms
Zhao, Ying; Karypis, George; Apr. 17, 2002; 13 pp.; In English
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439503; TR-02-014; No Copyright; Avail.: CASI: A03, Hardcopy

Fast and high-quality document clustering algorithms play an important role in providing intuitive navigation and browsing mechanisms by organizing large amounts of information into a small number of meaningful clusters, and in greatly improving the retrieval performance either via cluster-driven dimensionality reduction, term-weighting, or query expansion. This ever-increasing importance of document clustering and the expanded range of its applications led to the development of a number of novel algorithms and new clustering criterion functions, especially in the context of partitional clustering. The focus of this paper is to experimentally evaluate the performance of seven different global criterion functions in the context of agglomerative clustering algorithms and compare the clustering results of agglomerative algorithms and partitional algorithms for each one of the criterion functions. Our experimental evaluation shows that for every criterion function, partitional algorithms always lead to better clustering results than agglomerative algorithms, which suggests that partitional clustering algorithms are well-suited for clustering large document datasets due to not only their relatively low computational requirements, but also comparable or even better clustering performance.
DTIC
Agglomeration; Algorithms; Cluster Analysis

20050243060 Minnesota Univ., Minneapolis, MN USA
Concept Indexing: A Fast Dimensionality Reduction Algorithm With Applications to Document Retrieval and Categorization
Karypis, George; Han, Euihong; Mar. 6, 2000; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439511; TR-00-016; No Copyright; Avail.: CASI: A03, Hardcopy

In recent years, we have seen a tremendous growth in the volume of text documents available on the Internet, digital libraries, news sources, and company-wide intranets. This has led to an increased interest in developing methods that can efficiently categorize and retrieve relevant information. Retrieval techniques based on dimensionality reduction, such as Latent Semantic Indexing (LSI), have been shown to improve the quality of the information being retrieved by capturing the latent meaning of the words present in the documents. Unfortunately, the high computational requirements of LSI and its inability to compute an effective dimensionality reduction in a supervised setting limits its applicability. In this paper we present a fast dimensionality reduction algorithm, called concept indexing (CI) that is equally effective for unsupervised and supervised dimensionality reduction. CI computes a k-dimensional representation of a collection of documents by first clustering the documents into k groups, and then using the centroid vectors of the clusters to derive the axes of the reduced k-dimensional

space. Experimental results show that the dimensionality reduction computed by CI achieves comparable retrieval performance to that obtained using LSI, while requiring an order of magnitude less time. Moreover, when CI is used to compute the dimensionality reduction in a supervised setting, it greatly improves the performance of traditional classification algorithms such as C4.5 and kNN.
DTIC
Algorithms; Information Retrieval; Semantics

20050243076 Minnesota Univ., Minneapolis, MN USA
Centroid-Based Document Classification Algorithms: Analysis & Experimental Results
Han, Euihong; Karypis, George; Mar. 6, 2000; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439538; TR-00-017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In recent years we have seen a tremendous growth in the volume of text documents available on the Internet, digital libraries, news sources, and company-wide intranets. Automatic text categorization, which is the task of assigning text documents to pre-specified classes (topics or themes) of documents, is an important task that can help both in organizing as well as in finding information on these huge resources. Text categorization presents unique challenges due to the large number of attributes present in the data set, large number of training samples, and attribute dependencies. In this paper we focus on a simple linear-time centroid-based document classification algorithm, that despite its simplicity and robust performance, has not been extensively studied and analyzed. Our extensive experiments show that this centroid-based classifier consistently and substantially outperforms other algorithms such as Naive Bayesian, k-nearest-neighbors, and C4.5, on a wide range of datasets. Our analysis shows that the similarity measure used by the centroid-based scheme allows it to classify a new document based on how closely its behavior matches the behavior of the documents belonging to different classes, as measured by the average similarity between the documents. This matching allows it to dynamically adjust for classes with different densities. Furthermore, our analysis shows that the similarity measure of the centroid-based scheme accounts for dependencies between the terms in the different classes. We believe that this feature is the reason why it consistently outperforms other classifiers that cannot take these dependencies into account.
DTIC
Algorithms; Centroids; Classifications

20050243081 Minnesota Univ., Minneapolis, MN USA
Evaluation of Item-Based Top-N Recommendation Algorithms
Karypis, George; Sep. 15, 2000; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439546; TR-00-046; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The explosive growth of the world-wide-web and the emergence of e-commerce has led to the development of recommender systems a personalized information filtering technology used to identify a set of N items that will be of interest to a certain user. User-based Collaborative filtering is the most successful technology for building recommender systems to date, and is extensively used in many commercial recommender systems. Unfortunately, the computational complexity of these methods grows linearly with the number of customers that in typical commercial applications can grow to be several millions. To address these scalability concerns item-based recommendation techniques have been developed that analyze the user-item matrix to identify relations between the different items, and use these relations to compute the list of recommendations. In this paper we present one such class of item-based recommendation algorithms that first determine the similarities between the various items and then used them to identify the set of items to be recommended. The key steps in this class of algorithms are (i) the method used to compute the similarity between the items, and (ii) the method used to combine these similarities in order to compute the similarity between a basket of items and a candidate recommender item. Our experimental evaluation on five different datasets show that the proposed item-based algorithms are up to 28 times faster than the traditional user-neighborhood based recommender systems and provide recommendations whose quality is up to 27% better.
DTIC
Algorithms; Evaluation; System Effectiveness

20050243084 Minnesota Univ., Minneapolis, MN USA
Evaluation of Hierarchical Clustering Algorithms for Document Datasets
Zhao, Ying; Karypis, George; Jun. 3, 2002; 16 pp.; In English
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439551; TR-02-022; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Fast and high-quality document clustering algorithms play an important role in providing intuitive navigation and browsing mechanisms by organizing large amounts of information into a small number of meaningful clusters. In particular, hierarchical clustering solutions provide a view of the data at different levels of granularity, making them ideal for people to visualize and interactively explore large document collections. The focus of this paper is to evaluate different hierarchical clustering algorithms and toward this goal we compared various partitional and agglomerative approaches. Our experimental evaluation showed that partitional algorithms always lead to better clustering solutions than agglomerative algorithms, which suggests that partitional clustering algorithms are well-suited for clustering large document datasets due to not only their relatively low computational requirements, but also comparable or even better clustering performance. We also present a new class of clustering algorithms called constrained agglomerative algorithms that combine the features of both partitional and agglomerative algorithms. Our experimental results showed that they consistently lead to better hierarchical solutions than agglomerative or partitional algorithms alone.
DTIC
Algorithms; Cluster Analysis; Data Bases; Hierarchies

