National Aeronautics and Space Administration
Langley Research Center

Scientific and Technical Information Program Office

Scientific and Technical Aerospace Reports

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NASA STI Program ... in Profile

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- TECHNICAL MEMORANDUM. Scientific and technical findings that are of preliminary or specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.
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- Telephone the NASA STI Help Desk at (301) 621-0390
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  Hanover, MD 21076-1320

Introduction

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

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

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

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

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

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The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

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

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NASA Center for AeroSpace Information (CASI)

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National Technical Information Service (NTIS)

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

The Federal Depository Library Program (FDLP)

The U.S. Congress established the **Federal Depository Library Program** (FDLP) to ensure access by the American public to U.S. Government information. The program acquires and disseminates information products from all three branches of the U.S. Government to nearly 1,300 Federal depository libraries nationwide. The libraries maintain these information products as part of their existing collections and are responsible for assuring that the public has free access to the information. Locate the Federal Depository Libraries http://www.access.gpo.gov/su_docs.

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

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

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Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

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

20050051915 NASA Langley Research Center, Hampton, VA, USA

Integrated Mode Choice, Small Aircraft Demand, and Airport Operations Model User's Guide: Supplement

Dollyhigh, Samuel M.; Yackovetsky, Robert E., Technical Monitor; February 2004; In English

Contract(s)/Grant(s): NAS1-00135; WU 23-762-50-02

Report No.(s): NASA/CR-2004-212998/SUPPL; No Copyright; Avail: CASI; C01, CD-ROM

A mode choice model that generates on-demand air travel forecasts at a set of GA airports based on changes in economic characteristics, vehicle performance characteristics such as speed and cost, and demographic trends has been integrated with a model to generate integrated aircraft operations by airplane category at a set of 3227 airports. Numerous intermediate outputs can be generated, such as the number of additional trips diverted from automobiles and schedule air by the improved performance and cost of on-demand air vehicles. The total number of transported passenger miles that are diverted is also available. From these results the number of new aircraft to service the increased demand can be calculated. Output from the models discussed is in the format to generate the origin and destination traffic flow between the 3227 airports based on solutions to a gravity model.

Author

Airports; Economics; Forecasting; Schedules; Traffic

20050060618 NASA Glenn Research Center, Cleveland, OH, USA

Examples of Current and Future Uses of Neural-Net Image Processing for Aerospace Applications

Decker, Arthur J.; [2004]; 19 pp.; In English; Great Lakes Photonics Symposium, 7-11 Jun. 2004, Cleveland, OH, USA

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

Report No.(s): E-14634; No Copyright; Avail: CASI; A03, Hardcopy

Feed forward artificial neural networks are very convenient for performing correlated interpolation of pairs of complex noisy data sets as well as detecting small changes in image data. Image-to-image, image-to-variable and image-to-index applications have been tested at Glenn. Early demonstration applications are summarized including image-directed alignment of optics, tomography, flow-visualization control of wind-tunnel operations and structural-model-trained neural networks. A practical application is reviewed that employs neural-net detection of structural damage from interference fringe patterns. Both sensor-based and optics-only calibration procedures are available for this technique. These accomplishments have generated the knowledge necessary to suggest some other applications for NASA and Government programs. A tomography application is discussed to support Glenn's Icing Research tomography effort. The self-regularizing capability of a neural net is shown to predict the expected performance of the tomography geometry and to augment fast data processing. Other potential applications involve the quantum technologies. It may be possible to use a neural net as an image-to-image controller of an optical tweezers being used for diagnostics of isolated nano structures. The image-to-image transformation properties also offer the potential for simulating quantum computing. Computer resources are detailed for implementing the black box calibration features of the neural nets.

Author

Neural Nets; Image Processing; Data Processing; Tomography; Aerospace Engineering; Calibrating

20050060680 NASA Langley Research Center, Hampton, VA, USA

Transition in a Supersonic Boundary Layer due to Acoustic Disturbances

Balakumar, Ponnampalam; [2004]; 20 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Contract(s)/Grant(s): 065-30-31

Report No.(s): AIAA Paper 2005-0096; No Copyright; Avail: CASI; A03, Hardcopy

The boundary layer receptivity process due to the interaction of three-dimensional slow and fast acoustic disturbances with a blunted flat plate is numerically investigated at a free stream Mach number of 3.5 and at a high Reynolds number of 106/inch. The computations are performed with and without two-dimensional isolated roughness element located near the leading edge. Both the steady and unsteady solutions are obtained by solving the full Navier-Stokes equations using the 5th-order accurate weighted essentially non-oscillatory (WENO) scheme for space discretization and using third-order total-variation-diminishing (TVD) Runge-Kutta scheme for time integration. The simulations showed that the linear instability waves are generated very close to the leading edge. The wavelength of the disturbances inside the boundary layer first increases gradually and becomes longer than the wavelength for the instability waves within a short distance from the leading edge. The wavelength then decreases gradually and merges with the wavelength for the Tollmien_Schlichting wave. The initial amplitudes of the instability waves near the neutral points, the receptivity coefficients, are about 1.20 and 0.07 times the amplitude of the free-stream disturbances for the slow and the fast waves respectively. It was also revealed that small isolated roughness element does not enhance the receptivity process for the given nose bluntness.

Author

Supersonic Boundary Layers; Acoustics; Flat Plates; Free Flow; High Reynolds Number; Navier-Stokes Equation

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*.

20050042072 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA

A Computational Model for Rotor-Fuselage Interactional Aerodynamics

Boyd, D. Douglas, Jr.; Barnwell, Richard W.; Gorton, Susan Althoff; [2000]; 11 pp.; In English; 38th Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2000, Reno, NV, USA

Report No.(s): AIAA Paper 2000-0256; Copyright; Avail: CASI; A03, Hardcopy

A novel unsteady rotor-fuselage interactional aerodynamics model has been developed. This model loosely couples a Generalized Dynamic Wake Theory (GDWT) to a thin-layer Navier-Stokes solution procedure. This coupling is achieved using an unsteady pressure jump boundary condition in the Navier-Stokes model. The new unsteady pressure jump boundary condition models each rotor blade as a moving pressure jump which travels around the rotor azimuth and is applied between two adjacent planes in a cylindrical, non-rotating grid. Comparisons are made between measured and predicted time-averaged and time-accurate rotor inflow ratios. Additional comparisons are made between measured and predicted unsteady surface pressures on the top centerline and sides of the fuselage.

Author

Interactional Aerodynamics; Rotor Aerodynamics; Fuselages

20050050933 Old Dominion Univ., Norfolk, VA, USA

Advanced Applications of Adifor 3.0 for Efficient Calculation of First-and Second-Order CFD Sensitivity Derivatives

Taylor, Arthur C., III; November 23, 2004; 11 pp.; In English

Contract(s)/Grant(s): NCC1-01015; ODURF Proj. 111451; No Copyright; Avail: CASI; A03, Hardcopy

This final report will document the accomplishments of the work of this project. 1) The incremental-iterative (II) form of the reverse-mode (adjoint) method for computing first-order (FO) aerodynamic sensitivity derivatives (SDs) has been successfully implemented and tested in a 2D CFD code (called ANSERS) using the reverse-mode capability of ADIFOR 3.0. These preceding results compared very well with similar SDS computed via a black-box (BB) application of the reverse-mode capability of ADIFOR 3.0, and also with similar SDs calculated via the method of finite differences. 2) Second-order (SO) SDs have been implemented in the 2D ASNWERS code using the very efficient strategy that was originally proposed (but not previously tested) of Reference 3, Appendix A. Furthermore, these SO SOs have been validated for accuracy and

computational efficiency. 3) Studies were conducted in Quasi-1D and 2D concerning the smoothness (or lack of smoothness) of the FO and SO SD's for flows with shock waves. The phenomenon is documented in the publications of this study (listed subsequently), however, the specific numerical mechanism which is responsible for this unsmoothness phenomenon was not discovered. 4) The FO and SO derivatives for Quasi-1D and 2D flows were applied to predict aerodynamic design uncertainties, and were also applied in robust design optimization studies.
Author
Computational Fluid Dynamics; Aerodynamics; Sensitivity; Iterative Solution

20050050949 NASA Langley Research Center, Hampton, VA, USA
Pressure-Sensitive Paint Investigation of Double-Delta Wing Vortex Flow Manipulation
Erickson, Gary E.; Gonzalez, Hugo A.; January 2005; 35 pp.; In English
Report No.(s): AIAA Paper 2005-1059; No Copyright; Avail: CASI; A03, Hardcopy

A pressure-sensitive paint (PSP) technique was applied in a wind tunnel experiment in the NASA Langley Research Center 8-Foot Transonic Pressure Tunnel to quantify the effect of wing fillets on the global vortex-induced surface static pressure field about a sharp leading-edge 76 deg/40 deg double delta wing, or strake-wing, model at subsonic and transonic speeds. Global calibrations of the PSP were obtained at M = 0.50, 0.70, 0.85, 0.95, and 1.20, a Reynolds number per unit length of 2.0 million, and angles of attack from 10 degrees to 30 degrees using an in-situ method featuring the simultaneous acquisition of electronically-scanned pressures (ESP) at discrete locations on the model. The mean error in the PSP measurements relative to the ESP data was approximately 2 percent or less at M = 0.50 to 0.85 but increased to several percent at M = 0.95 and 1.20. The PSP pressure distributions and pseudo-colored planform view pressure maps clearly revealed the vortex-induced pressure signatures at all Mach numbers and angles of attack. Small fillets having a parabolic or diamond planform situated at the strake-wing intersection were designed to manipulate the vortical flows by, respectively, removing the leading-edge discontinuity or introducing additional discontinuities. The fillets caused global changes in the vortex-dominated surface pressure field that were effectively captured in the PSP measurements. The vortex surface pressure signatures were compared to available off-surface vortex cross-flow structures obtained using a laser vapor screen (LVS) flow visualization technique. The fillet effects on the PSP pressure distributions and the observed leading-edge vortex flow characteristics were consistent with the trends in the measured lift, drag, and pitching moment coefficients.
Author
Strakes; Delta Wings; Aerodynamic Configurations; Wind Tunnel Tests; Fillets; Pressure Distribution; Static Pressure

20050050953 NASA Langley Research Center, Hampton, VA, USA
Computations of Flow over a Hump Model Using Higher Order Method with Turbulence Modeling
Balakumar, P.; January 2005; 16 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Report No.(s): AIAA Paper 2005-1270; No Copyright; Avail: CASI; A03, Hardcopy

Turbulent separated flow over a two-dimensional hump is computed by solving the RANS equations with k - omega (SST) turbulence model for the baseline, steady suction and oscillatory blowing/suction flow control cases. The flow equations and the turbulent model equations are solved using a fifth-order accurate weighted essentially. nonoscillatory (WENO) scheme for space discretization and a third order, total variation diminishing (TVD) Runge-Kutta scheme for time integration. Qualitatively the computed pressure distributions exhibit the same behavior as those observed in the experiments. The computed separation regions are much longer than those observed experimentally. However, the percentage reduction in the separation region in the steady suction case is closer to what was measured in the experiment. The computations did not predict the expected reduction in the separation length in the oscillatory case. The predicted turbulent quantities are two to three times smaller than the measured values pointing towards the deficiencies in the existing turbulent models when they are applied to strong steady/unsteady separated flows.
Author
Turbulence Models; Turbulent Flow; Blowing; Suction; Flow Equations; Pressure Distribution

20050051127 Maryland Univ., College Park, MD USA
Conceptual Design Studies of a Mono Tiltrotor (MTR) Architecture
Leishman, J. G.; Preator, Robin; Baldwin, G. D.; Dec. 2004; 107 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-C-0531
Report No.(s): AD-A428702; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Mono Tiltrotor (MTR) is a proposed, innovative heavy-lift rotorcraft architecture. The emerging military strategies most suited to potential application of the MTR are Navy Sea Basing with Ship to Objective Maneuver, and Army Future Combat Systems with mounted maneuver and air mobility. The present work reports on a conceptual design study that has been conducted to predict the sizes and weights of the MTR architecture and to objectively examine its potential performance. A detailed weight budget has been determined based on historical component data for helicopters and airplanes. A thorough component drag breakdown has allowed for good estimates of the overall lift-to-drag ratio of the MTR concept in both the helicopter mode and airplane cruise conditions. A requirement was that the machine carry its payload over an unprecedented unrefueled distance of 1,000 nautical miles. It is shown that if technically realizable, the MTR architecture allows for a relatively compact and lightweight rotor design, with an accompanying lightweight airframe and relatively low fuel load compared to competing helicopter concepts.
DTIC
Lift Drag Ratio; Tilt Rotor Aircraft

20050051128 Florida Univ., Gainesville, FL USA
Membrane Wing Aerodynamics for micro AV Applications
Shyy, Wei; Lian, Yongsheng; Ifju, Peter; Jul. 2004; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428704; No Copyright; Avail: Defense Technical Information Center (DTIC)
Viewgraphs only of Membrane Wing Aerodynamics for micro AV Applications.
DTIC
Aerodynamic Characteristics; Aerodynamic Configurations; Aerodynamics; Membranes; Wings

20050051144 Bristol Univ., UK
Rapid Development of Aerodynamic Models for UCAV Flight Dynamics & Control Studies
Greenwell, Doug; Nov. 2002; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428730; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Aerodynamic Characteristics; Aerodynamics; Drone Vehicles; Flight Control; Models

20050051161 Air Force Research Lab., Wright-Patterson AFB, OH USA
Emerging Aerodynamic Technologies for High- Altitude Long-Endurance SensorCraft UAVs
Tilmann, Carl P.; Nov. 2002; 24 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428754; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts only on the Workshops on Aerodynamic Issues of Unmanned Air Vehicles
DTIC
Aerodynamics; High Altitude

20050051194 Defence Science Technology Lab., Farnborough, UK
Air Intakes for Subsonic UCAV Applications - Some Design Considerations
Martin, Peter G.; Oct. 2002; 24 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428819; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts from presentation on the design considerations of air intakes for subsonic UCAV applications.
DTIC
Air Intakes; Drone Vehicles

20050051196 Air Force Academy, CO USA
High Resolution Computational Unsteady Aerodynamic Techniques Applied to Maneuvering Unmanned Combat Aircraft
Morton, Scott; Jul. 2004; 40 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428822; No Copyright; Avail: Defense Technical Information Center (DTIC)

Briefing charts from presentation on high resolution computational unsteady aerodynamic techniques as applied to maneuvering unmanned combat aircraft.
DTIC
Aerodynamics; Aeromaneuvering; Computational Fluid Dynamics; Computerized Simulation; Drone Vehicles; Fighter Aircraft; High Resolution; Pilotless Aircraft; Unsteady Aerodynamics

20050051197 BAE Systems, Brough, UK
Aspects of Use of CFD for UAV Configuration Design
Pemberton, Tim; Nov. 2002; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428823; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts from presentation on the aspects of using computational fluid dynamics for the configuration design of Unmanned Aerial Vehicles (UAV).
DTIC
Computational Fluid Dynamics; Drone Vehicles

20050051198 Air Force Research Lab., Wright-Patterson AFB, OH USA
Computational and Physical Aspects of UAV Vortical Flows
Visbal, Miguel R.; Jul. 2004; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428824; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts from presentation on the computational and physical aspects of UAV(unmanned air vehicle) vortical flows.
DTIC
Drone Vehicles; Vortices

20050051203 Technische Univ., Berlin, Germany
Electrokinetic Flow Control and Propulsion for MAVs
Goeksel, B.; Rechenberg, I.; Bannasch, R.; Sep. 2003; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428830; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts from presentation on electrokinetic flow control and propulsion systems for Micro Air Vehicles (MAV).
DTIC
Drone Vehicles; Electrokinetics; Propulsion

20050051213 Air Force Research Lab., Wright-Patterson AFB, OH USA
High-Fidelity Computational Simulation of Nonlinear Fluid-Structure Interaction Problems
Gordnier, Raymond E.; Nov. 2002; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428840; No Copyright; Avail: Defense Technical Information Center (DTIC)
Key issues: 1) High-fidelity computational aeroelastic methods are needed to address UAV fluid/structure interaction issues; 2) These schemes will need to be very efficient to address long temporal integration requirements; 3) Well documented, basic experiments are still needed for code validation; 4) Additional disciplines may need to be added to adequately address the fluid/ structure interaction issues.
DTIC
Aeroelasticity; Computational Fluid Dynamics; Drone Vehicles; Nonlinear Systems; Nonlinearity; Simulation

20050051214 Nangia Aero Research Associates, Bristol, UK
Control Aspects of Flying Wings with Aft- & Forward- Sweep, Camber & Twist
Nangia, R. K.; Nov. 2002; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428841; No Copyright; Avail: Defense Technical Information Center (DTIC)
Concluding remarks: 1) Revival of interest in Flying Wings for military & civil; 2) Appreciation of solvers, linear theory, Euler; 3) Strategy: Appropriate solvers with stability constraints; 4) Aft- & forward- swept planforms designed & studied with lifting surface theory; 5) Capitalize on FSW laminar flow; 6) With aeroelastic tailoring, structural divergence should be less of a problem; 7) Preliminary work on laterals, FSW permits dihedral effect.
DTIC
Aerodynamic Stability; Aerodynamics; Camber; Control Surfaces; Swept Wings; Wings

20050051215 Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel
Mini UAV's: Can Active Flow Control Do It All?
Seifert, Avi; Nov. 2002; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428842; No Copyright; Avail: Defense Technical Information Center (DTIC)
What is 'All?' 1) Eliminate low Re effects on performance; 2) Control attitudes and provide guidance; 3) Propulsion by periodic excitation; 4) No moving parts.
DTIC
Active Control; Drone Vehicles; Excitation; Flow Distribution; Fluid Flow; Miniaturization; Pilotless Aircraft