20050243088 Minnesota Univ., Minneapolis, MN USA
Personalized Profile Based Search Interface With Ranked and Clustered Display
Kumar, Sachin; Oztekin, B. U.; Ertoz, Levent; Singhal, Saurabh; Han, Euihong; Kumar, Vipin; Jun. 1, 2001; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAH04-05-C-0008
Report No.(s): AD-A439556; TR-01-023; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have developed an experimental meta-search engine, which takes the snippets from traditional search engines and presents them to the user either in the form of clusters, indices or re-ranked list optionally based on the user's profile. The system also allows the user to give positive or negative feedback on the documents, clusters and indices. The architecture allows different algorithms for each of the features to be plugged-in easily, i.e. various clustering, indexing and relevance feedback algorithms, and profiling methods.
DTIC
Feedback; Information Retrieval; User Requirements

20050243098 Army High Performance Computing Research Center, Minneapolis, MN USA
PAFI: A Pattern Finding Toolkit
Seno, Masakazu; Kuramochi, Michihiro; Karypis, George; Jul. 7, 2003; 21 pp.; In English
Contract(s)/Grant(s): DAAH04-95-C-0008
Report No.(s): AD-A439568; TR-03-029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

PAFI is a set of programs that can be used to find frequent patterns in large and diverse databases. The current release of PAFI includes three different pattern discovery programs called LPMiner, SLPMiner, and FSG. LPMiner finds patterns corresponding to itemsets in a transaction database and is based on the algorithm described. SLPMiner finds patterns corresponding to sub-sequences in a sequential database and is based on the algorithm described. Finally, FSG finds patterns corresponding to connected undirected subgraphs in an undirected graph database and is based on the algorithms described. These programs can be used to mine a wide-range of datasets arising in commercial, information retrieval, and scientific applications. All three programs can be used to find patterns that satisfy a constant minimum support. Moreover, a key feature of LPMiner and SLPMiner is that they can find long frequent patterns without finding a large number of short patterns that are often useless. This is achieved by using length-decreasing support constraints, where the minimum occurrence frequency of a pattern is given as a non-increasing function of pattern length. PAFI's pattern discovery programs usually provide three additional functionalities. First, all three programs can generate maximal frequent patterns. A maximal frequent pattern is a frequent pattern that is not contained by any other frequent patterns. Generally, the number of maximal frequent patterns is much smaller than the number of all the frequent patterns, leading to higher readability of frequent pattern files. Second, SLPMiner and FSG can generate transaction-ID lists (TID-lists) indicating which sequences or graph transactions support a

particular frequent pattern. Third, all three programs can generate parent-children-lists (PC-lists) that can be used to construct the frequent pattern lattice.
DTIC
Algorithms; Computer Programs; Data Bases; Data Mining

20050243103 Naval Postgraduate School, Monterey, CA USA
How Can We Improve Information Sharing among Local Law Enforcement Agencies
Miller, Patrick E.; Sep. 1, 2005; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439576; No Copyright; Avail.: CASI: A05, Hardcopy

The events of 9/11 and subsequent examination of the intelligence community in the USA have clearly identified several areas that require immediate repair. While on the federal, state, and local levels there is a complex system of collecting, developing, and analyzing intelligence that can be used to prevent terrorist attacks, the USA does not have an accompanying system that shares intelligence information throughout the law enforcement community. The purpose of this thesis is to review information sharing between federal, state, and local law enforcement agencies and to suggest methods to improve that capability. In the aftermath of the September 11th attacks, authorities uncovered patterns of suspicious activity occurring in places such as Maryland, Florida, and New Jersey. These activities included individuals paying cash for plane tickets, taking flight lessons, inquiring about crop duster planes, and frequenting drug stores. Taken individually, these incidents were not overly suspicious nor were they seen as serious when reported to authorities. Yet, all together they illustrate, at best, highly suspicious behavior and, at worst, a picture of a master plan of prospective criminal activity. When collecting data on terrorist potential, one isolated incident in a local jurisdiction may not have obvious significance, but the ability to view all incidents together across cities or states might paint a more complete picture. Agencies are now recognizing the benefits of data sharing across institutions and jurisdictions. The success of the fusion center concept rests on the ability of the Office of the Director of National Intelligence, the Department of Homeland Security, and the FBI to make a collaborative decision on what system(s) would best meet these requirements.
DTIC
Intelligence; Law (Jurisprudence); Security; United States

20050243105 Minnesota Univ., Minneapolis, MN USA
Frequent Sub-Structure-Based Approaches for Classifying Chemical Compounds
Deshpande, Mukund; Kuramochi, Michihiro; Karypis, George; Mar. 10, 2003; 17 pp.; In English
Contract(s)/Grant(s): DAAH04-95-C-0008
Report No.(s): AD-A439580; TR-03-016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we study the problem of classifying chemical compound datasets. We present a sub-structure-based classification algorithm that decouples the sub-structure discovery process from the classification model construction and uses frequent subgraph discovery algorithms to find all topological and geometric sub-structures present in the dataset. The advantage of our approach is that during classification model construction, all relevant sub-structures are available allowing the classifier to intelligently select the most discriminating ones. The computational scalability is ensured by the use of highly efficient frequent subgraph discovery algorithms coupled with aggressive feature selection. Our experimental evaluation on eight different classification problems shows that our approach is computationally scalable and outperforms existing schemes by 10% to 35%, on the average.
DTIC
Chemical Composition; Classifications; Pulse Rate; Scalers