20050051216 Bath Univ., Bath, UK
Insect Flight and MAVs
Nov. 2002; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428844; No Copyright; Avail: Defense Technical Information Center (DTIC)
Insects are highly successful autonomous MAVs. They are specialized for flight at this size range, where conventional wings in steady motion perform badly. Flapping wings can generate 2-3X more lift -- the extra lift capacity is highly desirable for MAVs. Only a flapping design can exploit the high-lift/ high-drag aerodynamic mechanisms found in insect flight. After 350 million years of evolution, they have probably found good solutions for: Kinematics - Wing design - Control systems.
DTIC
Drone Vehicles; Insects; Miniaturization; Wings

20050051217 BAE Systems, Brough, UK
Stability & Control Aspects of UCAV Configurations
Flux, Paul; Nov. 2002; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428845; No Copyright; Avail: Defense Technical Information Center (DTIC)
Most UAV configurations are conventional, aerodynamically driven shapes, with conventional stability & control characteristics. However, the requirements of Combat UAVs (UCAVs) drive to radical configurations with unusual stability & control challenges: Finless - Rudderless - High wing sweep - Unusual wing shapes - Blended wing-bodies - No forebody. Stability & control issues must be addressed early in the UCAV design cycle.
DTIC
Aerodynamic Stability; Combat; Drone Vehicles; Stability

20050051260 Naval Air Systems Command, Patuxent River, MD USA
UCAV Aerodynamics and Vehicle Control in the Naval Environment
Ghee, Terence A.; Jul. 2004; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428949; EOARD-CSP-02-5078; No Copyright; Avail: Defense Technical Information Center (DTIC)
Document contains specifications on aircraft structure, launch mechanisms, and recovery configurations. included are the advantages of an unmanned combat air vehicle plus the challenging concerns surrounding it.
DTIC
Aerodynamics; Drone Vehicles; Maneuverability

20050060675 NASA Langley Research Center, Hampton, VA, USA
Pressure-Sensitive Paint Investigation of Double-Delta Wing Vortex Flow Manipulation
Erickson, Gary E.; Gonzalez, Hugo A.; [2004]; 60 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 721-10-66
Report No.(s): AIAA Paper 2005-1059; Copyright; Avail: CASI; A04, Hardcopy
A pressure-sensitive paint (PSP) technique was applied in a wind tunnel experiment in the NASA Langley Research Center 8-Foot Transonic Pressure Tunnel to quantify the effect of wing fillets on the global vortex-induced surface static pressure field about a sharp leading-edge 76o/40o double delta wing, or strake-wing, model at subsonic and transonic speeds. Global calibrations of the PSP were obtained at M = 0.50, 0.70, 0.85, 0.95, and 1.20, a Reynolds number per unit length of 2.0 million, and angles of attack from 10 degrees to 20 degrees using an in-situ method featuring the simultaneous acquisition of electronically-scanned pressures (ESP) at discrete locations on the model. The mean error in the PSP measurements relative to the ESP data was approximately 2 percent or less at M = 0.50 to 0.85 but increased to several percent at M =0.95 and 1.20.

The PSP pressure distributions and pseudo-colored planform view pressure maps clearly revealed the vortex-induced pressure signatures at all Mach numbers and angles of attack. Small fillets having a parabolic or diamond planform situated at the strake-wing intersection were designed to manipulate the vortical flows by, respectively, removing the leading-edge discontinuity or introducing additional discontinuities. The fillets caused global changes in the vortex-dominated surface pressure field that were effectively captured in the PSP measurements. The vortex surface pressure signatures were compared to available off-surface vortex cross-flow structures obtained using a laser vapor screen (LVS) flow visualization technique. The fillet effects on the PSP pressure distributions and the observed leading-edge vortex flow characteristics were consistent with the trends in the measured lift, drag, and pitching moment coefficients.
Author
Pressure Sensitive Paints; Vortices; Pressure Distribution; Delta Wings; Leading Edges

20050060732 Oklahoma Univ., Norman, OK, USA
Buoyancy Effects on Flow Transition in Low-Density Inertial Gas Jets
Pasumarthi, Kasyap S.; Agrawal, Ajay K.; January 2005; 11 pp.; In English
Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: CASI; A03, Hardcopy

Effects of buoyancy on transition from laminar to turbulent flow are presented for momentum-dominated helium jet injected into ambient air. The buoyancy was varied in a 2.2-sec drop tower facility without affecting the remaining operating parameters. The jet flow in Earth gravity and microgravity was visualized using the rainbow schlieren deflectometry apparatus. Results show significant changes in the flow structure and transition behavior in the absence of buoyancy.
Author
Buoyancy; Gas Jets; Laminar Flow; Turbulent Flow; Transition Flow

20050060774 NASA Langley Research Center, Hampton, VA, USA
Lessons Learned in the High-Speed Aerodynamic Research Programs of the NACA/NASA
Spearman, M. Leroy; [2004]; 7 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 23-090-50-60
Report No.(s): AIAA Paper 2005-0327; No Copyright; Avail: CASI; A02, Hardcopy

The achievement of flight with manned, powered, heavier-than-air aircraft in 1903 marked the beginning of a new era in the means of transportation. A special advantage for aircraft was in speed. However, when an aircraft penetrates the air at very high speeds, the disturbed air is compressed and there are changes in the density, pressure and temperature of the air. These compressibility effects change the aerodynamic characteristics of an aircraft and introduce problems in drag, stability and control. Many aircraft designed in the post-World War II era were plagued with the effects of compressibility. Accordingly, the study of the aerodynamic behavior of aircraft, spacecraft and missiles at high-speed became a major part of the research activity of the NACA/NASA. The intent of the research was to determine the causes and provide some solutions for the aerodynamic problems resulting from the effects of compressibility. The purpose of this paper is to review some of the high-speed aerodynamic research work conducted at the Langley Research Center from the viewpoint of the author who has been active in much of the effort.
Author
Aerodynamic Characteristics; Compressibility Effects; Dynamic Control; High Speed; Stability

20050060912 Oklahoma Univ., Norman, OK, USA
Numerical Simulations of Buoyancy Effects in low Density Gas Jets
Satti, R. P.; Pasumarthi, K. S.; Agrawal, A. K.; [2004]; 10 pp.; In English
Contract(s)/Grant(s): NAG3-2388; Copyright; Avail: CASI; A02, Hardcopy

This paper deals with the computational analysis of buoyancy effects in the near field of an isothermal helium jet injected into quiescent ambient air environment. The transport equations of helium mass fraction coupled with the conservation equations of mixture mass and momentum were solved using a staggered grid finite volume method. Laminar, axisymmetric, unsteady flow conditions were considered for the analysis. An orthogonal system with non-uniform grids was used to capture the instability phenomena. Computations were performed for Earth gravity and during transition from Earth to different gravitational levels. The flow physics was described by simultaneous visualizations of velocity and concentration fields at Earth and microgravity conditions. Computed results were validated by comparing with experimental data substantiating that buoyancy induced global flow oscillations present in Earth gravity are absent in microgravity. The dependence of oscillation

frequency and amplitude on gravitational forcing was presented to further quantify the buoyancy effects.
Author
Buoyancy; Computational Fluid Dynamics; Finite Volume Method; Flow Stability; Gas Jets; Oscillations

20050060924 Oklahoma Univ., Norman, OK, USA
Concentration Measurements in Self-Excited, Momentum-Dominated Helium Jets
Yildirim, Bekir Sedat; 2004; In English
Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: Other Sources; Abstract Only

Flow structure of momentum-dominated pure helium jets discharged vertically into ambient air was investigated using high-speed rainbow schlieren deflectometry (RSD) technique. Effects of the operating parameters, i.e., Reynolds number (Re) and Richardson number (Ri), on the oscillatory behavior of the flow were examined over a range of experimental conditions. To seek the individual effect of these parameters, one of them was fixed and the other was varied with certain constraints. Measurements revealed highly periodic oscillations in the laminar region as well as high regularity in transition and turbulent regions. Maximum spectral power profiles at different axial locations indicated the oscillation amplitude increasing until the breakdown of the jet in the turbulent regime. The transition from the laminar to turbulent flow was also investigated. Fast Fourier transform analysis performed in the transition regime showed that the flow oscillates at a unique frequency, which was the same in the upstream laminar flow region. Measured deflection angle data were used in Abel inversion algorithm to construct the helium concentration fields. Instantaneous helium concentration contours revealed changes in the flow structure and evolution of vortical structures during an oscillation cycle. Temporal evolution plots of helium concentration at different axial location showed repeatable oscillations at all axial and radial locations up to the turbulent regime. A cross-correlation technique, applied to find the spatial displacements of the vortical structures, provided correlation coefficient peaks between consecutive schlieren images. Results show that the vortical structure convected and accelerated only in the axial direction. Derived from text
Laminar Flow; Oscillations; Turbulent Flow; Correlation Coefficients; Dimensional Measurement

20050060926 Oklahoma Univ., Norman, OK, USA
High-Speed Rainbow Schlieren Deflectometry Analysis of Helium Jets Flowing into Air for Microgravity Applications
Leptuch, Peter A.; 2002; In English
Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: Other Sources; Abstract Only

The flow phenomena of buoyant jets have been analyzed by many researchers in recent years. Few, however have studied jets in microgravity conditions, and the exact nature of the flow under these conditions has until recently been unknown. This study seeks to extend the work done by researchers at the university of Oklahoma in examining and documenting the behavior of helium jets in micro-gravity conditions. Quantitative rainbow schlieren deflectometry data have been obtained for helium jets discharging vertically into quiescent ambient air from tubes of several diameters at various flow rates using a high-speed digital camera. These data have obtained before, during and after the onset of microgravity conditions. High-speed rainbow schlieren deflectometry has been developed for this study with the installation and use of a high-speed digital camera and modifications to the optical setup. Higher temporal resolution of the transitional phase between terrestrial and micro-gravity conditions has been obtained which has reduced the averaging effect of longer exposure times used in all previous schlieren studies. Results include color schlieren images, color time-space images (temporal evolution images), frequency analyses, contour plots of hue and contour plots of helium mole fraction. The results, which focus primarily on the periods before and during the onset of microgravity conditions, show that the pulsation of the jets normally found in terrestrial gravity ('earth'-gravity) conditions cease, and the gradients in helium diminish to produce a widening of the jet in micro-gravity conditions. In addition, the results show that the disturbance propagate upstream from a downstream source.
Author
Gas Jets; Helium; Jet Flow; Microgravity

20050060931 NASA Glenn Research Center, Cleveland, OH, USA
Gravitational Effects on Near-Field Flow Structure of Low-Density Gas Jets
Yep, Tze-Wing; Agrawal, Ajay K.; Griffin, DeVon; AIAA Journal; October 2003; Volume 41, No. 10, pp. 1973-1979; In English
Contract(s)/Grant(s): NAG3-2388; Copyright; Avail: CASI; A02, Hardcopy

Experiments were conducted in earth gravity and micro gravity to acquire quantitative data on near field flow structure of helium jets injected into air. Microgravity conditions were simulated in the 2.2 s drop tower at NASA John H. Glenn

Research Center. The jet flow was observed by quantitative rainbow schlieren deflectometry, a non-intrusive line of sight measurement technique suited for the microgravity environment. The flow structure was characterized by distribution of helium mole fraction obtained from color schlieren images taken at 60 Hz. Results show that the jet in microgravity was up to 70% wider than that in Earth gravity. Experiments reveal that the global flow oscillations observed in Earth are absent in microgravity. Quantitative deatails are provided of the evolution as the experiment undergoes changes in gravity in the drop tower.
Author
Gas Flow; Gas Jets; Gravitational Effects; Helium; Microgravity

20050061079 Stanford Univ., Stanford, CA, USA
LES Prediction of Pressure Fluctuations on a Low Speed Airfoil
Wang, M.; Iaccarino, G.; Moreau, S.; Roger, M.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 183-193; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

The noise generated by flow over a lifting surface is a major concern in many engineering applications. Examples include propeller noise, rotor noise, wind turbine noise, fan noise, and noise from wings and hydrofoils. Even in the absence of disturbances in the incoming stream, an airfoil (blade) can be noisy due to the unsteady and turbulent boundary layers and wake generated around the profile and their interaction with it, particularly in the trailing-edge region. This so-called self-noise, or trailing-edge noise, is a major contributor to the overall noise in rotating machines and generally defines the lower bound of noise.
Author
Aeroacoustics; Aerodynamic Noise; Trailing Edges; Propeller Noise; Turbulent Boundary Layer; Airfoils; Hydrofoils

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*.

20050051084 Boeing Phantom Works, Seattle, WA USA
Automated Aerial Refuel (AAR) Technologies and Challenges, Delivery Order 0048
Riley, David R.; Apr. 2004; 23 pp.; In English
Contract(s)/Grant(s): F33615-00-D-3052-0048; Proj-A00T
Report No.(s): AD-A428617; AFRL-VA-WP-TP-2004-314; No Copyright; Avail: CASI; A03, Hardcopy

This paper talks about the challenges of Aerial Refueling of Unmanned Air Vehicles.
DTIC
Pilotless Aircraft; Refueling; Remotely Piloted Vehicles

20050051118 Civil Aeromedical Inst., Oklahoma City, OK USA
In-Flight Medical Incapacitation and Impairment of U.S. Airline Pilots: 1993 to 1998
DeJohn, Charles A.; Wolbrink, Alex M.; Larcher, Julie G.; Oct. 2004; 30 pp.; In English
Report No.(s): AD-A428688; DOT/FAA/AM-04/16; No Copyright; Avail: Defense Technical Information Center (DTIC)

Although it is not known when the first accident due to pilot in-flight medical incapacitation occurred, a recent survey showed that almost one-third of all pilots who responded had experienced an incapacitation requiring another crew member to take over their duties, with safety of flight significantly threatened in 3% of cases. The importance of in-flight medical incapacitation and impairment can be better understood when it is realized that each in-flight medical incapacitation or impairment could potentially lead to an aircraft accident. We studied in-flight medical incapacitations and impairments in U.S. airline pilots from 1993 through 1998. We defined in-flight medical incapacitation as a condition in which a flight crew member was unable to perform any flight duties and impairment as a condition in which a crew member could perform limited flight duties, even though performance may have been degraded. We found 39 incapacitations and 11 impairments aboard 47 aircraft during the six-year period. All pilots were males. The average age for incapacitations was 47.0 years (range 25 to 59 years). The average age for impairments was 43.3 years (range 27 to 57 years). The in-flight medical event rate was 0.058 per 100,000 flight hours. The probability that an in-flight medical event would result in an aircraft accident was 0.04.

Incapacitations significantly increased with age, with more serious categories in the older age groups. The most frequent categories of incapacitation were loss of consciousness, cardiac, neurological, and gastrointestinal. Safety of flight was seriously impacted in seven of the 47 flights and resulted in two non-fatal accidents.
DTIC
Aerospace Medicine; Aircraft Accidents; Airline Operations; Physiological Effects

20050051147 Civil Aeromedical Inst., Oklahoma City, OK USA
The Aviation Accident Experience of Civilian Airmen With Refractive Surgery
Nakagawara, Van B.; Montgomery, Ron W.; Wood, Kathryn J.; Jun. 2002; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428733; DOT/FAA/AM-02/10; No Copyright; Avail: Defense Technical Information Center (DTIC)

Civil airmen with refractive surgery may obtain any class of Federal Aviation Administration (FAA) medical certificate provided they meet the applicable vision standards, and an eye specialist verifies that healing is complete, visual acuity is stable, and no significant glare intolerance is present. However, concerns remain regarding the quality of the resulting refractive correction, long-term stability, side effects, and the potential surgical complications associated with refractive surgery. The purpose of this study was to determine whether an association existed between refractive surgery and aviation accidents. Methods: Records for active airman during the study period, 1994-96, were extracted from the FAA 's Consolidated Airman Information System medical database. Airmen who carried pathology codes for refractive surgery (130) and general eye surgery (5179) were identified. These records were cross-referenced with the Accident/Incident Data System database to determine those airmen involved in aircraft accidents. Frequency totals and mean accident rates (accidents/100,000 flight hours) were calculated for each class of FAA medical certification. Analysis of Variance was performed to compare the mean accident rates of non-refractive and refractive surgery airmen. Results: The total accident rate was higher for airmen with refractive surgery (3.86/100,000 flight hours) when compared with those without refractive procedures (2.62/100, 000 flight hours). Accident rates for airmen with refractive surgery were also higher in all three classes of medical certification; however, analysis found that these differences were not statistically significant (p \g 0.05) for any class of medical certification or the total airman population. In addition, our review found no aviation accident in which refractive surgery was identified as a causal factor.
DTIC
Aircraft Accidents; Eye (Anatomy); Refractivity; Surgery

20050051252 Army Command and General Staff Coll., Fort Leavenworth, KS USA
The Fall of Fort Eben Emael: The Effects of Emerging Technologies on the Successful Completion of Military Objectives
Gukeisen, Thomas B.; Jun. 2004; 81 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428903; No Copyright; Avail: Defense Technical Information Center (DTIC)

This study details the events of 10 May 1940 at Fort Eben Emael, Belgium, and the elements that led to the successful seizure of the fort by the German military. The central focus of the thesis is the following question: Was the use of emerging technologies the key to the German victory at Fort Eben Emael? First, the author examines the technologies themselves. Second, he examines the leadership and training of the German unit that was assigned to seize Fort Eben Emael. Third, he reviews administrative and personnel issues that existed for the Belgians stationed at Fort Eben Emael. The author's investigation revealed that use of a glider did afford German troops the advantage of surprise, however, the hollow charge failed to live up to its reputation as it was most effective when used in a way that was no different than a conventional charge. Further, the German unit's training and leadership was exemplary and contributed more to the mission's success than the technologies the unit employed. Additionally, Fort Eben Emael was faced with serious internal issues that prevented a successful defense of the Fort. The author concludes that emerging technologies were not the most crucial component contributing to the German's mission success. (1 table, 9 figures, 38 refs.)
DTIC
Belgium; Military Operations; Strategy; System Effectiveness

20050051263 Civil Aeromedical Inst., Oklahoma City, OK USA
Gas Chromatographic/Mass Spectrometric Differentiation of Atenolol, Metoprolol, Propranolol, and an Interfering Metabolite Product of Metoprolol
Angier, Mike K.; Lewis, Russel J.; Chaturvedi, Arvind K.; Canfield, Dennis V.; Oct. 2004; 9 pp.; In English
Report No.(s): AD-A428964; DOT-FAA-AM-04-15; No Copyright; Avail: Defense Technical Information Center (DTIC)

Pilots who successfully control their hypertension with medications, diet, and/or exercise can be medically certified to fly an aircraft. At the present time, approximately 8% of active pilots are designated as 'hypertensive with medication' by the Federal Aviation Administration (FAA). One of the groups of antihypertensives is the beta-blocker. Of this group, atenolol, metoprolol, and propranolol are commonly prescribed, and they also have chemical and structural similarities. The FAA's Civil Aerospace Medical Institute (CAMI) toxicologically evaluates postmortem biological samples collected from pilots involved in fatal civil aviation accidents. Over the 10-year period, 1993-2002, CAMI has identified 50 pilot fatalities wherein atenolol was found in 24 pilots, metoprolol in 19 pilots, and propranolol in 7 pilots, which is consistent with the fact that these drugs have been in the lists of the top 200 most-prescribed drugs in the USA. In a few of the 50 pilot fatality cases, initial analysis suggested the presence of atenolol and metoprolol. However, there was no medical history with these cases supporting the use of both of these drugs, and it is also unusual for a patient to be prescribed atenolol together with metoprolol and/or propranolol. Therefore, further examination of the cases, wherein atenolol and metoprolol were apparently present, was undertaken. Atenolol, metoprolol, and/or propranolol, with their possible metabolite(s), were extracted from the selected case specimens, derivatized with pentafluoropropionic anhydride (PFPA), and analyzed by gas chromatography/mass spectrometry (GC/MS). The MS spectra of the PFPA derivatives of these 3 antihypertensives and a metoprolol metabolite are nearly identical. All of the PFPA derivatives had baseline GC separation, with the exception of a metoprolol metabolite product, which co-eluted with atenolol.
DTIC
Gas Chromatography; Mass Spectroscopy; Metabolites; Toxicology

20050060797 Old Dominion Univ., Norfolk, VA, USA
Black Box Testing: Experiments with Runway Incursion Advisory Alerting System
Mukkamala, Ravi; January 2005; 25 pp.; In English
Contract(s)/Grant(s): NAG1-03053; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes our research findings on the Black box testing of Runway Incursion Advisory Alerting System (RIAAS) and Runway Safety Monitor (RSM) system. Developing automated testing software for such systems has been a problem because of the extensive information that has to be processed. Customized software solutions have been proposed. However, they are time consuming to develop. Here, we present a less expensive, and a more general test platform that is capable of performing complete black box testing. The technique is based on the classification of the anomalies that arise during Monte Carlo simulations. In addition, we also discuss a generalized testing tool (prototype) that we have developed.
Author
Runways; Safety; Electronic Equipment; Computer Programs

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

20050042045 NASA Langley Research Center, Hampton, VA, USA
Investigation of Measurement Errors in Doppler Global Velocimetry
Meyers, James F.; Lee, Joseph W.; [1999]; 14 pp.; In English; SAE World Aviation Congress and Exposition, 19-21 Oct. 1999, San Francisco, CA, USA
Report No.(s): SAE-Paper 1999-01-5599; Copyright; Avail: CASI; A03, Hardcopy

While the initial development phase of Doppler Global Velocimetry (DGV) has been successfully completed, there remains a critical next phase to be conducted, namely the determination of an error budget to provide quantitative bounds for measurements obtained by this technology. This paper describes a laboratory investigation that consisted of a detailed interrogation of potential error sources to determine their contribution to the overall DGV error budget. A few sources of error were obvious; e.g., iodine vapor adsorption lines, optical systems, and camera characteristics. However, additional non-obvious sources were also discovered; e.g., laser frequency and single-frequency stability, media scattering characteristics, and interference fringes. This paper describes each identified error source, its effect on the overall error budget, and where possible, corrective procedures to reduce or eliminate its effect.
Author
Error Analysis; Instrument Errors; Velocity Measurement

20050051002 European Space Agency, Toulouse, France

The Role of Time and Frequency in The European Geostationary Navigation Overlay System (EGNOS)

Job, A.; Legenne, J.; Brunet, M.; Pieplu, J-M.; Batchelor, A.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 469-481; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

The European Geostationary Navigation Overlay System (EGNO$) is being developed in Europe to provide GPS and GLONASS regional augmentation services to aviation, maritime, and land users. EGNOS will provide the.following services: i) GEO-based GPS-like Ranging signals to improve the availability and continuity of GPS and GLONASS navigation services, ii) Ground Integrity Channel (GIC) to improve the integrity of GPS- and GLONASS-based navigation and position determination for safety-critical applications, and iii) Wide.Area Differential corrections (WAD) to improve the accuracy of GPS-SPS and GLONASS. Additionally, EGNOS will disseminate accurate time to users, synchronized to GPS, GLONASS, and UTC time scales. The paper provides an overview of EGNOS ground-segment architecture, gives requirements related to time aspects, and describes preliminary analysis and performances through test trials. It also covers initial results achieved in the frame of the EURIDIS program, conducted by CNES, after several months of measurements.

Author

Global Positioning System; Navigation; Augmentation; Rangefinding; Correction

20050051686 NASA Glenn Research Center, Cleveland, OH, USA

Enhanced Oceanic Situational Awareness for the North Atlantic Corridor

Welch, Bryan; Greenfield, Israel; [2004]; 18 pp.; In English; 2004 Integrated CNS Conference, 26-29 Apr. 2004, Fairfax, VA, USA

Contract(s)/Grant(s): 22-184-10-02; No Copyright; Avail: CASI; A03, Hardcopy

Air traffic control (ATC) mandated, aircraft separations over the oceans, impose a limitation of traffic capacity for a given corridor. The separations result from a lack of acceptable situational awareness over oceans where radar position updates are not available. This study considers the use of Automatic Dependent Surveillance (ADS) data transmitted over a commercial satellite communications system as an approach to provide ATC with the needed situational awareness and thusly allow for reduced aircraft separations. Traffic loading from a specific day are used as a benchmark against which to compare several approaches for coordinating data transmissions from aircraft to the satellites.

Author

Oceans; Situational Awareness; Air Traffic Control; Corridors; Aircraft Communication

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*.

20050041963 General Electric Aircraft Engines, Cincinnati, OH, USA

Cold Aero Performance of a Two-Dimensional Mixer Ejector Nozzle

Balan, C.; January 2005; 126 pp.; In English

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

Report No.(s): NASA/CR-2005-213134; E-14647; No Copyright; Avail: CASI; A07, Hardcopy

Since 1986, NASA and the U.S. aerospace industry have been assessing the economic viability and environmental acceptability of a second-generation supersonic civil transport, or High Speed Civil Transport (HSCT). Environmental acceptability in terms of airport community noise and economic viability are critical elements in this endeavor. Development of a propulsion system that satisfies strict airport noise regulations (FAR36 Stage III levels), at acceptable performance and weight, is critical to the success of any HSCT program. Two-dimensional mixer-ejector (2DME) exhaust systems are one approach in achieving this goal. In support of HSCT development, GEAE (GE Aircraft Engines), under contract to the NASA Glenn Research Center, conducted this test program at the NASA Langley 16 ft transonic wind tunnel to evaluate the cold aerodynamic performance aspects of the 2DME exhaust system concept. The effects of SAR (SAR, suppressor area ratio, = mixed-flow area/primary nozzle throat area), MAR (MAR = overall exhaust system exit/mixing-plane area), flap length, CER

(suppressor chute expansion ratio), chute alignment, and free stream Mach number were investigated on a 1/11th cold aerodynamic scale model of a 2DME exhaust system.
Author
Civil Aviation; Ejectors; Exhaust Systems; Mixers; Exhaust Nozzles; Suppressors; Aircraft Performance; Cold Flow Tests; Two Dimensional Models

20050041979 NASA Langley Research Center, Hampton, VA, USA
The Acoustic Analogy and Alternative Theories for Jet Noise Prediction
Morris, Philip J.; Farassat, F.; Morris, Philip J.; AIAA Journal; [2002]; Volume 40, No. 4, pp. 671-680; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

This paper describes several methods for the prediction of jet noise. All but one of the noise prediction schemes are based on Lighthill's or Lilley's acoustic analogy while the other is the jet noise generation model recently proposed by Tam and Auriault. In all the approaches some assumptions must be made concerning the statistical properties of the turbulent sources. In each case the characteristic scales of the turbulence are obtained from a solution of the Reynolds-averaged Navier Stokes equation using a k-epsilon turbulence model. It is shown that, for the same level of empiricism, Tam and Auriault's model yields better agreement with experimental noise measurements than the acoustic analogy. It is then shown that this result is not because of some fundamental flaw in the acoustic analogy approach: but, is associated with the assumptions made in the approximation of the turbulent source statistics. If consistent assumptions are made, both the acoustic analogy and Tam and Auriault's model yield identical noise predictions. The paper concludes with a proposal for an acoustic analogy that provides a clearer identification of the equivalent source mechanisms and a discussion of noise prediction issues that remain to be resolved.
Author
Jet Aircraft Noise; Noise Prediction (Aircraft); Aeroacoustics; Analogies; Mathematical Models

20050042035
Vibratory Loads Reduction Testing of the NASA/Army/MIT Active Twist Rotor
[2001]; 19 pp.; In English; American Helicopter Society 57th Annual Forum, 9-11 May 2001, Washington, DC, USA; Copyright; Avail: CASI; A03, Hardcopy

Recent studies have indicated that controlled strain-induced blade twisting can be attained using piezoelectric active fiber composite technology, and that such advancement may provide a mechanism for reduced rotorcraft vibrations and increased rotor performance. In order to validate these findings experimentally, a cooperative effort between the NASA Langley Research Center, the Army Research Laboratory, and the MIT Active Materials and Structures Laboratory has been developed. As a result of this collaboration a four-bladed, aeroelastically-scaled, active-twist model rotor has been designed and fabricated for testing in the heavy gas test medium of the NASA Langley Transonic Dynamics Tunnel. Initial wind tunnel testing has been conducted to assess the impact of active blade twist on both fixed- and rotating-system vibratory loads in forward flight. The active twist control was found to have a pronounced effect on all system loads and was shown to generally offer reductions in fixed-system loads of 60% to 95%, depending upon flight condition, with 1.1 to 1.4 of dynamic blade twist observed. A summary of the systems developed and the vibratory loads reduction results obtained are presented in this paper.
Author
Active Control; Rotors; Aerodynamic Loads; Vibratory Loads; Piezoelectricity; Loads (Forces)

20050050929 NASA Langley Research Center, Hampton, VA, USA
Deformation Measurements of Smart Aerodynamic Surfaces
Fleming, Gary A.; Burner, Alpheus; January 2005; 11 pp.; In English; 44th Annual SPIE International Symposium on Optical Science, Engineering and Instrumentation, 18-23 Jul. 1999, Denver, CO, USA; No Copyright; Avail: CASI; A03, Hardcopy

Video Model Deformation (VMD) and Projection Moire Interferometry (PMI) were used to acquire wind tunnel model deformation measurements of the Northrop Grumman-built Smart Wing tested in the NASA Langley Transonic Dynamics Tunnel. The F18-E/F planform Smart Wing was outfitted with embedded shape memory alloys to actuate a seamless trailing edge aileron and flap, and an embedded torque tube to generate wing twist. The VMD system was used to obtain highly accurate deformation measurements at three spanwise locations along the main body of the wing, and at spanwise locations on the flap and aileron. The PMI system was used to obtain full-field wing shape and deformation measurements over the entire wing lower surface. Although less accurate than the VMD system, the PMI system revealed deformations occurring

between VMD target rows indistinguishable by VMD. This paper presents the VMD and PMI techniques and discusses their application in the Smart Wing test.
Author
Shape Memory Alloys; Aerodynamics; Deformation; Planforms; Wind Tunnel Tests; Mission Adaptive Wings; Aeroelastic Research Wings; Smart Materials; Smart Structures

20050050945 NASA Langley Research Center, Hampton, VA, USA
Design and Development of a Real-Time Model Attitude Measurement System for Hypersonic Facilities
Jones, Thomas W.; Lunsford, Charles B.; January 2005; 10 pp.; In English; 43rd AIAA Aerospace Sciences Meeting, 10-13 Jan. 2005, Reno, NV, USA
Report No.(s): AIAA Paper 2005-1411; No Copyright; Avail: CASI; A02, Hardcopy

A series of wind tunnel tests have been conducted to evaluate a multi-camera videogrammetric system designed to measure model attitude in hypersonic facilities. The technique utilizes processed video data and applies photogrammetric principles for point tracking to compute model position including pitch, roll and yaw variables. A discussion of the constraints encountered during the design, development, and testing process, including lighting, vibration, operational range and optical access is included. Initial measurement results from the NASA Langley Research Center (LaRC) 31-Inch Mach 10 tunnel are presented.
Author
Attitude (Inclination); Attitude Control; Real Time Operation; Photogrammetry; Hypersonic Speed; Yaw; Roll

20050051101 Air Force Occupational Measurement Center, Randolph AFB, TX USA
Occupational Survey Report AFSC 2A0X1A Avionics Test Station and Components (Avionics Systems, F-15)
Sanchez, Leroy; Apr. 2004; 46 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428646; No Copyright; Avail: Defense Technical Information Center (DTIC)

Presentation of findings from the Occupational Survey Report for AFSC 2A0X1A, Avionics Test Station and Components for the Avionics Systems on the F-15 Aircraft.
DTIC
Armed Forces (United States); Avionics; F-15 Aircraft; Military Personnel; Personnel; Surveys; Tasks

20050051103 Air Force Occupational Measurement Center, Randolph AFB, TX USA
Occupational Survey Report. AFSC 2A7X3, Aircraft Structural Maintenance
Pickett, Bryan; Jun. 2004; 47 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428650; No Copyright; Avail: Defense Technical Information Center (DTIC)

Presentation of findings from the Occupational Survey Report for AFSC 2A7X3, Aircraft Structural Maintenance.
DTIC
Armed Forces (United States); Maintenance; Military Personnel; Personnel; Surveys; Tasks

20050051116 Army Command and General Staff Coll., Fort Leavenworth, KS USA
Will USA Army Attack Aviation be a Relevant Combat Multiplier in Future Conflicts
Brockhard, Douglas L., Jr; Jun. 2004; 86 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428685; No Copyright; Avail: Defense Technical Information Center (DTIC)

As the U.S. Army transforms, in terms of (1) a lighter, more rapidly deployable force and (2) its doctrine, significant criticism has been cast as to the effectiveness and relevance of attack helicopters. Critics of attack aviation have raised doubts based on the performance of attack aviation during Operations Enduring Freedom and Iraqi Freedom. While it would be foolish to argue that attack aviation is the answer to every situation and is a perfect force multiplier, it by no means is irrelevant and ineffective. Based on lessons learned from both Operation Enduring Freedom and Operation Iraqi Freedom, Army attack aviation will adjust its tactics, techniques and procedures and will continue to be an effective and relevant force on the future battlefield.
DTIC
Attack Aircraft; Combat; Military Helicopters; Multipliers; United States

20050051121 Civil Aeromedical Inst., Oklahoma City, OK USA
Evaluation of a Head Injury Criteria Component Test Device
DeWeese, Richard L.; Moorcroft, David M.; Nov. 2004; 20 pp.; In English
Report No.(s): AD-A428692; DOT/FAA/AM-04/18; No Copyright; Avail: Defense Technical Information Center (DTIC)

Aircraft seats that are certified to meet the requirements of 14 CFR Parts 23.562, 25.562, 27.562 and 29.562 must protect the occupant from serious head injury as defined by the Head Injury Criterion (HIC). Currently this is demonstrated during a dynamic sled test that includes a 50% male-size test dummy, the seat, and any surrounding aircraft structure that could be impacted by the occupant's head. To reduce cost and expedite design and certification, a means of demonstrating compliance using a component-level test was desired. A project to develop a component test method was initiated by the FAA Technical Center's Materials and Structures Branch, under contract to the National Institute for Aviation Research (NAIR) at Wichita State University (WSU). This effort resulted in the development of the HIC Component Test Device (HCTD) as described in FAA report DOT/FAA/AR-02-99. The HCTD consisted of a test dummy head attached to a pivoted arm that is propelled in an arc by an air actuator. The device was transferred to CAMI in Dec. 2002 for evaluation and further development.
DTIC
Criteria; Injuries; Seats; Sleds

20050051162 Royal Military Academy, Brussels, Belgium
A Fuel Cell Propulsion System for a for a Mini-UAV
Hendrick, P.; Muzzalupo, D.; Verstraete, D.; Jul. 2004; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428755; No Copyright; Avail: Defense Technical Information Center (DTIC)