20050243111 Minnesota Univ., Minneapolis, MN USA
Parallel Formulations of Tree-Projection Based Sequence Mining Algorithms
Guralnik, Valerie; Karypis, George; Jan. 20, 2003; 24 pp.; In English
Contract(s)/Grant(s): DAAH04-05-C-0008
Report No.(s): AD-A439587; TR-03-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Discovery of sequential patterns is becoming increasingly useful and essential in many scientific and commercial domains. Enormous sizes of available datasets and possibly large number of mined patterns demand efficient, scalable, and parallel algorithms. Even though a number of algorithms have been developed to efficiently parallelize frequent pattern discovery algorithms that are based on the candidate-generation-and-counting framework, the problem of parallelizing the more efficient projection-based algorithms has received relatively little attention and existing parallel formulations have been

targeted only toward shared-memory architectures. The irregular and unstructured nature of the task-graph generated by these algorithms and the fact that these tasks operate on overlapping sub-databases makes it challenging to efficiently parallelize these algorithms on scalable distributed-memory parallel computing architectures. In this paper we present and study a variety of distributed-memory parallel algorithms for a tree-projection-based frequent sequence discovery algorithm that are able to minimize the various overheads associated with load imbalance, database overlap, and interprocessor communication. Our experimental evaluation on a 32 processor IBM SP show that these algorithms are capable of achieving good speedups, substantially reducing the amount of the required work to find sequential patterns in large databases.
DTIC
Algorithms; Decision Theory; Mining; Parallel Processing (Computers)

20050243113 Naval Postgraduate School, Monterey, CA USA
Maritime Military Decision Making in Environments of Extreme Information Ambiguity: An Initial Exploration
Reeves, Andrew T.; Sep. 1, 2005; 151 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439589; No Copyright; Avail.: CASI: A08, Hardcopy

This thesis examines the following hypothesis: Through the combined use of common training and collaborative planning, a decision maker may sufficiently alleviate the harmful effects of an environment of information so that he/she can continue to make effective decisions. An environment of extreme information ambiguity, a dependent variable, is one of the most difficult components of a battle where the decision maker may reach a confusing and debilitating point where surviving seems less and less likely. Common training, an independent variable, purports that everyone who is relevant to the situation in the battlespace has similar skills, education, doctrine, and standards of performance coupled with comparable experiences. Collaborative planning, an independent variable, connotes a sharing of ideas; synchronization of assets, use of information technology, global real-time mission planning, face-to-face meetings, and other information sharing techniques for situations of collective concern. This thesis is a unique and in depth exploration of the relation of these three variables. Until now, no other research has looked at the relation of common training and collaborative planning with respect to decision making in environments of extreme information ambiguity. In order to explore the model the researcher analyzed two historical military battles: the Battle of Trafalgar and the Battle of Midway. Detailed research using a case study method was conducted to determine if the battles substantiated the thesis model. Research results indicate that for the maritime battles studied, the model appears to be a useful tool for interpretation and description of events and their outcomes. However, future studies should also increase the number and type of battles and other factors such as time and leadership should be considered.
DTIC
Ambiguity; Decision Making; Human Relations; Leadership; Military Operations; Mission Planning

20050243116 Naval Postgraduate School, Monterey, CA USA
Return on Investment Analysis of Information Warfare Systems
Rios, Cesar G., Jr; Sep. 1, 2005; 81 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439595; No Copyright; Avail.: CASI: A05, Hardcopy

The USA Navy's Cryptologic Carry-On Program Office manages a portfolio of Information Warfare (IW) systems. This research and case study demonstrate how the Knowledge Value Added (KVA) Methodology can be used to formulate a framework for extracting and analyzing performance parameters and measures of effectiveness for each system. KVA measures the effectiveness and efficiency of CCOP systems and the impact they have on the Intelligence Collection Process (ICP) on board U.S. Navy Ships. By analyzing the outputs of the subprocesses involved in the ICP in common units of change, a price per unit of output can be generated to allocate both cost and revenue at the subprocess level. With this level of financial detail, a return on investment (ROI) analysis can be conducted for each process, or asset.
DTIC
Data Acquisition; Information Systems; Warfare

20050243122 Maryland Univ., Baltimore, MD USA
ITTALKS: A Case Study in the Semantic Web and DAML
Cost, R. S.; Finin, Tim; Joshi, Anupam; Peng, Yun; Nicholas, Charles; Soboroff, Ian; Chen, Harry; Kagal, Lalana; Perich, Filip; Zou, Youyong; Jan. 1, 2005; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0591
Report No.(s): AD-A439603; No Copyright; Avail.: CASI: A03, Hardcopy

Effective use of the vast quantity of information now available on the web will require the use of Semantic Web markup

languages such as the DARPA Agent Markup Language (DAML). Such languages will enable the automated gathering and processing of much information that is currently available but insufficiently utilized. Effectively, such languages will facilitate the integration of multi-agent systems with the existing information infrastructure. As part of our exploration of Semantic Web technology, and DAML in particular, we have constructed ITTALKS, a web-based system for automatic and intelligent notification of information technology talks. In this paper, we describe the ITTALKS system, and discuss the numerous ways in which the use of Semantic Web concepts and DAML extend its ability to provide an intelligent online service to both the human community and the agents assisting them.
DTIC
Document Markup Languages; Internets; Programming Languages; Semantics

20050243128 Library of Congress, Washington, DC USA
Bibliography on Future Trends in Terrorism
Berry, LaVerle; Curtis, Glenn; Hudson, Rex; Sep. 1, 1998; 156 pp.; In English
Report No.(s): AD-A439620; No Copyright; Avail.: CASI: A08, Hardcopy

This bibliography provides annotations on future trends in terrorism from open-source literature published between 1996 and mid-1998. The dominant trend discussed in this literature is the increasing likelihood that terrorists will use weapons of mass destruction (WMD), particularly against the USA. Accordingly, many of the 295 monographs and journal articles surveyed in this bibliography discuss the potential threats of nuclear, biological, and chemical terrorism and the countermeasures that need to be implemented in responding to these threats. A number of other articles discuss the emerging threat of computer or cyberterrorism and the potential threat to the USA' information-technology (IT)-based infrastructure. Many articles discuss new technologies to counter more conventional terrorist threats, such as detecting bombs at airports. The compilers of the bibliography have endeavored to include the most recent, relevant, and substantive articles on terrorism (those published in 1998) from journals, news magazines, selected newspapers, and monographs. The bibliography also includes relevant items published in 1996-1997 but not annotated for the Federal Research Division's previous terrorism bibliographies (June 1993 and October 1997). Several foreign-language items have been included and are indicated as such. In general, however, the effort focused on English-language sources. The bibliography is organized into six geographic regions -- Africa, Asia, Europe, Latin American, the Middle East, and North America -- as well as a general International section. Most entries are listed under the International and North America sections. All entries have keywords, such as antiterrorism, WMD, cyberterrorism, and others. Upon request, the Federal Research Division will supply specialized, subject-oriented, or geographical printouts.
DTIC
Bibliographies; Biological Weapons; Chemical Warfare; Destruction; Nuclear Warfare; Terrorism; Trends