This conference paper focuses on a reconfiguration of the Dragon Eye mini unmanned air vehicle (UAV) produced by the U.S. Navy in 2001. The vehicle's wingspan is 1.14 meters, its speed 19 m/s, and it has an electric propulsion system that uses batteries. The mission specification is to modify the Dragon Eye to carry a payload of 1.0 kg with a brushless DC motor that has a proton exchange membrane fuel cell (PEMFC). This presentation describes the working principles of fuel cells, the types of fuel cells available for the mission, various designs for a mini-UAV aircraft, wing design, internal elements, internal architecture, PEMFC stack configuration, the aircraft's longitudinal stability, how it compares with the Dragon Eye, and specific characteristics of the fuel cell used in this modification. The presentation encompasses 37 briefing charts.
DTIC
Drone Vehicles; Electric Propulsion; Fuel Cells; Hydrogen Oxygen Fuel Cells; Miniaturization; Pilotless Aircraft; Propulsion

20050051200 European Aeronautics Defence and Space Co., Ulm, Germany
Micro Aerial Vehicles - An EADS Perspective
Littman, Enno; Sep. 2003; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428827; No Copyright; Avail: Defense Technical Information Center (DTIC)

Briefing charts from presentation on the development of various unmanned air vehicles by the European Aeronautic and Defence and Space Company, ISR division.
DTIC
Drone Vehicles

20050051201 Technische Hogeschool, Delft, Netherlands
Developmental History of a New Family of Subscale, Convertible, High Performance, UAVs
Barrett, Ron; Sep. 2003; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428828; No Copyright; Avail: Defense Technical Information Center (DTIC)

Briefing charts from presentation on the developmental history of a new family of subscale, convertible, high performance UAVs.
DTIC
Drone Vehicles

20050051202 Bath Univ., Bath, UK
How To Steal From Nature
Vincent, Julian; Jul. 2004; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428829; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts from presentation on adapting natural phenomena to the development of umanned aerial vehicles.
DTIC
Bioengineering; Drone Vehicles

20050051205 QinetiQ Ltd., Farnborough, UK
Micro-Aerial Vehicles Materials & Structures
Hooper, Alan; O'Keefe, Eoin; Sep. 2003; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428832; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts from presentation on the materials and structures of micro aerial vehicles (MAV).
DTIC
Drone Vehicles; Miniaturization

20050051218 North Carolina Agricultural and Technical State Univ., Greensboro, NC USA
Nondestructive Evaluation (NDE) Technology Initiative Program (NTIP). Delivery Order 0038: NDE Sensory Monitoring System for Aircraft Structure
Sundaresan, M.; Grandhi, G.; Uppaluri, S.; Kermerling, J.; Jul. 2003; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-97-D-5271-0038; Proj-4349
Report No.(s): AD-A428848; AFRL-ML-WP-RE-2004-4281; No Copyright; Avail: Defense Technical Information Center (DTIC)
The concept of a biomimetic sensor system design that can be embedded in aircraft structure is explored in this project. Signal processing techniques for quantifying the sensor responses are studied. In particular, wavelet analysis is used to extract the time frequency information about the acoustic emission (AE) signals and to separate the Lamb wave modes. The continuous sensor used in this biomimetic sensor system was used to monitor fatigue crack extensions in an aluminum plate and in a glass epoxy composite panel. The sensor was found to be sufficiently sensitive to detect fatigue crack growth rates on the order of 4 x 10(exp -6) inch/cycle. The waveforms from the mode I type crack growth showed some differences. Based on these differences, nine different AE signal types were identified and their relative frequency components were examined. Further, continuous sensor with its distributed sensing nodes was shown to be superior to traditional single node AE sensors, particularly for monitoring highly attenuated structures such as composite panels and large regions. In addition, an algorithm for locating the source of acoustic emission signals in a two-dimensional plane from the signal from a single channel continuous sensor was developed and verified through numerical simulations. As a final part of this effort, an emulator of the embedded local processor chip that is a key element in the biomimetic sensor system was developed. (22 figures, 3 refs.)
DTIC
Aircraft Structures; Biomimetics; Composite Materials; Composite Structures; Crack Propagation; Embedding; Nondestructive Tests; Panels; Sound Detecting and Ranging; Wavelet Analysis

20050051226 Purdue Univ., West Lafayette, IN USA
Active Control of Secondary Flow in Engine Inlets
Sullivan, John P.; Jan. 2002; 83 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0123
Report No.(s): AD-A428867; PURDUE-531-1282-0171; AFRL-SR-AR-TR-05-0005; No Copyright; Avail: CASI; A05, Hardcopy
As the next generation of unmanned aerial vehicles (UAV) and unmanned combat aerial vehicles (UCAV) are being developed, the need for highly compact inlet diffusers is increasing quickly. In order to design and evaluate such inlets, additional flow property measurement techniques need to be brought to bear on the situation. The use of pressure-sensitive paint (PSP) and seven-hole pressure probes on these designs will expand the knowledge and understanding of flow properties and behavior involved in highly compact inlet diffusers. The purpose of this thesis is to evaluate the use of PSP and seven-hole pressure probe in evaluating inlet diffusers.
DTIC
Active Control; Engine Inlets; Secondary Flow

20050051645 Army Missile Command, Redstone Arsenal, AL USA
Sensors for Micro Aerial Vehicles
Mann, Greg; Sep. 2003; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428825; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts from presentation of sensors and technologies developed for Micro Air Vehicles (MAV).
DTIC
Drone Vehicles

20050051715 NASA Glenn Research Center, Cleveland, OH, USA
Numerical Prediction of Chevron Nozzle Noise Reduction using Wind-MGBK Methodology
Engblom, W.A.; Bridges, J.; Khavarant, A.; January 2005; 19 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK
Contract(s)/Grant(s): NASA Order C-31035-T
Report No.(s): AIAA Paper 2004-2979; No Copyright; Avail: CASI; A03, Hardcopy
Numerical predictions for single-stream chevron nozzle flow performance and farfield noise production are presented. Reynolds Averaged Navier Stokes (RANS) solutions, produced via the WIND flow solver, are provided as input to the MGBK code for prediction of farfield noise distributions. This methodology is applied to a set of sensitivity cases involving varying degrees of chevron inward bend angle relative to the core flow, for both cold and hot exhaust conditions. The sensitivity study results illustrate the effect of increased chevron bend angle and exhaust temperature on enhancement of fine-scale mixing, initiation of core breakdown, nozzle performance, and noise reduction. Direct comparisons with experimental data, including stagnation pressure and temperature rake data, PIV turbulent kinetic energy fields, and 90 degree observer farfield microphone data are provided. Although some deficiencies in the numerical predictions are evident, the correct farfield noise spectra trends are captured by the WIND-MGBK method, including the noise reduction benefit of chevrons. Implications of these results to future chevron design efforts are addressed.
Author
Mathematical Models; Noise Reduction; Numerical Analysis; Nozzle Design; Flow Distribution; Noise Prediction (Aircraft); Aeroacoustics; Multiblock Grids

20050051760 NASA Glenn Research Center, Cleveland, OH, USA
Technologies for Turbofan Noise Reduction
Huff, Dennis; [2005]; 27 pp.; In English; 10th AIAA/CEAS Aeroacoustics Conference, 10-12 May 2004, Manchester, UK
Contract(s)/Grant(s): WBS 22-781-30-12; No Copyright; Avail: CASI; A03, Hardcopy
An overview presentation of NASA's engine noise research since 1992 is given for subsonic commercial aircraft applications. Highlights are included from the Advanced Subsonic Technology (AST) Noise Reduction Program and the Quiet Aircraft Technology (QAT) project with emphasis on engine source noise reduction. Noise reduction goals for 10 EPNdB by 207 and 20 EPNdB by 2022 are reviewed. Fan and jet noise technologies are highlighted from the AST program including higher bypass ratio propulsion, scarf inlets, forward-swept fans, swept/leaned stators, chevron nozzles, noise prediction methods, and active noise control for fans. Source diagnostic tests for fans and jets that have been completed over the past few years are presented showing how new flow measurement methods such as Particle Image Velocimetry (PIV) have played a key role in understanding turbulence, the noise generation process, and how to improve noise prediction methods. Tests focused on source decomposition have helped identify which engine components need further noise reduction. The role of Computational AeroAcoustics (CAA) for fan noise prediction is presented. Advanced noise reduction methods such as Hershel-Quincke tubes and trailing edge blowing for fan noise that are currently being pursued n the QAT program are also presented. Highlights are shown form engine validation and flight demonstrations that were done in the late 1990's with Pratt & Whitney on their PW4098 engine and Honeywell on their TFE-731-60 engine. Finally, future propulsion configurations currently being studied that show promise towards meeting NASA's long term goal of 20 dB noise reduction are shown including a Dual Fan Engine concept on a Blended Wing Body aircraft.
Author
Jet Aircraft Noise; Noise Reduction; Turbofans; Technology Utilization; Aeroacoustics

20050060617 NASA Glenn Research Center, Cleveland, OH, USA
Structural Sizing of a Horizontal Take-Off Launch Vehicle with an Air Collection and Enrichment System
McCurdy, David R.; Roche, Joseph M.; [2004]; 11 pp.; In English; 40th AIAA/ASME/SAF/ASEE Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): NAS3-00145; No Copyright; Avail: CASI; A03, Hardcopy

In support of NASA's Next Generation Launch Technology (NGLT) program, the Andrews Gryphon booster was studied. The Andrews Gryphon concept is a horizontal lift-off, two-stage-to-orbit, reusable launch vehicle that uses an air collection and enrichment system (ACES). The purpose of the ACES is to collect atmospheric oxygen during a subsonic flight loiter phase and cool it to cryogenic temperature, ultimately resulting in a reduced initial take-off weight To study the performance and size of an air-collection based booster, an initial airplane like shape was established as a baseline and modeled in a vehicle sizing code. The code, SIZER, contains a general series of volume, surface area, and fuel fraction relationships that tie engine and ACES performance with propellant requirements and volumetric constraints in order to establish vehicle closure for the given mission. A key element of system level weight optimization is the use of the SIZER program that provides rapid convergence and a great deal of flexibility for different tank architectures and material suites in order to study their impact on gross lift-off weight. This paper discusses important elements of the sizing code architecture followed by highlights of the baseline booster study.
Author
Reusable Launch Vehicles; Launching; Cryogenic Temperature; Enrichment; Propellants

20050060659 North Dakota Univ., Grand Forks, ND, USA
SiAlON Coatings of Silicon Nitride and Silicon Carbide
Nowok, J. W.; Hurley, J. P.; Kay, J. P.; Jun. 2000; 24 pp.; In English
Report No.(s): DE2004-824976; No Copyright; Avail: Department of Energy Information Bridge

The need for new engineering materials in aerospace applications and in stationary power turbine blades for high-efficiency energy-generating equipment has led to a rapid development of ceramic coatings. They can be tailored to have superior physical (high specific strength and stiffness, enhanced high-temperature performance) and chemical (high-temperature corrosion resistance in more aggressive fuel environments) properties than those of monolithic ceramic materials. Among the major chemical properties of SiAlON-Y ceramics are their good corrosion resistance against aggressive media combined with good thermal shock behavior. The good corrosion resistance results from the yttria-alumina-garnet (YAG), Al5Y3O12, formed during the corrosion process of SiAlON-Y ceramics in combustion gases at 1300 C. The interfacial chemical precipitation of the YAG phase is beneficial. This phase may crystallize in cubic and/or tetragonal modifications and if formed in SiAlON-Y ceramic may simultaneously generate residual stress. Also, this phase can contain a large number of point defects, which is a consequence of the large unit cell and complexity of the YAG structure because it has no close-packed oxygen planes. Therefore, the need exists to elucidate the corrosion mechanism of a multilayered barrier with respect to using SiAlON-YAG as a corrosion-protective coating. Stress corrosion cracking in the grain boundary of a silicon nitride (Si3N4) ceramic enriched in a glassy phase such as SiAlON can significantly affect its mechanical properties.
NTIS
Silicon Carbides; Silicon Nitrides; Ceramic Coatings; Mechanical Properties

20050060678 NASA Langley Research Center, Hampton, VA, USA
Design and Development of a Real-Time Model Attitude Measurement System for Hypersonic Facilities
Jones, Thomas W.; Lunsford, Charles B.; December 28, 2004; 10 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 12-T04-40-30
Report No.(s): AIAA Paper 2005-1411; No Copyright; Avail: CASI; A02, Hardcopy

A series of wind tunnel tests have been conducted to evaluate a multi-camera videogrammetric system designed to measure model attitude in hypersonic facilities. The technique utilizes processed video data and applies photogrammetric principles for point tracking to compute model position including pitch, roll and yaw variables. A discussion of the constraints encountered during the design, development, and testing process, including lighting, vibration, operational range and optical access is included. Initial measurement results from the NASA Langley Research Center (LaRC) 31-Inch Mach 10 tunnel are presented.
Author
Wind Tunnel Tests; Real Time Operation; Photogrammetry; Video Data; Attitude Control; Attitude (Inclination)

20050060997 NASA Dryden Flight Research Center, Edwards, CA, USA
Real-Time Stability Margin Measurements for X-38 Robustness Analysis
Bosworth, John T.; Stachowiak, Susan J.; February 10, 2005; 28 pp.; In English
Contract(s)/Grant(s): WU 953-50-00-SE-RR
Report No.(s): NASA/TP-2005-212856; H-2565; No Copyright; Avail: CASI; A03, Hardcopy

A method has been developed for real-time stability margin measurement calculations. The method relies on a tailored-forced excitation targeted to a specific frequency range. Computation of the frequency response is matched to the specific frequencies contained in the excitation. A recursive Fourier transformation is used to make the method compatible with real-time calculation. The method was incorporated into the X-38 nonlinear simulation and applied to an X-38 robustness test. X-38 stability margins were calculated for different variations in aerodynamic and mass properties over the vehicle flight trajectory. The new method showed results comparable to more traditional stability analysis techniques, and at the same time, this new method provided coverage that is more complete and increased efficiency.
Author
Real Time Operation; Robustness (Mathematics); Stability Tests; X-38 Crew Return Vehicle; Control Systems Design

20050060999 United Technologies Research Center, East Hartford, CT, USA
Large Engine Technology Program. Task 21: Rich Burn Liner for Near Term Experimental Evaluations
Hautman, D. J.; Padget, F. C.; Kwoka, D.; Siskind, K. S.; Lohmann, R. P.; January 2005; 64 pp.; In English
Contract(s)/Grant(s): NAS3-26618; WBS 22-714-09-46
Report No.(s): NASA/CR-2005-213136; E-14650; No Copyright; Avail: CASI; A04, Hardcopy

The objective of the task reported herein, which was conducted as part of the NASA sponsored Large Engine Technology program, was to define and evaluate a near-term rich-zone liner construction based on currently available materials and fabrication processes for a Rich-Quench-Lean combustor. This liner must be capable of operation at the temperatures and pressures of simulated HSCT flight conditions but only needs sufficient durability for limited duration testing in combustor rigs and demonstrator engines in the near future. This must be achieved at realistic cooling airflow rates since the approach must not compromise the emissions, performance, and operability of the test combustors, relative to the product engine goals. The effort was initiated with an analytical screening of three different liner construction concepts. These included a full cylinder metallic liner and one with multiple segments of monolithic ceramic, both of which incorporated convective cooling on the external surface using combustor airflow that bypassed the rich zone. The third approach was a metallic platelet construction with internal convective cooling. These three metal liner/jacket combinations were tested in a modified version of an existing Rich-Quench-Lean combustor rig to obtain data for heat transfer model refinement and durability verification.
Author
Combustion Chambers; Engine Design; Fabrication; Linings; Supersonic Transports; Technology Utilization

20050061002 NYMA, Inc., Brook Park, OH, USA
Two Stage Supersonic Inlet (TSSI):10-inch Model Calculations
Chapman, Dave, Technical Monitor; Smith, C. F.; Smith, G. E.; January 2005; 38 pp.; In English
Contract(s)/Grant(s): NAS3-25963; NAS3-27186; WBS 22-714-09-46
Report No.(s): NASA/CR-2005-213287; E-14734; No Copyright; Avail: CASI; A03, Hardcopy

The bifurcated inlet examined in this study (which is one of several being considered in the High Speed Research (HSR) Program) was chosen based upon paper trade studies of axisymmetric, single sided, and bifurcated inlets. For a given compression ratio and mass flow a bifurcated inlet weighs less than a single sided inlet. An axisymmetric inlet has less bleed requirements than 2D inlets but has trouble matching transonic airflow requirements without going to a variable diameter centerbody. The bifurcated inlet was selected as one of the candidates because of its ability to match airflow schedules. The inlet examined in this study, the Two Stage Supersonic Inlet (TSSI), was a candidate mixed compression bifurcated inlet. It has a novel concept to aid in inlet stability. This concept was tested in the 10x10 wind tunnel at NASA Glenn. CFD tools were used to predict and interpret the experimental results.
Author
Computational Fluid Dynamics; Supersonic Inlets; Wind Tunnel Tests; Two Dimensional Models; Branching (Mathematics)

20050061010 General Electric Aircraft Engines, Cincinnati, OH, USA
HSCT Sector Combustor Hardware Modifications for Improved Combustor Design
Greenfield, Stuart C.; Heberling, Paul V.; Moertle, George E.; January 2005; 78 pp.; In English
Contract(s)/Grant(s): NAS3-26617; WBS 22-714-09-46
Report No.(s): NASA/CR-2005-213322; E-14782; No Copyright; Avail: CASI; A05, Hardcopy

An alternative to the stepped-dome design for the lean premixed prevaporized (LPP) combustor has been developed. The new design uses the same premixer types as the stepped-dome design: integrated mixer flameholder (IMFH) tubes and a cyclone swirler pilot. The IMFH fuel system has been taken to a new level of development. Although the IMFH fuel system

design developed in this Task is not intended to be engine-like hardware, it does have certain characteristics of engine hardware, including separate fuel circuits for each of the fuel stages. The four main stage fuel circuits are integrated into a single system which can be withdrawn from the combustor as a unit. Additionally, two new types of liner cooling have been designed. The resulting lean blowout data was found to correlate well with the Lefebvre parameter. As expected, CO and unburned hydrocarbons emissions were shown to have an approximately linear relationship, even though some scatter was present in the data, and the CO versus flame temperature data showed the typical cupped shape. Finally, the NOx emissions data was shown to agree well with a previously developed correlation based on emissions data from Configuration 3 tests performed at GEAE. The design variations of the cyclone swirler pilot that were investigated in this study did not significantly change the NOx emissions from the baseline design (GEAE Configuration 3) at supersonic cruise conditions.
Author
Civil Aviation; High Speed; Premixing; Combustion Chambers; Prevaporization; Supersonic Transports; Hardware

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*.