20050243133 Minnesota Univ., Minneapolis, MN USA
Weight Adjustment Schemes for a Centroid Based Classifier
Shankar, Shrikanth; Karypis, George; May 30, 2000; 22 pp.; In English
Contract(s)/Grant(s): DA/DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439629; TR-00-035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In recent years we have seen a tremendous growth in the volume of text documents available on the Internet, digital libraries, news sources, and company-wide intra-nets. Automatic text categorization, which is the task of assigning text documents to pre-specified classes (topics or themes) of documents, is an important task that can help both in organizing as well as in finding information on these huge resources. Similarity based categorization algorithms such as k-nearest neighbor, generalized instance set and centroid based classification have been shown to be very effective in document categorization. A major drawback of these algorithms is that they use all features when computing the similarities. In many document data sets, only a small number of the total vocabulary may be useful for categorizing documents. A possible approach to overcome this problem is to learn weights for different features (or words in document data sets). In this report we present two fast iterative feature weight adjustment algorithms for the linear complexity centroid based classification algorithm. Our algorithms use a measure of the discriminating power of each term to gradually adjust the weights of all features concurrently. We experimentally evaluate our algorithms on the Reuters-21578 and OHSUMED document collections and compare it against Rocchio, Widrow-Hoff and SVM. We also compared its performance in terms of classification accuracy on data sets with multiple classes. On these data sets we compared its performance against traditional classifiers such as k-nn, Naive Bayesian and C4. 5. Experiments show that feature weight adjustment improves the performance of the centroid-based classifier by 2- 5%, substantially outperforms Rocchio and Widrow-Hoff and is competitive with SVM. These algorithms also

outperform traditional classifiers such as k-nn, naive bayesian and C4.5 on the multi-class text document data sets.
DTIC
Centroids; Classifications; Classifiers

20050243149 Calgary Univ., Alberta Canada
Fusion of Dependent and Independent Biometric Information Sources
Huang, Dongliang; Leung, Henry; Li, Winston; Mar. 1, 2005; 60 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W7714-4-0-9130; Proj-15BF27
Report No.(s): AD-A439652; DRDC-O-CR-2005-052; No Copyright; Avail.: CASI: A04, Hardcopy

In this report, an overview of information fusion techniques for dependent and independent sources, specifically for biometric applications, is provided. The information fusion architecture is presented for both dependent and independent sources addressing in detail the various fusion techniques at four different levels namely: raw data or signal level, feature level, decision level and multi-level integrated fusion. Furthermore, the report addresses the question of whether independent biometric sources can be fused to provide multi-modal biometric system with enhanced performance. The report shows that even when the sources are independent, the performance of a multi-modal biometric system can be better than that of a biometric system based on single source. The performance is measured in terms of total false accept rate (FAR) and false rejection rate (FRR). The conditions for achieving an improved performance for the decision level fusion using AND, OK and majority voting are derived theoretically and confirmed through computer simulations.
DTIC
Biometrics; Information Systems; Multisensor Fusion

20050243170 Minnesota Univ., Minneapolis, MN USA
Text Categorization Using Weight Adjusted k-Nearest Neighbor Classification
Han, Euihong; Karypis, George; Kumar, Vipin; May 17, 1999; 11 pp.; In English
Contract(s)/Grant(s): DAAH04-95-1-0538
Report No.(s): AD-A439688; TR-99-019; No Copyright; Avail.: CASI: A03, Hardcopy

Categorization of documents is challenging, as the number of discriminating words can be very large. The authors present a nearest neighbor classification scheme for text categorization in which the importance of discriminating words is learned using mutual information and weight adjustment techniques. The nearest neighbors for a particular document are then computed based on the matching words and their weights. They evaluate their scheme on both synthetic and real-world documents. Experiments with synthetic data sets show that this scheme is robust under different emulated conditions. Empirical results on real-world documents demonstrate that this scheme outperforms state-of-the-art classification algorithms such as C4.5, RIPPER, Rainbow, and PEBLS.
DTIC
Classifications; Information Retrieval; Information Theory; Texts

20050243183 Maryland Univ., Baltimore, MD USA
Modeling and Evaluating Trust Network Inference
Ding, Li; Kolari, Pranam; Ganjugunte, Shashidhara; Finin, Tim; Joshi, Anupam; Jan. 1, 2005; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-0591; NSF-ITR-HS-0326460
Report No.(s): AD-A439712; No Copyright; Avail.: CASI: A03, Hardcopy

The growth in knowledge sharing enabled by the (Semantic) Web has made trust an increasingly critical issue. Based on explicit inter-agent trust relations, a trust network emerges on the (Semantic) Web in the knowledge sharing context. The concept of a trust network and its application to knowledge sharing have received recent attention but neither their structural properties (e.g. dynamics, complexity) nor inference mechanisms (e.g. trust discovery, trust evolution, trust propagation) have been well addressed. This paper formalizes trust network inference notions, providing both data and computational models, and suggests an evaluation model for benchmarking. The data model clarifies the data (context, restriction, output) used by trust network inference for knowledge sharing. It also elaborates trust network representation and articulates different types of trust. The computational model reviews graph theory and referral network interpretations of trust network inference and proposes a new one that treats trust networks as an emergent property. This new model supports both trust evolution and trust propagation. The evaluation model describes metrics as well as methods to generate test scenarios and data. We argue that this

approach is more customizable, flexible and scalable than traditional approaches such as public reputation systems and collaborative filtering.
DTIC
Computer Networks; Inference