20050041976 Toledo Univ., OH, USA
High Speed Operation and Testing of a Fault Tolerant Magnetic Bearing
DeWitt, Kenneth; Clark, Daniel; December 27, 2004; 14 pp.; In English
Contract(s)/Grant(s): NNC04AA19A; No Copyright; Avail: CASI; A03, Hardcopy

Research activities undertaken to upgrade the fault-tolerant facility, continue testing high-speed fault-tolerant operation, and assist in the commission of the high temperature (1000 degrees F) thrust magnetic bearing as described. The fault-tolerant magnetic bearing test facility was upgraded to operate to 40,000 RPM. The necessary upgrades included new state-of-the art position sensors with high frequency modulation and new power edge filtering of amplifier outputs. A comparison study of the new sensors and the previous system was done as well as a noise assessment of the sensor-to-controller signals. Also a comparison study of power edge filtering for amplifier-to-actuator signals was done; this information is valuable for all position sensing and motor actuation applications. After these facility upgrades were completed, the rig is believed to have capabilities for 40,000 RPM operation, though this has yet to be demonstrated. Other upgrades included verification and upgrading of safety shielding, and upgrading control algorithms. The rig will now also be used to demonstrate motoring capabilities and control algorithms are in the process of being created. Recently an extreme temperature thrust magnetic bearing was designed from the ground up. The thrust bearing was designed to fit within the existing high temperature facility. The retrofit began near the end of the summer, 04, and continues currently. Contract staff authored a NASA-TM entitled 'An Overview of Magnetic Bearing Technology for Gas Turbine Engines', containing a compilation of bearing data as it pertains to operation in the regime of the gas turbine engine and a presentation of how magnetic bearings can become a viable candidate for use in future engine technology.
Author
Fault Tolerance; Magnetic Bearings; High Temperature; Position Sensing

20050051908 Solar Turbines International, San Diego, CA, USA
Laser Stabilization for Near Zero NO(sub x) Gas Turbine Combustion Systems
2004; In English
Report No.(s): DE2004-825743; No Copyright; Avail: National Technical Information Service (NTIS)

Historically, the development of new industrial gas turbines has been primarily driven by the intent to achieve higher efficiency, lower operating costs and lower emissions. Higher efficiency and lower cost is obtained through higher turbine operating temperatures, while reduction in emissions is obtained by extending the lean operating limit of the combustor. However reduction in the lean stability limit of operation is limited greatly by the chemistry of the combustion process and by the occurrence of thermoacoustic instabilities. Solar Turbines, CFD Research Corporation, and Los Alamos National Laboratory have teamed to advance the technology associated with laser-assisted ignition and flame stabilization, to a level where it could be incorporated onto a gas turbine combustor.
NTIS
Lasers; Nitrogen Oxides; Gas Turbines; Combustion Chambers; Computational Fluid Dynamics

20050060688 NASA Glenn Research Center, Cleveland, OH, USA

Noise and Spreading of a Subsonic Coannular Jet - Comparison with Single Equivalent Jet

Zaman, K. B. M. Q.; Dahl, M. D.; January 2005; 12 pp.; In English; 43rd AIAA Aerospace Sciences Meeting, 10-13 Jan. 2005, Reno, NV, USA

Contract(s)/Grant(s): WBS 22-781-30-47

Report No.(s): AIAA Paper 2005-0210; No Copyright; Avail: CASI; A03, Hardcopy

The issue of scaling of noise as well as spreading of subsonic coannular jets is revisited. Far-field noise and centerline Pitot-static pressure surveys are conducted with concentric, circular nozzles having an outer-to-inner diameter ratio of 1.42. Both the inner nozzle and the outer annular passage are convergent. Outer-to-inner Mach number ratio (R) is varied over a large range from 0 to approximately 10. Results are examined on the basis of single equivalent jet parameters calculated by satisfying continuity, momentum and energy equations. The results confirm that coannular jets with normal velocity profiles are noisier than the single equivalent jet. Jets with 'inverted' velocity profiles are also found to be noisier except in a narrow R-range of 1-1.5. In the latter range, contrasting the inference in previous studies of IVP jets, the present data do not exhibit a clear noise reduction. When normalized with equivalent jet parameters the asymptotic Mach number decay rate, as well as potential core length, are found to be comparable to those of a single jet. However, an abrupt shift in the virtual origin is noted across R=1.

Author

Far Fields; Gas Jets; Jet Aircraft Noise; Noise Reduction; Annular Flow; Subsonic Flow

20050061098 Stanford Univ., Stanford, CA, USA

Integrated RAN-LES of a Realistic Gas Turbine Compressor/Combustor Assembly

Schlueter, J. U.; Wu, X.; Kim, S.; Alonso, J. J.; Pitsch, H.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 117-129; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

In the development of a gas turbine, computational fluid dynamics (CFD) is usually used to predict the flow in single components of the engine, such as the compressor, the combustor, or the turbine. the simulation of the entire flow path of a gas turbine engine using today's flow solvers is prohibited by the enormous computational costs. However, the increasing computational resources and the improved efficiency of future flow solvers puts the simulation of an entire engine within reach. In order for such a simulation to be useful in the design process, it has to deliver accurate results within a reasonable turnover time.

Derived from text

Gas Turbine Engines; Combustion Chambers; Compressors; Computational Fluid Dynamics

08
AIRCRAFT STABILITY AND CONTROL

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

20050051003 NASA Langley Research Center, Hampton, VA, USA

Free-to-Roll Investigation of Uncommanded Lateral Motions for an Aircraft with Vented Strakes

Owens, Elaine M.; Bryant, Elaine M.; Barlow, Jewel B.; January 2005; 8 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Report No.(s): AIAA Paper 2005-0239; No Copyright; Avail: CASI; A02, Hardcopy

A free-to-roll study of the low-speed lateral characteristics of the pre-production F/A-l8E was conducted in the NASA Langley 12-Foot Low-Speed Tunnel. In developmental flight tests the F/A-18E unexpectedly experienced uncommanded lateral motions in the power approach configuration. The objective of this study was to determine the feasibility of using the free-to-roll technique for the detection of uncommanded lateral motions for the pre-production F/A-l8E in the power approach configuration. The data revealed that this technique in conjunction with static data revealed insight into the cause of the lateral motions. The free-to-roll technique identified uncommanded lateral motions at the same angle-of-attack range as experienced in flight tests. The cause of the uncommanded lateral motions was unsteady asymmetric wing stall. The paper also shows that free-to-roll data or static force and moment data alone are not enough to accurately capture the potential for an aircraft to experience uncommanded lateral motion.

Author

F-18 Aircraft; Roll; Lateral Stability; Strakes

20050051580 NASA Langley Research Center, Hampton, VA, USA

Progress Towards Computational Method for Circulation Control Airfoils

Swanson, R. C.; Rumsey, C. L.; Anders, S. G.; [2005]; 27 pp.; In English; 43rd Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Report No.(s): AIAA Paper 2005-0089; Copyright; Avail: CASI; A03, Hardcopy

The compressible Reynolds-averaged Navier-Stokes equations are solved for circulation control airfoil flows. Numerical solutions are computed with both structured and unstructured grid solvers. Several turbulence models are considered, including the Spalart-Allmaras model with and without curvature corrections, the shear stress transport model of Menter, and the k-enstrophy model. Circulation control flows with jet momentum coefficients of 0.03, 0.10, and 0.226 are considered. Comparisons are made between computed and experimental pressure distributions, velocity profiles, Reynolds stress profiles, and streamline patterns. Including curvature effects yields the closest agreement with the measured data.

Author

Circulation Control Airfoils; Navier-Stokes Equation; Numerical Analysis; Momentum; Turbulence Models; Pressure Distribution

20050060669 NASA Langley Research Center, Hampton, VA, USA

Free-to-Roll Investigation of Uncommanded Lateral Motions for an Aircraft With Vented Strakes

Bryan, Elaine M.; Owens, D. Bruce; Barlow, Jewel B.; [2004]; 8 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Contract(s)/Grant(s): 23-762-45-DB

Report No.(s): AIAA Paper 2005-0239; Copyright; Avail: CASI; A02, Hardcopy

A free-to-roll study of the low-speed lateral characteristics of the pre-production F/A-18E was conducted in the NASA Langley 12-Foot Low-Speed Tunnel. In developmental flight tests the F/A-18E unexpectedly experienced uncommanded lateral motions in the power approach configuration. The objective of this study was to determine the feasibility of using the free-to-roll technique for the detection of uncommanded lateral motions for the preproduction F/A-18E in the power approach configuration. The data revealed that this technique in conjunction with static data revealed insight into the cause of the lateral motions. The free-to-roll technique identified uncommanded lateral motions at the same angle-of-attack range as experienced in flight tests. The cause of the uncommanded lateral motions was unsteady asymmetric wing stall. The paper also shows that free-to-roll data or static force and moment data alone are not enough to accurately capture the potential for an aircraft to experience uncommanded lateral motion.

Author

Roll; Strakes; Aerodynamic Configurations; F-18 Aircraft; Wind Tunnel Tests; Subsonic Wind Tunnels; Lateral Stability; Vents

09
RESEARCH AND SUPPORT FACILITIES (AIR)

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

20050041980 NASA Langley Research Center, Hampton, VA, USA

Application of Piloted Simulation to High-Angle-of-Attack Flight-Dynamics Research for Fighter Aircraft

Ogburn, Marilyn E.; Foster, John V.; Hoffler, Keith D.; AGARD FMP Symposium on Piloted Effectiveness; January 2005; Volume 29, pp. 16; In English; AGARD FMP Sysposium on Piloted Effectiveness, 14-19 Oct. 1991, Brussels, Belgium; No Copyright; Avail: CASI; A03, Hardcopy

This paper reviews the use of piloted simulation at Langley Research Center as part of the NASA High-Angle-of-Attack Technology Program (HATP), which was created to provide concepts and methods for the design of advanced fighter aircraft. A major research activity within this program is the development of the design processes required to take advantage of the benefits of advanced control concepts for high-angle-of-attack agility. Fundamental methodologies associated with the effective use of piloted simulation for this research are described, particularly those relating to the test techniques, validation of the test results, and design guideline/criteria development.

Author

Aerodynamics; Aircraft Design; Control Theory; Controllability; Fighter Aircraft; Flight Simulation

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*.

20050050862 George C. Marshall Inst., Washington, DC, USA, George C. Marshall Inst., Washington, DC, USA
New Directions in Space: A Report on the Lunar and Mars Initiatives
Seitz, Frederick; Hawkins, Willis; Jastrow, Robert; Nierenberg, William A.; [1990]; 33 pp.; In English; Copyright; Avail: Other Sources

This report focuses on one aspect of the current space program: The establishment of a manned base on the Moon and the manned exploration of Mars. These missions were announced by the President last year as a major U.S. space policy objective to be implemented under the leadership of the Vice President, acting as Chairman of the National Space Council. On March 8, 1990, the White House released Presidential guidelines for the execution of the lunar and Mars programs. The guidelines stressed the need for new approaches and the development of innovative technologies with a potential for major cost, schedule and performance improvements. They also called for a competitive environment, with several years allotted to the definition of at least two significantly different human space exploration 'reference architectures.' Selection of the final technical concepts for the mission is scheduled to occur only after the relative merits of the competing reference architectures have been evaluated.

Author

Lunar Bases; Mars Bases; Manned Mars Missions; Lunar Exploration; Mars Exploration; Governments; Policies; United States

20050050930 NASA, Washington, DC, USA
Aeronautics and Space Report of the President: Fiscal Year 2003 Activities
[2003]; 157 pp.; In English
Report No.(s): NASA/NP-2004-17-389-HQ; No Copyright; Avail: CASI; A08, Hardcopy

The National Aeronautics and Space Act of 1958 directed the annual Aeronautics and Space Report to include a comprehensive description of the programmed activities and the accomplishments of all agencies of the USA in the field of aeronautics and space activities during the preceding calendar year. In recent years, the reports have been prepared on a fiscal-year basis, consistent with the budgetary period now used in programs of the Federal Government. This year's report covers activities that took place from October 1, 2002, through September 30, 2003.

Author

Presidential Reports; United States; Aeronautics; Astronautics; Aerospace Sciences

20050051175 Office of the Under Secretary of Defense (Acquisitions and Technology), Washington, DC USA
Defense Science Board Task Force on Contributions of Space Based Radar to Missile Defense
Jun. 2004; 33 pp.; In English
Report No.(s): AD-A428771; No Copyright; Avail: Defense Technical Information Center (DTIC)

In accordance with the National Defense Authorization Act for FY 2004, the Defense Science Board (DSB) was asked to assess the potential contributions of a Space Based Radar (SBR) to missile defense. In response, the Undersecretary of Defense for Acquisition, Technology and Logistics (USD (AT&L), and the Director, Missile Defense Agency (MDA) directed that the DSB Task Force on the Contribution of a Space Based Radar to Missile Defense perform the following tasks: Assess the impact of adding a missile defense mission on the ability of SBR satellites to conduct their primary missions; Assess how different SBR architectures and technical approaches might affect the ability of the satellites to achieve their primary missions and to contribute to missile defense; Assess the value of potential SBR capabilities in the context of the family of sensors being developed by the Missile Defense Agency; and Recommend any future actions that might be desirable related to SBR contributions to missile defense.

DTIC

Defense Program; Missile Defense; Missiles; Space Based Radar

20050051939 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Teaming for Exploration

Covault, Craig; Aviation Week and Space Technology; January 2005; Volume 162, No. 5, pp. 20-22; In English; Copyright; Avail: Other Sources

A multibillion-dollar NASA contracting effort, the largest since the Apollo, shuttle, and space station developments, is formally underway with the release of the draft request for proposals for the Crew Exploration Vehicle (CEV) to replace the shuttle and eventually return astronauts to the Moon as a stepping-stone to Mars. With guidance from the draft request for proposals (RFP) now in hand, contractors are beginning a flurry of activity to posture for formal bids and to align their earlier in-house concepts with major new exploration program specifics, including strong guidelines on managing cost and risk. And Lockheed Martin will announce this week that it is teaming with EADS Space Transportation for the CEV contract. Should this team win, Europe's largest aerospace contractor would be in line for a key role in developing a replacement for the shuttle and renewed human operations on the lunar surface.

Author

NASA Space Programs; Launch Vehicles; Manned Space Flight; Contractors; Government Procurement; Aerospace Industry

20050060694 NASA, Washington, DC, USA

On a Slow Roll

Hughes, David; Aviation Week and Space Technology; January 2005; Volume 62, No. 5, pp. 39-40; In English; Copyright; Avail: Other Sources

Satellite navigation and surveillance products and services can cut costs, improve accuracy, expand coverage and enhance safety. But the global transformation of air traffic management (ATM) that satellites and ground augmentation systems have promised is being realized much more slowly than expected. 'There are still a lot of nations that could benefit [from satellite navigation and surveillance] that haven't invested dime in new equipment.' says Tim Katanik, manager of business development for navigation and landing systems Raytheon. But then things usually move slowly in this industry, he adds.

Author

Surveillance; Safety; Navigation; Costs

20050060974 NASA Langley Research Center, Hampton, VA, USA

Analysis of In-Space Assembly of Modular Systems

Moses, Robert W.; VanLaak, James; Johnson, Spencer L.; Chytka, Trina M.; Reeves, John D.; Todd, B. Keith; Moe, Rud V.; Stambolian, Damon B.; January 18, 2005; 9 pp.; In English; 1st Space Exploration Conference: Continuing the Voyage of Discovery, Jan. 30 - Feb. 1, 2005, Orlando, FL, USA

Contract(s)/Grant(s): 23-090-20-65; No Copyright; Avail: CASI; A02, Hardcopy

Early system-level life cycle assessments facilitate cost effective optimization of system architectures to enable implementation of both modularity and in-space assembly, two key Exploration Systems Research & Technology (ESR&T) Strategic Challenges. Experiences with the International Space Station (ISS) demonstrate that the absence of this rigorous analysis can result in increased cost and operational risk. An effort is underway, called Analysis of In-Space Assembly of Modular Systems, to produce an innovative analytical methodology, including an evolved analysis toolset and proven processes in a collaborative engineering environment, to support the design and evaluation of proposed concepts. The unique aspect of this work is that it will produce the toolset, techniques and initial products to analyze and compare the detailed, life cycle costs and performance of different implementations of modularity for in-space assembly. A multi-Center team consisting of experienced personnel from the Langley Research Center, Johnson Space Center, Kennedy Space Center, and the Goddard Space Flight Center has been formed to bring their resources and experience to this development. At the end of this 30-month effort, the toolset will be ready to support the Exploration Program with an integrated assessment strategy that embodies all life-cycle aspects of the mission from design and manufacturing through operations to enable early and timely selection of an optimum solution among many competing alternatives. Already there are many different designs for crewed missions to the Moon that present competing views of modularity requiring some in-space assembly. The purpose of this paper is to highlight the approach for scoring competing designs.