20050243196 New York Univ., New York, NY USA
Exploiting Application Tunability for Efficient, Predictable Parallel Resource Management
Chang, Fangzhe; Karamcheti, Vijay; Kedem, Zvi; Jan. 1, 1998; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-96-1-0320; CCR-94-11590
Report No.(s): AD-A439729; No Copyright; Avail.: CASI: A03, Hardcopy

Parallel computing is becoming increasingly central and mainstream driven both by the widespread availability of commodity SMP and high-performance cluster platforms as well as the growing use of parallelism in general-purpose applications such as image recognition virtual reality and media processing. In addition to performance requirements, the latter computations impose soft real-time constraints. necessitating efficient, predictable parallel resource management. Unfortunately, traditional resource management approaches in both parallel and real-time systems are inadequate for meeting this objective; the parallel approaches focus primarily on improving application performance and/or system utilization at the cost of arbitrarily delaying a given application. while the real-time approaches are overly conservative sacrificing system utilization in order to meet application deadlines. In this paper we propose a novel approach for increasing parallel system utilization while meeting application soft real-time deadlines. Our approach exploits the application tunability found in several general-purpose computations. Tunability refers to an application's ability to trade off resource requirements over time, while maintaining a desired level of output quality. In other words, a large allocation of resources in one stage of the computation's lifetime may compensate. in a parameterizable manner, for a smaller allocation in another stage. We first describe language extensions to support tunability in the Calypso programming system, a component of the MILAN metacomputing project, and evaluate their expressiveness using an image processing application. We then characterize the performance benefits of tunability, using a synthetic task system to systematically identify its benefits and shortcomings.
DTIC
Resources Management; Tuning

20050243199 Naval Postgraduate School, Monterey, CA USA
Cooperative Research and Development Agreements (CRADA) with Industry as a Value Enhancing Asset in the Academic/Research Environment. A Case Study at the Naval Postgraduate School (NPS)
Ferraris, Guillermo L.; Sep. 1, 2005; 233 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439733; No Copyright; Avail.: CASI: A11, Hardcopy

Cooperative Research and Development Agreements (CRADAs) are used by federal laboratories to participate in collaborative efforts and partnerships with industry. Although not technically a research laboratory, the Naval Postgraduate School (NPS) is a federally funded research university that has developed an extensive sponsored program of Technology Transfer (T2) with the private sector. Cooperative research and development is often a two-way instrument whereby knowledge-generated value can flow in both directions. This thesis assesses that value from the perspective of the federal partner, based on the NPS case as a specialized academic and research institution. The research and analysis performed within the context of this thesis contributes to goals established in the NPS's 'Technology Transfer Business Plan,' which focuses on the measurement of outcomes and benefits resulting from CRADAs, one of the preferred and most widely used mechanisms in technology transfer within the Department of Defense, particularly at the NPS. The perspective chosen, in the direction from the nonfederal entity -- generally industry -- towards the federal partner, has not been researched and reported in the specialized literature as extensively as in the opposite direction.
DTIC
Agreements; Industries; Schools; Technology Transfer; Universities

20050243202 New York Univ., New York, NY USA
WebSeAl: Web Server Allocation
Karaul, Mehmet; Korilis, Yannis A.; Orda, Ariel; Jan. 1, 1997; 11 pp.; In English
Contract(s)/Grant(s): F30602-96-1-0320; CCR-94-11590
Report No.(s): AD-A439737; No Copyright; Avail.: CASI: A03, Hardcopy

With the rapid growth of the World Wide Web, clients attempting to access some popular web sites are experiencing slow

response times due to server load and network congestion. Replacing the single server machine with a set of replicated servers is a cost-effective solution to partition server load which also allows incremental scalability and fault transparency. Distributing these replicated servers geographically can reduce network congestion and increase availability. However, distributed web sites are faced with the issue of allocating servers: how do clients find out about he replicas and how do they decide which one to contact? Popular web sites have well publicized server names and require a transparent mapping of the public server name to replicated servers.
DTIC
Congestion; Internets

20050243204 Naval Postgraduate School, Monterey, CA USA
War in Shangri-La: The Information Dimension of Nepal's Maoist Insurgency and Counterinsurgency
Letch, Steven R.; Sep. 1, 2005; 146 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439739; No Copyright; Avail.: CASI: A07, Hardcopy

This analysis examines the information dimension of the ongoing Maoist insurgency and counterinsurgency in Nepal. The paper follows two lines of research: first, it presents an analytic framework that properly conceives the challenge of counterinsurgency and calibrates government actions through the use of information systems and operations; then, it applies this framework to the contemporary crisis in Nepal to postulate effective counterinsurgency strategies for the Nepalese government and its supporters. The paper analyzes the environment, structure, and dynamics of the insurgent and counterinsurgent systems in Nepal to determine the extent to which information is or could be employed in the fight. Based on the conditions identified in the research, the paper proposes information-based strategies and tactics that favorably affect conflict dynamics on behalf of the Nepalese government. Finally, the paper offers constructive and appropriate ways for the USA to support Nepalese information operations efforts in the counterinsurgency. This research focuses primarily on the use of information in insurgencies, but it also realizes that information strategies must be balanced and blended with other important dimensions of insurgent conflict. Thus, the insights gained here are intended to support further analysis of the larger set of dynamics that shape the conflict in Nepal.
DTIC
Information Systems; Nepal; Warfare

20050243214 Woods Hole Oceanographic Inst., MA USA
2003 SOLAS Summer School
McGillis, Wade R.; Dec. 31, 2003; 10 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0882
Report No.(s): AD-A439763; No Copyright; Avail.: CASI: A02, Hardcopy

In 2003, the USA provided support for the participation of 18 students, three research assistants, and seven lecturers in the first Surface Ocean Lower Atmosphere Study (SOLAS) Summer School. The purpose of this school was to introduce graduate students and young researchers to different components of SOLAS research including biogeochemical interactions and feedbacks, exchange processes, and air-sea fluxes. The SOLAS summer school used a theoretical framework, practical exercise, and laboratory experiments to promote an intensive learning environment. Most importantly, it provided the opportunity for young researchers interested in SOLAS science to meet one another and interact with lecturers currently researching these important global issues.
DTIC
Schools; Summer

20050243235 Minnesota Univ., Minneapolis, MN USA
Multilevel Refinement for Hierarchical Clustering
Karypis, George; Han, Euihong; Kumar, Vipin; May 17, 1999; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAG55-98-1-0441; DAAH04-95-C-0008
Report No.(s): AD-A439812; TR-99-020; No Copyright; Avail.: CASI: A03, Hardcopy

Hierarchical methods are well-known clustering techniques that can be potentially very useful for various data mining tasks. A hierarchical clustering scheme produces a sequence of clusterings in which each clustering is nested into the next clustering in the sequence. Since hierarchical clustering is a greedy search algorithm based on a local search, the merging decisions made early in the agglomerative process are not necessarily the right ones. One possible solution to this problem is to refine a clustering produced by the agglomerative hierarchical algorithm to potentially correct the mistakes made early

in the agglomerative process. The problem of refining a clustering has many similarities with that of refining a min-cut k-way partitioning of a graph. In this paper, the authors explore multilevel refinement schemes for refining and improving the clusterings produced by hierarchical agglomerative clustering. This algorithm combines traditional hierarchical clustering with multilevel refinement that has been found to be very effective for computing min-cut k-way partitioning of graphs. They consider several clustering objective functions for the proposed refinement step and investigate the usefulness of these objective functions. Their experimental results demonstrate that this algorithm produces clustering solutions that are consistently and significantly better than those produced by hierarchical clustering algorithms alone. Furthermore, their algorithm has the additional advantage of being extremely fast, as it operates on a sparse similarity matrix. The amount of time required by the algorithm ranged from 2 seconds for a data set with 358 items, to 80 seconds for a data set with 9,133 items on a Pentium II PC.
DTIC
Algorithms; Cluster Analysis; Data Bases; Hierarchies; Information Retrieval; Refining

20050243243 Naval Postgraduate School, Monterey, CA USA
A Design for Sensing the Boot Type of a Trusted Platform Module Enabled Computer
Vernon, Richard C.; Sep. 1, 2005; 68 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439832; No Copyright; Avail.: CASI: A04, Hardcopy

Modern network technologies were not designed for high assurance applications. As the DOD moves towards implementing the Global Information Grid (GIG), hardened networks architectures will be required. The Monterey Security Architecture (MYSEA) is one such project. This work addresses the issue of object reuse as it pertains to volatile memory spaces in untrusted MYSEA clients. When a MYSEA client changes confidentiality levels, it is possible that classified material remains in volatile system memory. If the system is not power cycled before the next the login, an attacker could retrieve sensitive information from the previous session. This thesis presents a conceptual design to protect against such an attack. A processor may undergo a hard or soft reboot. The proposed design uses a secure coprocessor to sense the reboot type of the host platform. In addition, a count is kept of the number of hard reboots the host platform has undergone. Using services provided by the secure coprocessor, the host platform can trustfully attest to a remote entity that it has undergone a hard reboot. This addresses the MYSEA object reuse problem. The design was tested using the CPU simulator software SimpleScalar.
DTIC
Architecture (Computers); Detection

20050243360 Geological Survey, Washington, DC USA
A Forest Vegetation Database for Western Oregon
Busing, Richard T.; Jun. 1, 2004; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439690; USGS-OFR-2004-1249; No Copyright; Avail.: CASI: A03, Hardcopy

Data on forest vegetation in western Oregon were assembled for 2323 ecological survey plots. All data were from fixed-radius plots with the standardized design of the Current Vegetation Survey (CVS) initiated in the early 1990s. For each site, the database includes: 1) live tree density and basal area of common tree species, 2) total live tree density, basal area, estimated biomass, and estimated leaf area; 3) age of the oldest overstory tree examined, 4) geographic coordinates, 5) elevation, 6) interpolated climate variables, and 7) other site variables. The data are ideal for ecoregional analyses of existing vegetation.
DTIC
Data Bases; Forests; Oregon; Vegetation

20050243398 Massachusetts Univ., Amherst, MA USA
A Conditional Model of Deduplication for Multi-Type Relational Data
Culotta, Aron; McCallum, Andrew; Jan. 1, 2005; 17 pp.; In English
Contract(s)/Grant(s): BCHD030010; NSF IIS-03-6249
Report No.(s): AD-A439607; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Record deduplication is the task of merging database records that refer to the same underlying entity. In relational databases, accurate deduplication for records of one type is often dependent on the merge decisions made for records of other types. Whereas nearly all previous approaches have merged records of different types independently, this work models these inter-dependencies explicitly to collectively deduplicate records of multiple types. We construct a conditional random field model of deduplication that captures these relational dependencies, and then employ a novel relational partitioning algorithm

to jointly deduplicate records. We evaluate the system on two citation matching datasets, for which we deduplicate both papers and venues. We show that by collectively deduplicating paper and venue deduplication, and up to a 20% error reduction in paper deduplication over competing methods.
DTIC
Data Bases; Relational Data Bases; Errors

20050243401 Maryland Univ., Baltimore, MD USA
An Ontology for Context-Aware Pervasive Computing Environments
Chen, Harry; Finin, Tim; Joshi, Anupam; Jan. 1, 2005; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-1-0215
Report No.(s): AD-A439610; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document describes COBRA-ONT an ontology for supporting pervasive context-aware systems. COBRA-ONT, expressed in the Web Ontology Language OWL, is a collection of ontologies for describing places, agents, events and their associated properties in an intelligent meeting room domain. This ontology is developed as a part of the Context Broker Architecture (CoBrA), a broker-centric agent architecture that provides knowledge sharing, context reasoning, and privacy protection supports for pervasive context-aware systems. We also describe an inference engine for reasoning with information expressed using the COBRA-ONT ontology and the ongoing research in using the DAML-Time ontology for context reasoning.
DTIC
Architecture (Computers); Multisensor Fusion; Inference; Computer Programs

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*.