Author

Spacecraft Design; Design Analysis; Orbital Assembly; Spacecraft Modules

20050061110 NASA Johnson Space Center, Houston, TX, USA
Research and Technology
November 1982; 80 pp.; In English
Contract(s)/Grant(s): 953-36-00-00-72
Report No.(s): NASA/TM-58249; JSC-18671; No Copyright; Avail: CASI; A05, Hardcopy

This report is prepared on an annual basis for the purposes of highlighting the fiscal year research and technology (R&T) activities. Its intent !s to better inform the R&T Program Managers of significant accomplishments that promise practical and beneficial program application. The report is not inclusive of all R&T activities. This document will be updated in November of each year.
Author (revised)
NASA Space Programs; Research and Development; Manned Space Flight; Bioastronautics; Planetary Geology; Remote Sensing

13
ASTRODYNAMICS

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

20050042027 NASA Langley Research Center, Hampton, VA, USA
Entry Trajectory Issues for the Stardust Sample Return Capsule
Desai, Prasun N.; Mitcheltree, Robert A.; Cheatwood, F. McNeil; [1999]; 11 pp.; In English; International Symposium on Atmospheric Reentry Vehicles and Systems, 16-18 Mar. 1999, Arcachon, France; No Copyright; Avail: CASI; A03, Hardcopy

The Stardust mission was successfully launched on February 7, 1999. It will be the first mission to return samples from a comet. The sample return capsule, which is passively controlled during the fastest Earth entry ever, will land by parachute in Utah. The present study describes the analysis of the entry, descent, and landing of the returning sample capsule utilizing the final, launch configuration capsule mass properties. The effects of two aerodynamic instabilities are revealed (one in the high altitude free molecular regime and the other in the transonic/subsonic flow regime). These instabilities could lead to unacceptably large excursions in the angle-of-attack near peak heating and main parachute deployment, respectively. To reduce the excursions resulting from the high altitude instability, the entry spin rate of the capsule is increased. To stabilize the excursions from the transonic/subsonic instability, a drogue chute with deployment triggered by a gravity-switch and timer is added prior to main parachute deployment. A Monte Carlo dispersion analysis of the modified entry (from which the impact of off-nominal conditions during the entry is ascertained) predicts that the capsule attitude excursions near peak heating and drogue chute deployment are within Stardust mission limits. Additionally, the size of the resulting 3-sigma landing ellipse is 60.8 km in downrange by 19.9 km in crossrange, which is within the Utah Test and Training Range boundaries.
Author
Atmospheric Entry; Angle of Attack; Monte Carlo Method; Stardust Mission; Atmospheric Entry Simulation; Aeromaneuvering; Aerodynamic Heating

20050050931 NASA Langley Research Center, Hampton, VA, USA
Entry Dispersion Analysis for the Genesis Sample Return Capsule
Desai, Prasun N.; Cheatwood, F. McNeil; January 2005; 19 pp.; In English; AAS/AIAA Astrodynamics Specialists Conference, 16-19 Aug. 1999, Girdwood, AK, USA
Report No.(s): Paper AAS 99-469; No Copyright; Avail: CASI; A03, Hardcopy

Genesis will be the first mission to return samples from beyond the Earth-Moon system. The spacecraft will be inserted into a halo orbit about the L1 (Sun-Earth) libration point where it will remain for two years collecting solar wind particles. Upon Earth return, the sample return capsule, which is passively controlled, will descend under parachute to Utah. The present study describes the analysis of the entry, descent, and landing scenario of the returning sample capsule. The robustness of the entry sequence is assessed through a Monte Carlo dispersion analysis where the impact of off-nominal conditions is ascertained. The dispersion results indicate that the capsule attitude excursions near peak heating and drogue chute deployment are within Genesis mission limits. Additionally, the size of the resulting 3-sigma landing ellipse is 47.8 km in downrange by 15.2 km in crossrange, which is within the Utah Test and Training Range boundaries.
Author
Genesis Mission; Reentry Physics; Spacecraft Reentry; Hypersonic Reentry

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

20050041815 Mississippi Space Services, Bay Saint Louis, MS, USA
NASA Fire Protection
Clark, Theodore; May 08, 2001; 13 pp.; In English; NASA Fire Protection Coordinates Conference, 16-18 May 2001, Pasadena, MD, USA
Contract(s)/Grant(s): NAS13-99030
Report No.(s): SE-2001-04-00016; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides information on fire protection operations and administration at Stennis Space Center (SSC). The presentation also lists innovative practices and recent improvements.
CASI
Research Facilities; Test Facilities; Fire Prevention

20050041816 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Facility Activation and Characterization for IPD Turbopump Testing at NASA Stennis Space Center
Sass, J. P.; Pace, J. S.; Raines, N. G.; Meredith, T. O.; Taylor, S. A.; Ryan, H. M.; October 15, 2005; 1 pp.; In English
Report No.(s): SSTI-8080-0004; No Copyright; Avail: Other Sources; Abstract Only

The Integrated Powerhead Demonstrator (IPD) is a 250K lbf (1.1 MN) thrust cryogenic hydrogen/oxygen engine technology demonstrator that utilizes a full flow staged combustion engine cycle. The Integrated Powerhead Demonstrator (IPD) is, in part, supported by NASA. IPD is also supported through the Department of Defense's Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program, which seeks to increase the performance and capability of today's state-of-the-art rocket propulsion systems while decreasing costs associated with military and commercial access to space. The primary industry participants include Boeing-Rocketdyne and GenCorp Aerojet. The IPD Program recently achieved two major milestones. The first was the successful completion of the IPD Oxidizer Turbopump (OTP) hot-fire test project at the NASA John C. Stennis Space Center (SSC) E-1 test facility in June 2003. A total of nine IPD Workhorse Preburner tests were completed, and subsequently 12 IPD OTP hot-fire tests were completed. The second major milestone was the successful completion of the IPD Fuel Turbopump (FTP) cold-flow test project at the NASA SSC E-1 test facility in November 2003. A total of six IPD FTP cold-flow tests were completed. The next phase of development involves IPD integrated engine system testing also at the NASA SSC E-1 test facility scheduled to begin in early 2005. Following and overview of the NASA SSC E-1 test facility, this paper addresses the facility aspects pertaining to the activation and testing of the IPD oxidizer and fuel turbopumps. In addition, some of the facility challenges encountered and the lessons learned during the test projects shall be detailed.
Author
Test Facilities; Hydrogen Oxygen Engines; Turbine Pumps

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*.

20050051059 Stanford Univ., Stanford, CA USA
Smart Memory Systems: Polymorphous Computing Architectures
Horowitz, Mark; Aug. 2004; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F29601-00-2-0085; Proj-DARP
Report No.(s): AD-A428584; AFRL-VS-PS-TR-2004-1180; No Copyright; Avail: Defense Technical Information Center (DTIC)

We describe a new universal computing element for future embedded applications. Our polymorphic architecture contains course-grain reconfigurable processors, memory, and network. Each application is compiled into a set of programs for the nodes, and a set of configuration files for the chip. These configuration files optimize the chip for the kinds of tasks that the

application demands, creating efficient SIMD engines for the stream-oriented portions of applications and efficient thread machines for the control-intensive portions. To efficiently program our polymorphic architecture, we created a number of abstract machine models that efficiently implement different models of computation and then created a set of virtual machine simulators to allow software development before the hardware was present. These virtual machine interfaces also allow an embedded system to evolve as new hardware or software components are added since they represent a stable, parameterized abstract interface between the hardware and the software.
DTIC
Architecture (Computers); Computer Storage Devices; Memory (Computers); Polymorphism

20050051250 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Stuttgart, Germany
Laser Ablation of Metal Doped Polymers with CO2 Laser
Schall, Wolfgang O.; Eckel, Hans-Albert; Tegel, Jochen; Waiblinger, Frank; Walther, Sebastian; Jul. 2004; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8655-03-1-3061
Report No.(s): AD-A428898; No Copyright; Avail: Defense Technical Information Center (DTIC)

Conclusions: 1) Goals for I sub s = 800 s not met; 2) In air: accelerated air fraction unknown; all related values are wrong; 3) In vacuum: deposited energy goes up with increasing metal fraction, but coupling coefficient decreases; 4) Strong evidence for large energy loss in a decoupled laser absorption wave; 5) Nature and characteristics of absorption wave need investigation; 6) Can shorter pulse lengths help prevent decoupling?
DTIC
Ablation; Additives; Carbon Dioxide Lasers; Doped Crystals; Laser Ablation

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20050050963 Naval Research Lab., Washington, DC, USA
Two-way Satellite Time Transfer Applications with the Eastern Range
Galysh, I.; Koch, D.; Beard, R.; Reid, W.; Buisson, J.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 341-353; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

The Eastern Range at Cape Canaveral, as part of the Range Modernization program, is incorporating Two-Way Satellite Time Transfer (TWSTT) systems into their stations. A detailed study of the mechanization of TWSTT into their systems had been performed and an experiment into different satellite links has been reported before. A design implementation has been completed. Acceptance testing was successfully performed at the Naval Research Laboratory (NRL), including over-the-air testing prior to the first installation at the Range Operation Control Center (ROCC), Cape Canaveral. The first phase of ROCC installation was completed in July 1998. The results of acceptance testing at NRL indicated a sub-nanosecond time transfer capability. Data from those tests will be presented and discussed. Installation test data from the initial phase will be presented. Calibration of these units for absolute time comparison was difficult, but will support a nanosecond-level capability. The calibration methods and results will be described.
Author
Acceptability; Communication Satellites; Flight Tests; Satellite Networks; Time

20050050964 Bureau International des Poids et Mesures, Sevres, France
Two-way Satellite Time Transfer Using Intelsat 706 on a Regular Basis: Status and Data Evaluation
Azoubib, J.; Kirchner, D.; Lewandowski, W.; Hetzel, P.; Klepczynski, W. J.; Matsakis, D.; Parker, T.; Ressler, H.; Soering, A.; deJong, G., et al.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 393-404; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

TWSTT (Two-Way Satellite Time Transfer) observations in Europe and between Europe and the USA resumed on 20 January 1997, using the INTELSAT 706 satellite on a regular basis. Six European and two US stations observe regularly. Two other European stations are about to become operational. The paper first describes the activities of the CCTF (Consultative Committee for Time and Frequency) Working Group on TWSTT. The use of INTELSAT 706 satellite and status of

participating stations is then discussed together with related data. Evaluation of the TWSTT data reported in this paper includes its comparison with GPS common-view time transfer data for selected continental and intercontinental links over a period of one-and-a-half years.
Author
Global Positioning System; Intelsat Satellites; Satellite Observation

20050050970 ITT Industries, Inc., Clifton, NJ, USA
Analysis of On-Orbit Behavior of GPS Block II-R Time Keeping System
Dass, Todd; Petzinger, John; Rajan, John; Rawicz, Harris; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 173-186; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents three phases of the Time Keeping System analysis (TKS) of the first on-orbit GPS IIR Satellite, SVN 43. The first phase is a comparison of the performance of the SVN 43 Rubidium Atomic Frequency Standard (RAFS) to other GPS satellite clocks. The results indicate that the SVN 43 RAFS is performing better than specification and ranks highly when compared to the other clocks in the constellation. The second phase was to analyze all available data to determine the causes of several transients seen in the SVN 43 TKS. This led to a concentration on the RAFS and associated inputs and outputs, as well as the utilization of TKS simulation tools. The third phase was to examine the entire system to determine how to improve our visibility into the TKS operation. This led to an SV software enhancement whose purpose is to buffer TKS related data in SV memory for subsequent dump and analysis. An example will be presented showing the value of this new TKS buffer capability in the investigation of some TKS events that occurred in August 1998.
Author
Time Measurement; Atomic Clocks; Rubidium; Systems Analysis; Global Positioning System; Software Engineering; Navigation Satellites

20050050971 Russian Inst. of Radionavigation and Time, Saint Petersburg, Russia
Results of RIRT's Comparisons via GLONASS Signals
Bogdanov, Pyotr P.; Gevorkyan, Arvid G.; Zholnerov, Vadim S.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 211-217; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

At present using the signals of satellite navigation system for comparisons of remote clocks in common-view mode is the most popular and precise method. But its practical realization in Russia via GLONASS signals was suspended for many years due to lack of automated receiving system. This paper describes the experimental operation of automated system for receiving of GLONASS signals in the Russian Institute of Radionavigation and Time, St.Petersburg. The results of the time scale comparisons are presented for the period from the beginning of 1996 to the end of 1998.
Author
Russian Federation; Radio Navigation; Satellite Navigation Systems; GLONASS

20050050983 Technical Univ. of Austria, Graz, Austria
Calibration of Three European TWSTFT Stations Using a Portable Station and Comparison of TWSTFT and GPS Common-View Measurement Results
Kirchner, D.; Ressler, H.; Hetzel, P.; Soering, A.; Lewandowski, W.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 365-376; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

After a brief introduction and description of the portable station and a discussion of different approaches to use it for station calibration, the calibration trip is described and the results are presented. The calibrated TWSTFT measurements are compared with the GPS measurements calibrated by a GPS receiver trip carried out at the same time as the TWSTFT calibration and by previous GPS receiver trips. The findings are discussed and some envisaged activities using the portable station are mentioned.
Author
Global Positioning System; Calibrating

20050050984 Space Operations Squadron (2nd), Schriever AFB, CO, USA
1998 GPS Time Transfer Performance
Huser, Stacy Jo; Hutsell, Steven T.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 125-134; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

Every year more and more government and civilian agencies rely on GPS for accurate timing and navigation. The GPS Operational Control Segment, using information provided by the USA Naval Observatory, maintains the GPS timing signal well within specifications. This paper summarizes 1998 GPS Time Transfer performance for authorized users and relates the results to the mechanics of the GPS time steering algorithm. Data from previous years will also be presented as a means of comparison.
Author
Global Positioning System; Time Signals; Navigation; Timing Devices

20050050985 Natural Resources Canada, Canada
Real-Time GPS Monitoring of Atomic Frequency Standards in the Canadian Active Control System (CACS)
Lahaye, F.; Caissy, M.; Popelar, J.; Douglas, R. J.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 187-199; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

Ten Real-Time Active Control Points (RTACP) across Canada continuously monitor all GPS satellites in view and generate wide area UPS corrections with an update rate of 2 s. Dual frequency high precision geodetic GPS receivers using free running atomic frequency standards (masers, Cs and Rb) provide pseudorange and phase measurements at 1 s intervals. Ionosphere-free, carrier-phase-filtered pseudorange data are combined with rapid GPS satellite orbit predictions and RTACP coordinates in a least-squares adjustment to determine satellite and station clock offsets with respect to a virtual reference clock (VRC). The VRC is maintained as a weighted mean of RTACP long-term clock models. The VRC is related to the mean GPS system time using a long-term linear clock model with correlation time of a few days and it is traceable to UTC (NRC). This approach mitigates the effects of instabilities of individual RTACP clocks, eliminates clock discontinuities, and provides VRC stability better than 10(exp -14) for time intervals greater than 1 day. The system provides continuous RTACP clock synchronization with RMS residuals in the range of 0.1-0.5 ns and real-time GPS satellite clock corrections with RMS residuals in the range of 0.3-0.8 ns. The quality of the real-time results are presented and discussed.
Author
Global Positioning System; Atomic Clocks; Canada; Navigation Satellites; Real Time Operation; Receivers; Active Control

20050050988 Communications Research Lab., Koganei, Japan
Two-way Satellite Time Transfer Activities in Asian-Pacific Region
Imae, Michito; Hosokawa, Mizuhiko; Imamura, Kuniyasu; Yukawa, Hirotaka; Shibuya, Yasuhisa; Fisk, Peter T. H.; Quigg, Steve; Lawn, Malcolm A.; Thorn, John S.; Wouters, Michael J., et al.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 355-363; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

Two-Way Satellite Time Transfer (TWSTT) is one of the most precise time transfer techniques, and time transfer using this method has been used between European and North American Time and Frequency laboratories on a regular bases. In the Asia-Pacific Region four Time and Frequency laboratories have been involved in establishing a precise time transfer network using the TWSTT technique. After several continuous 24-hour TWSTT experiments between Communications Research Laboratory(CRL) in Japan and National Measurement Laboratory(NML) in Australia, a regular, twice weekly TWSTT link has been established since April 1998 using a Ku-band transponder on INTELSAT satellite 702 located at 177 deg. E. CRL and Shaanxi Astronomical Observatory of Chinese Academy of Sdence(CSAO) have just established a precise time transfer link using the TWSTT technique from October, 1998. For this time transfer link we are using a Ku-band transponder on the JCSAT-3 satellite, which is owned by Japanese satellite communication company and is located at 128 deg. E. National Research Laboratory of Metrology(NRLM) in Japan is also planning to join the TWSTT link network with a link to CRL also using JCSAT-3 from March1999. For the next step toward a global TWSTT network we are planning to connect the Asia-Pacific TWSTT link to European and North American time and frequency laboratories. Such a network of precise time transfer links will not only by itself be useful in contributing to TAI and UTC but also provide an accurate time transfer reference for other precise time transfer techniques such as the GPS carrier phase method.
Author
Satellite Communication; Time Signals; Transponders

20050050995 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Frequency Transfer and Cleanup System for Ultra-High Stability at Both Long and Short Times for the Cassini Ka-Band Experiment
Calhoun, M. D.; Dick, G. J.; Wang, R. T.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 405-412; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

New radio science experiments, including a gravitational wave search and several atmospheric occultation studies, are planned for the Cassini Ka-band experiment. These experiments are made possible by reduced solar-induced phase fluctuations at the high-frequency (32 GHZ) of the radio link between the earth and the spacecraft. In order to match the improved link performance, a significant upgrade is under way to improve the frequency stability capabilities of NASA's Deep Space Network (DSN). Significant improvements are being undertaken in many areas, including antenna vibration and (wet) tropospheric calibration, in addition to frequency generation and distribution. We describe here the design and development of a system to provide a reference signal with the highest possible frequency stability for both long-term, short-term, and phase noise, at an antenna (DSS 25) that is remote from the frequency standards room at SPC-10 at the Goldstone site. The new technologies were developed in order to meet the very tight requirements. They are: 1) a Stabilized Fiber-Optic Distribution Assembly (SFODA) that includes active compensation of thermal variations to transfer long-term stability over 16 km of ordinary fiber-optic cable, and 2) a Compensated Sapphire Oscillator (CSO) that provides short-term performance in a cryocooled sapphire oscillator with ultra-high short-term stability and low phase noise.
Author
Cassini Mission; Frequency Stability; Extremely High Frequencies; Space Communication; Deep Space Network

20050051001 Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin, Italy
Short-Term Characterizations of GPS-Disciplined Oscillators and Field Trial for Frequency of Italian Calibration Centers
Pettiti, V.; Cordara, F.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 161-171; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

Quartz and rubidium oscillators disciplined by the signals of the Global Positioning System satellites (GPSDOs) are increasingly used as reference standards in calibration centers and in telecommunication networks, thanks to their cesium-like long-term instability, and several investigations are undergoing in the metrological laboratories of different countries concerning their use for the traceability to the national standards of time. Some of these devices were in the past at the Tune and Frequency Laboratory of IEN, as regards to their use as frequency and time references in secondary laboratories and their traceability to the Italian standard of time. In further investigations performed, evidence was found of short-term frequency instabilities, not previously detected, mainly due to temperature effects and to the disciplining algorithms used, that must be taken into account especially in the frequency calibration field. The long and short-term instability results obtained at IEN on some GPSDOs, that show the real uncertainty limits in calibration, are reported in this paper. They are also checked by means of a field-trial on frequency, carried on among some Italian Calibration centers equipped with GPSDOs or other frequency references, using either a free rubidium or a quartz oscillator as travelling standards.
Author
Global Positioning System; Quartz; Rubidium; Standards; Time Measurement; Cesium; Calibrating

20050061035 Massachusetts Inst. of Tech., Cambridge, MA, USA
ORION-II: A True Formation Flying Mission in LEO
How, Jonathan P.; May 25, 2004; 135 pp.; In English
Contract(s)/Grant(s): NCC5-704; Copyright; Avail: CASI; A07, Hardcopy

The final report for the Orion-II project is taken from Chapter 5 of 'CDGPS-Based Relative Navigation for Multiple Spacecraft,' a thesis by Megan Mitchell submitted to the MIT Department of Aeronautics and Astronautics, June 2004. This chapter begins with a comparison of the simulation architecture for the original and current simulation setups. Next, the changes made to the individual components of the navigation system are described. Finally, tests performed with a Spirent Simulator at NASA Goddard Space Flight Center (GSFC) are discussed. In addition to the development of the testbed components described, a new clean room facility was developed in the Orion Laboratory at MIT.
Author (revised)
Formation Flying; Space Navigation; Global Positioning System; Space Communication; Feedback Control; Systems Simulation

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

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

20050041967 Hersh Walker Acoustics, Westlake Village, CA, USA

Two-Dimensional Air-Flow Tests of the Effect of ITA Flowliner Slot Modification by Grinding/Polishing on Edge Tone Generation Potential

Sutliff, Daniel L., Technical Monitor; Walker, Bruce E.; December 2004; 48 pp.; In English

Contract(s)/Grant(s): NASA Order S-40405; WBS 22-104-08-41

Report No.(s): NASA/CR-2004-213405; E-14915; No Copyright; Avail: CASI; A03, Hardcopy

Hersh Walker Acoustics (HWA) has performed a series of wind tunnel tests to support crack-repair studies for ITA flowliner vent slots. The overall goal of these tests is to determine if slot shape details have a significant influence on the propensity of the flowliner to produce aero-acoustic oscillations that could increase unsteady stresses on the flowliner walls. The test series, conducted using a full-scale two-dimensional model of a six-slot segment of the 38 slot liner, was intended to investigate the effects of altering slot shape by grinding away cracked portions.

Author

Aeroacoustics; Air Flow; Polishing; Slots; Wind Tunnel Tests; Grinding; Two Dimensional Models; Space Shuttle Main Engine; Rocket Linings

20050060761 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Entry, Descent, and Landing Operations Analysis for the Genesis Re-Entry Capsule

Desai, Prasun N.; Lyons, Dan T.; January 20, 2005; 14 pp.; In English; 15th AAS/AIAA Space Flight Mechanics Conference, 23-27 Jan. 2005, Copper Mountain, CO, USA

Report No.(s): AAS-05-121; No Copyright; Avail: CASI; A03, Hardcopy

On September 8, 2004, the Genesis spacecraft returned to Earth after spending 29 months about the sun-Earth libration point collecting solar wind particles. Four hours prior to Earth arrival, the entry capsule containing the samples was released for entry and subsequent landing at the Utah Test and Training Range. This paper provides an overview of the entry, descent, and landing trajectory analysis that was performed during the Mission Operations Phase leading up to final approach to Earth. The operations effort accurately delivered the entry capsule to the desired landing site. The final landing location was 8.3 km from the target, and was well within the allowable landing area. Preliminary reconstruction analyses indicate that the actual entry trajectory was very close to the pre-entry prediction.

Author

Descent Trajectories; Trajectory Analysis; Landing Sites; Reentry Trajectories; Reentry Vehicles; Atmospheric Entry

20050061014 Massachusetts Inst. of Tech., Cambridge, MA, USA

CDGPS-Based Relative Navigation for Multiple Spacecraft

Mitchell, Megan Leigh; June 2004; 134 pp.; In English

Contract(s)/Grant(s): NCC5-704; Copyright; Avail: CASI; A07, Hardcopy

This thesis investigates the use of Carrier-phase Differential GPS (CDGPS) in relative navigation filters for formation flying spacecraft. This work analyzes the relationship between the Extended Kalman Filter (EKF) design parameters and the resulting estimation accuracies, and in particular, the effect of the process and measurement noises on the semimajor axis error. This analysis clearly demonstrates that CDGPS-based relative navigation Kalman filters yield good estimation performance without satisfying the strong correlation property that previous work had associated with 'good' navigation filters. Several examples are presented to show that the Kalman filter can be forced to create solutions with stronger correlations, but these always result in larger semimajor axis errors. These linear and nonlinear simulations also demonstrated the crucial role of the process noise in determining the semimajor axis knowledge. More sophisticated nonlinear models were included to reduce the propagation error in the estimator, but for long time steps and large separations, the EKF, which only uses a linearized covariance propagation, yielded very poor performance. In contrast, the CDGPS-based Unscented Kalman relative navigation Filter (UKF) handled the dynamic and measurement nonlinearities much better and yielded far superior performance than the EKF. The UKF produced good estimates for scenarios with long baselines and time steps for which the EKF would diverge rapidly. A hardware-in-the-loop testbed that is compatible with the Spirent Simulator at NASA GSFC was developed to

provide a very flexible and robust capability for demonstrating CDGPS technologies in closed-loop. This extended previous work to implement the decentralized relative navigation algorithms in real time.
Author
Global Positioning System; Navigation; Kalman Filters; Feedback Control; Formation Flying

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20050050982 Nippon Electric Co. Ltd., Tokyo, Japan
The Role of Time and Frequency in the MTSAT Satellite-Based Augmentation System (MSAS)
Ishita, Toru; Nii, Aileen S.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 459-468; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

The MTSAT Satellite-based Augmentation System (MSAS) is a satellite-based augmentation system (SBAS) for navigation. The MSAS is one of several applications that shares the use of the Multifunctional Transport Satellite (MTSAT), a geostationary earth orbiting (GEO) satellite, which will be launched by the Japanese Ministry of Transport in August 1999. The MSAS design is based on the development of the US Wide Area Augmentation System (WAAS) and therefore may be familiar to those who are acquainted with the WAAS Time and frequency play a critical role in four areas within MSAS, and these areas are the focus of this paper. Firstly, MSAS performs several functions. One - it collects data from the NAVSTAR Global Positioning System (GPS); two - it provides an independent ranging signal from MTSAT to supplement the navigation signals from the GPS constellation; three - it provides differential corrections to improve the navigation capability of the GPS; four - it provides the offset of MSAS Network Time (MNT) from Coordinated Universal Time (UTC); and five - it provides system integrity information to the user. With these functions, the MSAS can become the primary means of time distribution and synchronization within Japan and other areas under the footprint of the MTSAT. The accuracy and precision attainable by MSAS is critically dependent on the performance of the time and frequency subsystems in the four areas of discussion. Derived from text
Time Dependence; Frequencies; Transport Vehicles; Artificial Satellites; Augmentation

20050050989 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, Germany
On the Problems of System Time Generation for a Future GNSS2
Hahn, J. H.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 445-457; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

For any satellite navigation system clock synchronization to a system common time is a requirement of utmost importance. There are some features, being of particular interest, which are studied here. For clock comparisons one- and two-way methods can be applied. In the present conventional systems GPS & GLONASS systems, only the first method is actively in use. Improvements in several areas are expected in scenarios applying two-way and inter-satellite-links (ISL). For generation of the system time scale (STS) with one or some chosen types of clocks the ensemble solution is the most stable and reliable. There are several and sometimes different constraints for the realization of a STS for navigation or timing users. In this paper we discuss the impact of clock comparison measures and of STS generation peculiarities on the development of a 2nd generation Global Navigation Satellite System (GNSS2). We give simulation results of a STS and induced navigation/timing user clock error in a possible GNSS2 scenario, defined by (Case 1) 15 Inclined Geosynchronous Satellites (IGSO) equipped with a RAFS (space Rb) each + 3 Geostationary Satellites (GEO) equipped with an H-Maser, and 4 ground stations operating with a Cs-frequency standard, where both inter.satellite and two-way links are adopted. It will be shown that for the navigation user the error contribution due to the clocks can reach a value of about 0.7 ns (1 sigma), with an update interval of 30 rain in this particular scenario. Satellite constellations equipped with H-Maser give better results. For time dissemination purposes, the UTC steering policy will be addressed and an error 445 reaching 27 ns (1 sigma) is expected in the above scenario. Finally we also investigated a constellation using Ultra Stable Quartz Oscillators on-board the satellites

(Case 2). We show that such a configuration could also satisfy the needs of navigation/timing users.
Author
Navigation Satellites; Communication Satellites; Time Measurement; Satellite Navigation Systems; Global Positioning System; GLONASS; Synchronism

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SPACECRAFT PROPULSION AND POWER

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

20050041919 NASA Glenn Research Center, Cleveland, OH, USA
Electric Propulsion Technology Development for the Jupiter Icy Moons Orbiter Project
December 2004; 26 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2001, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): WBS 22-982-10-03
Report No.(s): NASA/TM-2004-213290; Paper AIAA 2004-3449; E-14737; No Copyright; Avail: CASI; A03, Hardcopy

During 2004, the Jupiter Icy Moons Orbiter project, a part of NASA's Project Prometheus, continued efforts to develop electric propulsion technologies. These technologies addressed the challenges of propelling a spacecraft to several moons of Jupiter. Specific challenges include high power, high specific impulse, long lived ion thrusters, high power/high voltage power processors, accurate feed systems, and large propellant storage systems. Critical component work included high voltage insulators and isolators as well as ensuring that the thruster materials and components could operate in the substantial Jupiter radiation environment. A review of these developments along with future plans is discussed.
Author
Electric Propulsion; Jupiter Project; Jupiter Satellites; Technology Utilization; NASA Space Programs

20050041950 NASA Glenn Research Center, Cleveland, OH, USA
Reliability Assessment Approach for Stirling Convertors and Generators
Shah, Ashwin R.; Schreiber, Jeffrey G.; Zampino, Edward; Best, Timothy; December 2004; 18 pp.; In English; Space Technology and Applications International Forum (STAIF-2003), 2-5 Feb. 2003, Albuquerque, NM, USA
Contract(s)/Grant(s): WBS 972-20-01
Report No.(s): NASA/TM-2004-213078; E-14554; No Copyright; Avail: CASI; A03, Hardcopy

Stirling power conversion is being considered for use in a Radioisotope Power System for deep-space science missions because it offers a multifold increase in the conversion efficiency of heat to electric power. Quantifying the reliability of a Radioisotope Power System that utilizes Stirling power conversion technology is important in developing and demonstrating the capability for long-term success. A description of the Stirling power convertor is provided, along with a discussion about some of the key components. Ongoing efforts to understand component life, design variables at the component and system levels, related sources, and the nature of uncertainties is discussed. The requirement for reliability also is discussed, and some of the critical areas of concern are identified. A section on the objectives of the performance model development and a computation of reliability is included to highlight the goals of this effort. Also, a viable physics-based reliability plan to model the design-level variable uncertainties at the component and system levels is outlined, and potential benefits are elucidated. The plan involves the interaction of different disciplines, maintaining the physical and probabilistic correlations at all the levels, and a verification process based on rational short-term tests. In addition, both top-down and bottom-up coherency were maintained to follow the physics-based design process and mission requirements. The outlined reliability assessment approach provides guidelines to improve the design and identifies governing variables to achieve high reliability in the Stirling Radioisotope Generator design.
Author
Reliability Analysis; Converters; Stirling Engines; Radioisotope Heat Sources; Generators; Systems Engineering

20050051582 International Space Univ., Inc., Arlington, VA, USA
Support for ISU's 2003 Summer Session Program and the Theme Day on 'Upcoming Technologies for Space'
Finarelli, Margaret G.; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NNG04GB28G; No Copyright; Avail: CASI; A01, Hardcopy

Electric propulsion, whether powered by solar generators or by nuclear reactors, offers a valuable solution to the problems posed by chemical in-space propulsion. It maybe argued that solar electric propulsion is more applicable to near-Earth missions or to missions to the nearer planets, whereas nuclear electric propulsion remains operational even in the vicinity of the far outer planets. Taking into account considerations such as cost and safety it can be concluded that both types of electric propulsion are complementary having their specific niches of application. A third technology based on non-chemical sources for high efficiency propulsion is solar thermal propulsion, which may find its own specific niche in near-Earth missions or missions to the inner planets.
Derived from text
Electric Propulsion; Nuclear Electric Propulsion; Chemical Propulsion; Solar Generators; Nuclear Reactors

20050051953 NASA Glenn Research Center, Cleveland, OH, USA
High Temperature Materials Needs in NASA's Advanced Space Propulsion Programs
Eckel, Andrew J.; Glass, David E.; January 2005; 52 pp.; In English; Westec Exposition, 22-25 Mar. 2004, Los Angeles, CA, USA
Contract(s)/Grant(s): 794-20-65; No Copyright; Avail: CASI; A04, Hardcopy

In recent years, NASA has embarked on several new and exciting efforts in the exploration and use of space. The successful accomplishment of many planned missions and projects is dependent upon the development and deployment of previously unproven propulsion systems. Key to many of the propulsion systems is the use of emergent materials systems, particularly high temperature structural composites. A review of the general missions and benefits of utilizing high temperature materials will be presented. The design parameters and operating conditions will be presented for both specific missions/vehicles and classes of components. Key technical challenges and opportunities are identified along with suggested paths for addressing them.
Author
Space Exploration; High Temperature; Space Programs; Propulsion System Configurations; Propulsion System Performance; Refractory Materials

20050060622 NASA Glenn Research Center, Cleveland, OH, USA
Effect of Random Thermal Spikes on Stirling Convertor Heater Head Reliability
Shah, Ashwin R.; Korovaichuk, Igor; Halford, Gary R.; [2004]; 18 pp.; In English; International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): 972-20-01
Report No.(s): E-14918; Copyright; Avail: CASI; A03, Hardcopy

Onboard radioisotope power systems being developed to support future NASA exploration missions require reliable design lifetimes of up to 14 yr and beyond. The structurally critical heater head of the high-efficiency developmental Stirling power converter has undergone extensive computational analysis of operating temperatures (up to 650 C), stresses, and creep resistance of the thin-walled Inconel 718 bill of material. Additionally assessment of the effect of uncertainties in the creep behavior of the thin-walled heater head, the variation in the manufactured thickness, variation in control temperature, and variation in pressure on the durability and reliability were performed. However, it is possible for the heater head to experience rare incidences of random temperature spikes (excursions) of short duration. These incidences could occur randomly with random magnitude and duration during the desired mission life. These rare incidences could affect the creep strain rate and therefore the life. The paper accounts for these uncertainties and includes the effect of such rare incidences, random in nature, on the reliability. The sensitivities of variables affecting the reliability are quantified and guidelines developed to improve the reliability are outlined. Furthermore, the quantified reliability is being verified with test data from the accelerated benchmark tests being conducted at the NASA Glenn Research Center.
Author
Operating Temperature; Temperature Gradients; Temperature Effects; Component Reliability; Spacecraft Power Supplies; Radioactive Isotopes; Stirling Cycle