20050243009 Naval Postgraduate School, Monterey, CA USA
GPS Ephemeris Message Broadcast Simulation
Browne, Nathan J.; Light, James J.; Sep. 1, 2005; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439430; No Copyright; Avail.: CASI: A05, Hardcopy

The warfighter constantly needs increased accuracy from GPS and a means to increasing this accuracy to the decimeter level is a broadcast ephemeris message containing GPS satellite orbit and clock corrections. The ephemeris message is produced at the GPS MCS (Master Control Station) which receives GPS signal data from NGA and Air Force worldwide and uses sophisticated software to produce the orbit and clock corrections. The problem is getting the ephemeris message to the tactical user in a forward operating area. This thesis proposed a notional architecture for pushing the ephemeris message to the tactical user. It then modeled the architecture and simulated the broadcast of the ephemeris message to a tactical user using NETWARS. The baseline architecture was simulated and analyzed and then additional constraints were placed upon the network to simulate a real-world model. The simulation results demonstrated that the architecture was feasible for ephemeris message broadcast with the constraints on time intervals between broadcasts, residual traffic and message size.
DTIC
Broadcasting; Ephemerides; Global Positioning System; Messages; Simulation

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20050240969 Lawrence Livermore National Lab., Livermore, CA USA
Science and Technology Review: Probing the Universe
Nov. 2004; 36 pp.; In English
Report No.(s): DE2005-15014512; UCRL-TR-52000-04-11; No Copyright; Avail.: National Technical Information Service (NTIS)

Contents: Focus on High-Energy Detection; Probing the Universe with Mirrors That Trick Light; From Seeing to Understanding; The Right Bang for the Job; Cell by Cell: Moving Biology toward a More Predictive Future; The Laboratory in the News; Patents and Awards; Abstracts.
NTIS
Research and Development; Technologies; Universe

20050242034 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Discussions on the Cancellation Effect on a Circular Orbit
Li, R.; Derbenev, S.; January 2005; 8 pp.; In English
Report No.(s): DE2005-840017; No Copyright; Avail.: Department of Energy Information Bridge
In this study, we discuss some controversial points raised concerning the cancellation effect for transverse dynamics on a curved orbit, and show how they can be perceived from the view point of the cancellation picture.
NTIS
Circular Orbits; Cancellation

20050242044 Department of Energy, Washington, DC USA
Science and Technology Review: The Physics of Stars Simulated in Three Dimensions
May 2002; 32 pp.; In English
Report No.(s): DE2005-15013298; No Copyright; Avail.: National Technical Information Service (NTIS)
For many years, Livermore researchers have played a major role in advancing astrophysical knowledge through their expertise in high-energy physics and advanced computer technology. The astrophysics community has benefited from Livermore contributions in the search for dark matter in the universe, laser guide star optics that sharpen astronomical views made from Earth, advanced instruments for U.S. and European spacecraft, and laboratory-created hot plasmas similar to those existing in distant stars.
NTIS
Research and Development; Technologies; Computerized Simulation; Astrophysics

20050243218 RAND Corp., Santa Monica, CA USA
Astronomical Odds: A Policy Framework for the Cosmic Impact Hazard
Sommer, Geoffrey S.; Jun. 1, 2004; 197 pp.; In English
Report No.(s): AD-A439773; No Copyright; Avail.: CASI: A09, Hardcopy
The phrase ‘astronomical odds’ expresses the rarest of life’s experiences in terms of the unfathomable vastness of outer space. Ironically, this work examines the ‘astronomical odds’ of a particular astronomical event, and shows how social responses to the prospect of the event are shaped by the inconceivability of those odds. The event in question is a cosmic impact (collision of either a comet or an asteroid with the Earth, potentially destroying a city, a region, or all human civilization). This ‘impact hazard’ is treated from the perspective of a policy analyst interested in the general category of low-probability-but-high-consequence events. Such extreme events have proven problematic, in terms of both the formulation and execution of public policy. Why should this be so, and what measures can be taken to surmount the difficulties? There are cognitive barriers to serious consideration of very remote hazards, and these are nicely captured by the colloquial term ‘giggle factor.’ These barriers on the individual level may aggregate into barriers on the organizational level, and thus serve to constrain policymaker action. The end result may be a less than socially-optimal level of resource allocation: in effect, the social system has a blind spot. On the other hand, heuristics may operate that unjustifiably magnify the attention given to such hazards, and these heuristics may be susceptible to manipulation by interested stakeholders. The consequence would then be a greater than socially-optimal level of resource allocation. The task is to first define how a socially-optimal level of resource allocation might be derived, and then to explore how such a level might be maintained in the face of policymaker aversion or rent-seeking behavior by stakeholders. If such a level cannot be maintained, then what is the constrained optimum?
DTIC
Asteroids; Astronomy; Collisions; Comets; Hazards; Policies; Probability Theory

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20050240970 Department of Energy, Washington, DC USA, National Science Foundation, Washington, DC USA
Discovering the Quantum Universe: The Role of Particle Colliders
January 2005; 50 pp.; In English
Report No.(s): PB2006-101154; No Copyright; Avail.: National Technical Information Service (NTIS)

This report explores in successively greater depth the role that accelerators will play in discovering the quantum universe. Chapter 1 introduces three discovery themes. Chapter 2 elucidates the meaning of the three themes in the context of the Large Hadron Collider and the International Inear Collider. Chapter 3 presents a discussion in depth of the physics of the Higgs particle and supersymmetry; the search for dark matter; and the quest for ultimate unification.
NTIS
Exploration; Universe

20050241682 Lawrence Livermore National Lab., Livermore, CA USA
Laboratory Studies of the Fe K-Shell Emission
Beiersdorfer, P.; Dec. 27, 2004; 16 pp.; In English
Report No.(s): DE2005-15014620; UCRL-PROC-208771; No Copyright; Avail.: Department of Energy Information Bridge

An overview is given of measurements of the Fe K-shell spectrum from low-density laboratory sources. The measurements include wavelengths, electron-impact collision cross sections, innershell ionization phenomena, dielectronic recombination resonance strengths, charge exchange recombination, electron beam polarization effects, resonance excitation, and radiative cascade contributions. K-shell spectra have now also been obtained with microcalorimeters, including microcalorimeter arrays that are twins of the ASTRO-E and ASTRO-E2 missions, which illustrate typical resolving powers and spectral capabilities.
NTIS
Electron-Ion Recombination; Ionization Cross Sections; Resonance Charge Exchange

20050241968 Lawrence Livermore National Lab., Livermore, CA USA
Summary of the Meeting
Lovelace, R. V. E.; Ryutov, D. D.; Dec. 16, 2003; 8 pp.; In English
Report No.(s): DE2005-15013788; UCRL-PROC-201503; No Copyright; Avail.: Department of Energy Information Bridge

This was a meeting between two large groups of researchers: astrophysicists and space physicists, on the one hand, and laboratory plasma physicists, on the other. The meeting has clearly demonstrated a growing mutual interest of these two groups: presenters of one group tried to make their talks understandable to another group, discussions were very lively, and a number of points for further joint effort have been identified. This was a timely meeting in view of the explosion of observational data from new space and ground based instruments. New phenomena have been observed and/or understood more clearly, including gamma ray burst sources, the Sunyaev-Zeldovich effect, the anisotropy of the cosmic microwave background, high magnetic field pulsars or magnetars, solar acoustic spectroscopy, ultra luminous star burst galaxies, and many others. Specific talks and posters covered essentially all areas of plasma physics related to astrophysics and space physics, from dusty plasmas, through reconnection physics, to high-energy-density phenomena. Some talks were related to the development of the conceptual framework of the plasma physics, like modern models of the hydrodynamic turbulence, magnetic dynamos, Hall magnetohydrodynamics, and hydrodynamical and magnetohydrodynamic instabilities in rotating systems.
NTIS
Plasma Physics; Atmospheric Physics; Astrophysics; Spectroscopy

20050241969 Lawrence Livermore National Lab., Livermore, CA USA
Laboratory Studies of X-Ray Emission from Fe L-Shell Transitions and Their Diagnostic Utility
Brown, G. V.; Beiersdorfer, P.; Chen, H.; Scofield, J. H.; Boyce, K. R.; Jan. 19, 2005; 16 pp.; In English
Report No.(s): DE2005-15014492; UCRL-CONF-209097; No Copyright; Avail.: Department of Energy Information Bridge

Non-terrestrial objects are home to complex, dynamic, intriguing environments. High-resolution x-ray spectra from these sources measured by satellites such as the Chandra x-ray Observatory, XMM-Newton, the Solar Maximum Mission, and the

soon-to-be-launched Astro-E2 provide a means for understanding the physics governing these sources. Especially rich is the x-ray emission from L-shell transitions in highly-charged iron ions. This emission is the source of a variety of diagnostics whose utility lies in the accuracy of the atomic data employed to model the x-ray spectra either globally or using ratios of key emission lines. The atomic data used to describe these diagnostics are generally provided by large theoretical calculations and benchmarked by laboratory data. I will discuss the laboratory measurements of Fe L-shell x-ray emission, past, present, and future, how these data are being implemented in spectral modeling packages, and how models are being built using data obtained exclusively in the laboratory.
NTIS
Emission; X Rays

20050242994 Naval Postgraduate School, Monterey, CA USA
A Novel Photovoltaic Power Converter for Military and Space Applications
Fernandez, Randyll R. M., Jr; Sep. 1, 2005; 97 pp.; In English; Original contains color illustrations
Report No.(s): AD-A439411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this thesis is to consider PhotoVoltaic Power Converter (PVPC) technology, developed by Atira Technologies , and its prospects for military and space applications. This research will validate the hypothesis that PVPC technology enables a solar power system to produce usable power during low-and no-light conditions which standard solar power systems fail to provide. Solar cell panels are exposed to sunlight at different angles and with variable intensity, therefore the resulting output power varies depending on the illumination angle as well as the light intensity of each panel. Atira Technologies devised a novel buck-boost converter that is specifically designed to track the maximum power point of each solar panel. This would provide a significant increase in the overall available power by utilizing a switching topology in a subdued lighting condition. Although a small amount of power is generated, given enough time, a battery will reach its full charge, compared to no additional charging if the battery is using a panel without the circuit. In addition, this research will also show the vital sustaining information to substantiate PVPC's claim of usefulness and effectiveness to allow for longer time on station both in the field and in space so it can extend its missions.
DTIC
Military Technology; Photovoltaic Effect; Power Converters; Solar Energy; Technology Utilization

20050243167 Aerospace Corp., Los Angeles, CA USA
Low-Altitude Distribution of Radiation Belt Electrons
Selesnick, R. S.; Looper, M. D.; Albert, J. M.; Nov. 10, 2004; 12 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A439680; AFRL-VS-HA-TR-2004-1205; No Copyright; Avail.: CASI: A03, Hardcopy

A numerical simulation of the low-altitude electron radiation belt is described. It includes dependences on the electron's bounce and drift phases, equatorial pitch angle, and kinetic energy in the range of 1 to several MeV at L = 3.5. Physical processes in addition to the adiabatic electron motion are pitch angle diffusion and backscattering from a realistic model atmosphere. Quasi-linear diffusion coefficients are calculated from a model of the whistler mode plasmaspheric hiss wave intensity. Comparisons of the simulation results with electron data from a low-altitude satellite show that the model accounts for the main features of the electron spatial distribution during selected periods of differing geomagnetic activity.
DTIC
Electrons; Low Altitude; Radiation Belts; Simulation; Spatial Distribution

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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*.

20050240871 Lawrence Livermore National Lab., Livermore, CA USA
21st Century Steam for Asteroid Mitigation
Dearborn, D. S.; Mar. 16, 2004; 32 pp.; In English
Report No.(s): DE2005-15013978; UCRL-PROC-202922; No Copyright; Avail.: National Technical Information Service (NTIS)

The systematic requirements to divert an object on an earth-impacting course are developed relating the minimum

velocity perturbation (both magnitude and direction) to the time available before impact. This, coupled with the accuracy to which orbits can be determined, restricts the time available for any mitigation technology to operate. Because nuclear energy densities are nearly a million times higher than those possible with chemical bonds, it is the most mass efficient means for storing delivering energy with todays technology. The question is how to most effectively apply that energy. This paper will examine the simple case of shattering the body, as well as a more controlled approach in which one or more small velocity increments divert a body. The optimal approach depends on the detailed circumstances, but in either case, already developed technology permits a successful diversion with a few years to decades of notice. The success of nuclear options on relatively short timescales permits consideration of other technologies that while not so well developed might be sufficiently improved to divert small (100 meter) bodies.

NTIS

Asteroids; Earth (Planet); Steam

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