20050060623 NASA Glenn Research Center, Cleveland, OH, USA
Low Temperature Life-Cycle Testing of a Lithium-Ion Battery for Low-Earth-Orbiting Spacecraft
Reid, Concha; September 20, 2004; 12 pp.; In English; NASA Aerospace Battery Workshop, 16-18 Nov. 2004, Huntsville, AL, USA
Contract(s)/Grant(s): 22-319-20-L1
Report No.(s): E-14936; No Copyright; Avail: CASI; A03, Hardcopy

A flight-qualified, lithium-ion (Li-ion) battery developed for the Mars Surveyor Program 2001 lander is undergoing life-testing at low temperature under a low-Earth-orbit (LEO) profile to assess its capability to provide long term energy storage for aerospace missions. NASA has embarked upon an ambitious course to return humans to the moon by 2015-2020 in preparation for robotic and human exploration of Mars and robotic exploration of the moons of outer planets. Li-ion batteries are excellent candidates to provide power and energy storage for multiple aspects of these missions due to their low specific energy, low energy density, and excellent low temperature performance. Laboratory testing of Li-ion technology is necessary in order to assess lifetime, characterize multi-cell battery-level performance under aerospace conditions, and to gauge safety aspects of the technology. Life-cycle testing provides an opportunity to examine battery-level performance and the dynamics of individual cells in the stack over the entire life of the battery. Data generated through this testing will be critical to establish confidence in the technology for its widespread use in manned and unmanned mission. This paper discusses the performance of the 28 volt, 25 ampere-hour battery through 6000 LEO cycles, which corresponds to one year on LEO orbit. Testing is being performed at 0 C and 40% depth-of-discharge. Individual cell behaviors and their effect on the performance of the battery are described. Capacity, impedance, energy efficiency and end-of-discharge voltage at 1000 cycle intervals are reported. Results from this life-testing will help contribute to the database on battery-level performance of aerospace Li-ion batteries and low temperature cycling under LEO conditions.
Author
Low Earth Orbits; Mars Surveyor 2001 Mission; Surveyor Project; Low Temperature; Metal Ions; Lithium Batteries

20050060719 NASA Glenn Research Center, Cleveland, OH, USA
NEXT Ion Engine 2000 Hour Wear Test Results
Soulas, George C.; Kamhawi, Hani; Patterson, Michael J.; Britton, Melissa A.; Frandina, Michael M.; August 2004; 34 pp.; In English; 40th Joint Propulsion Conference and Exhibit by the AIAA, ASME, SAE, and ASEE, 11-14 Jul. 2004, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): WBS 22-800-50-01
Report No.(s): NASA/TM-2004-213222; AIAA Paper 2004-3791; E-14729; Copyright; Avail: CASI; A03, Hardcopy

The results of the NEXT 2000 h wear test are presented. This test was conducted with a 40 cm engineering model ion engine, designated EM1, at a 3.52 A beam current and 1800 V beam power supply voltage. Performance tests, which were conducted over a throttling range of 1.1 to 6.9 kW throughout the wear test, demonstrated that EM1 satisfied all thruster performance requirements. The ion engine accumulated 2038 h of operation at a thruster input power of 6.9 kW, processing 43 kg of xenon. Overall ion engine performance, which includes thrust, thruster input power, specific impulse, and thrust efficiency, was steady with no indications of performance degradation. The ion engine was also inspected following the test. This paper presents these findings.
Author
Ion Engines; Wear Tests; Xenon; Rocket Thrust; NASA Space Programs; Ion Propulsion

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*.

20050041914 National Renewable Energy Lab., Golden, CO, Energy Photovoltaics, Inc., Princeton, NJ, USA
Advanced CIGS Photovoltaic Technology
Delahoy, A. E.; Chen, L.; May 2004; In English
Report No.(s): DE2004-15007603; NREL/SR-520-35922; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of this subcontract is to develop and integrate the various pieces of new technology that EPV considers enabling for cost-effective production of CIGS modules. EPV has conducted research to help generate a technology base for production of CIGS PV modules using vacuum deposition of CIGS onto glass. This strategy is consistent with the observation that, despite there being several approaches to forming device-quality CIGS, vacuum deposition has maintained the world record for the highest-efficiency CIGS device. A record thin-film solar cell efficiency of 19.2% (with Ni-Al grid and MgF2 ARC) for a 0.41-cm2 device was achieved by NREL in 2003 using vacuum-deposited CIGS. The deposition employed four point sources and detection of the Cu-poor to Cu-rich transition for process control. To extend this type of processing to the

realm of large-area substrates, EPV developed vacuum equipment designed for heating and coating 0. 43-m2 moving substrates, with a projected further scale up to 0.79 m2. The substrates are typically low-cost, soda-lime glass, and the materials are supplied to the moving substrates using novel linear-source technology developed by EPV. The use of elemental selenium rather than toxic H2Se gas helps make for a safe manufacturing environment. These choices concerning film deposition, substrates, and source materials help to minimize the processing costs of CIGS.
NTIS
Aluminum Alloys; Photovoltaic Effect; Nickel Alloys; Magnesium Fluorides; Coating

20050041991 Edison Welding Inst., Columbus, OH, USA, Pacific Gas and Electric Co., San Ramon, CA, USA
Internal Repair of Gas Pipelines Survey of Operator Experience and Industry Needs Report
Hrris, I. D.; Sep. 2003; 64 pp.; In English
Report No.(s): DE2004-824951; No Copyright; Avail: Department of Energy Information Bridge

A repair method that can be applied from the inside of a gas transmission pipeline (i.e., a trenchless repair) is an attractive alternative to conventional repair methods since the need to excavate the pipeline is precluded. This is particularly true for pipelines in environmentally sensitive and highly populated areas. The objectives of the project are to evaluate, develop, demonstrate, and validate internal repair methods for pipelines; develop a functional specification for an internal pipeline repair system; and prepare a recommended practice for internal repair of pipelines. The purpose of this survey is to better understand the needs and performance requirements of the natural gas transmission industry regarding internal repair. A total of fifty-six surveys were sent to pipeline operators. A total of twenty completed surveys were returned, representing a 36% response rate, which is considered very good given the fact that tailored surveys are known in the marketing industry to seldom attract more than a 10% response rate. The twenty survey responses produced the following principal conclusions: (1) Use of internal weld repair is most attractive for river crossings, under other bodies of water (e.g., lakes and swamps) in difficult soil conditions, under highways, under congested intersections, and under railway crossings. All these areas tend to be very difficult and very costly if, and where, conventional excavated repairs may be currently used. (2) Internal pipe repair offers a strong potential advantage to the high cost of horizontal direct drilling (HDD) when a new bore must be created to solve a leak or other problem in a water/river crossing. (3) The typical travel distances required can be divided into three distinct groups: up to 305 m (1, 000 ft.); between 305 m and 610 m (1,000 ft. and 2,000 ft.); and beyond 914 m (3,000 ft.). In concept, these groups require pig-based systems; despooled umbilical systems could be considered for the first two groups. For the last group a self-propelled system with an onboard self-contained power and welding system is required. (4) Pipe size range requirements range from 50.8 mm (2 in.) through 1,219.2 mm (48 in.) in diameter. The most common size range for 80% to 90% of operators surveyed is 508 mm to 762 mm (20 in. to 30 in.) diameter, with 95% using 558.8 mm (22 in.) diameter pipe.
NTIS
Corrosion; Pipelines

20050041995 Institute of Gas Technology, Des Plaines, IL
Sealing Large-Diameter Cast-Iron Pipe Joints Under Live Conditions
Kothari, K. M.; Pittard, G. T.; Jan. 2004; In English
Report No.(s): DE2004-825238; No Copyright; Avail: National Technical Information Service (NTIS)

Utilities in the U.S. operate over 75,000 km (47,000 miles) of old cast-iron pipes for gas distribution. The bell-and-spigot joints that connect pipe sections together tend to leak as these pipes age. Current repair practices are costly and highly disruptive. The objective of this program is to design, test and commercialize a robotic system capable of sealing multiple cast iron bell and spigot joints from a single pipe entry point. The proposed system will perform repairs while the pipe remains in service by traveling through the pipe, cleaning each joint surface, and installing a stainless-steel sleeve lined with an epoxy-impregnated felt across the joint. This approach will save considerable time and labor, avoid traffic disruption, and eliminate any requirement to interrupt service to customers (which would result in enormous expense to utilities). Technical challenges include: (1) repair sleeves must compensate for diametric variation and eccentricity of cast-iron pipes; (2) the assembly must travel long distances through pipes containing debris; (3) the pipe wall must be effectively cleaned in the immediate area of the joint to assure good bonding of the sleeve; and (4) an innovative bolt-on entry fitting is required to conduct repair operations on live mains.
NTIS
Sealing; Joints (Junctions); Pipes (Tubes)

20050042000 Georgia Inst. of Tech., Atlanta, GA, USA, Notre Dame Univ., IN, USA, Pacific Northwest National Lab., Richland, WA, USA

Interfacial Radiolysis Effects in Tank Waste Speciation

Orlando, T. M.; Meisel, D.; Camaioni, D. M.; 1999; In English

Report No.(s): DE2004-826002; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of this project was to develop an understanding of radiolysis in systems relevant to nuclear wastes stored in tanks at DOE sites such as Hanford, Savannah River, and Idaho. Since these wastes are highly heterogeneous systems, determining the effects of particulate matter on the radiolytic yields was the main focus of interest. When translated to site-specific concerns, quantitative modeling of these processes can be developed once the fundamental phenomena are understood. Interpretation of the results and conclusions to specific issues, especially safety concerns, at the sites was a major goal. The results were transferred to site operators as soon as the experimental observations were confirmed to be reliable. NTIS

Radiolysis; Radioactive Wastes; Storage Tanks

20050042050 Tulane Univ., New Orleans, LA, USA

Performance-Related Test for Asphalt Emulsions

Kee, D. D.; Abadie, C. D.; Hetzer, M.; Frederic, K.; Oct. 2004; 62 pp.; In English

Report No.(s): PB2005-101492; FHWA/LA-04/390; No Copyright; Avail: CASI; A04, Hardcopy

Yield stress was investigated as a potential quality control parameter for asphalt emulsions. Viscometric data were determined using the concentric cylinder, parallel plate, and cone and plate geometries with rotational rheometers. We also investigated the use of a novel slotted plate technique to determine the yield stress in a direct way-that is to say, without extrapolation. The Saybolt 'viscosity' was determined with a Saybolt Viscometer following the AASHTO T 72-97 standard procedure. The slotted plate technique generated reproducible and consistent results that were far superior to those obtained by rotational rheometer techniques. The yield stress of the emulsions appears to be a more accurate measure of the performance specification for asphalt emulsions than the Saybolt 'viscosity' data. NTIS

Emulsions; Rheology; Asphalt; Functional Design Specifications

20050051034 Naval Research Lab., Stennis Space Center, MS USA

Quantification of Macrobenthic Effects on Diagenesis Using a Multicomponent Inverse Model in Salt Marsh Sediments

Furukawa, Yoko; Smith, April C.; Kostka, Joel E.; Watkins, Janet; Alexander, Clark R.; May 2004; 16 pp.; In English

Report No.(s): AD-A428547; No Copyright; Avail: CASI; A03, Hardcopy

Using a multicomponent inverse model, we quantified the rates of organic matter (OM) remineralization and the relative importance of major terminal electron acceptors Fe(III)-(oxy)hydroxides and SO 2/4 in salt marsh sediments with varying degrees of bioturbation and vegetation at Skidaway Island, Georgia. The model determined the rates of OM diagenesis by seeking simultaneous agreement between measured and model-calculated depth. concentration profiles of multiple major redox species while using the biological transport parameters determined from direct field observations. The OM degradation rates are found to be greater and penetrate deeper in sediments with vegetation or bioturbation than in sediments with limited macrobenthic components, in which organic matter degradation is restricted to the immediate vicinity of water-sediment interface. The results also confirmed previous observations that Fe(III)-(oxy)hydroxides are much more important than sulfate as terminal electron acceptors in the heavily bioturbated station and provided the numerical values to the depth-dependent relative importance. Solid-phase Fe is recycled as a terminal electron acceptor greater than or equal 30 times in the bioturbated station, because biological mixing repeatedly moves reduced Fe(II) back into the aerobic environment, where it is reoxidized to form Fe(III)-(oxy) hydroxides and is reused as a terminal electron acceptor. Vegetation appears to have little influence on net solute transport, but it stimulates microbial activities and significantly enhances the remineralization of OM at depths. DTIC

Acceptor Materials; Electron Transfer; Geochemistry; Marshlands; Organic Materials; Sediments

20050051802 Pennsylvania State Univ., University Park, PA, USA, Stanford Univ., CA, USA

Electrochemical and Electrochromic Properties of Nanoworm-Shaped Ta(sub 2)O(sub 5)Pt Thin-Films

Park, K. W.; Toney, M. F.; May 2004; 20 pp.; In English

Report No.(s): DE2004-826936; SLAC-PUB-10454; No Copyright; Avail: Department of Energy Information Bridge

A Ta(sub 2)O(sub 5)-Pt nanostructure electrode was fabricated by means of cosputtering. Wormlike Pt nanoparticles were

produced in Ta(sub 2)O(sub 5) matrix as observed by transmission electron microscopy (TEM) and small angle x-ray scattering (SAXS). The electrochemical and electrochromic properties of nanoworm-shaped Ta(sub 2)O(sub 5)-Pt electrode are compared with those of Ta(sub 2)O(sub 5) thin-film electrode without Pt nanoparticles.
NTIS
Electrochromism; Fabrication; Nanostructure (Characteristics); Thin Films; Platinum; Tantalum Oxides; Electrochemistry

20050051829 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Duct Tape Durability Testing
Sherman, M. H.; Walker, I. S.; Apr. 2004; In English
Report No.(s): DE2004-826108; LBNL-54767; No Copyright; Avail: National Technical Information Service (NTIS)

Duct leakage is a major source of energy loss in residential buildings. Most duct leakage occurs at the connections to registers, plenums, or branches in the duct system. At each of these connections, a method of sealing the duct system is required. Typical sealing methods include tapes or mastics applied around the joints in the system. Field examinations of duct systems have shown that taped seals tend to fail over extended periods of time. The Lawrence Berkeley National Laboratory (LBNL) has been testing sealant durability for several years using accelerated test methods and found that typical duct tape (i.e., cloth-backed tapes with natural rubber adhesives) fails more rapidly than other duct sealants. This report summarizes the results of duct sealant durability testing over two years for four UL 181B-FX listed duct tapes (two cloth tapes, a foil tape and an Oriented Polypropylene (OPP) tape). One of the cloth tapes was specifically developed in collaboration with a tape manufacturer to perform better in our durability testing. The tests involved the aging of common 'core-to-collar joints' of flexible duct to sheet metal collars. Periodic air leakage tests and visual inspection were used to document changes in sealant performance. After two years of testing, the flex-to-collar connections showed little change in air leakage, but substantial visual degradation from some products. A surprising experimental result was failure of most of the clamps used to mechanically fasten the connections. This indicates that the durability of clamps also need to be addressed ensure longevity of the duct connection. An accelerated test method developed during this study has been used as the basis for an ASTM standard (E2342-03).
NTIS
Durability; Tapes; Ducts

20050051843 Russian Federal Nuclear Center, Sarov, Russia
RFNC-VNIIEF Capabilities to Production High Pure Isotopes for Scientific and Medical Applications
Feb. 2002; 12 pp.; In English
Report No.(s): DE2004-828336; No Copyright; Avail: Department of Energy Information Bridge

In the technical paper there is presented the information on the basic equipment and more than thirty-year experience of RFNC-VNIIEF activities in the sphere of producing highly enriched isotopes of actinide elements--thorium, uranium, neptunium, plutonium, americium and curium--for scientific researches and practical applications. Electromagnetic separator and radiochemical methods provide obtaining of superpure isotope samples for nuclear-physical radiometric and mass-spectrometric equipment, and also as tracers when analyzing environmental contamination.
NTIS
Contamination; Isotopes; Actinide Series; Curium; Uranium; Neptunium

20050051861 Environmental Protection Agency, Washington, DC, USA
Background Document for Proposed CPG III and Draft RMAN III
Jul. 1998; 246 pp.; In English
Report No.(s): PB2005-102051; EPA/530/R-98/003; No Copyright; Avail: CASI; A11, Hardcopy

Section 6002(e) of RCRA requires EPA to designate items that are or can be made with recovered materials and to recommend practices to assist procuring agencies in meeting their obligations with respect to designated items under RCRA section 6002. After EPA designates an item, RCRA requires that each procuring agency, when purchasing a designated item, must purchase that item composed of the highest percentage of recovered materials practicable. Executive Order 12873 (Executive Order) establishes the procedure for EPA to follow in implementing RCRA section 6002(e). Section 502 of the Executive Order directs EPA to issue a Comprehensive Procurement Guideline (CPG) that designates items that are or can be made with recovered materials. Concurrent with the CPG, EPA must publish its recommended procurement practices for purchasing designated items, including recovered materials content levels, in a related Recovered Materials Advisory Notice (RMAN). The Executive Order also directs EPA to update the CPG annually and to issue RMANs periodically to reflect

changing market conditions. The first CPG (CPG I) was published on May 1, 1995 (60 FR 21370). It established 8 product categories, designated 19 new items, and consolidated 5 earlier item designations. The first CPG update (CPG II) was published on November 13, 1997 (62 FR 60962), and designated an additional 12 products. Today, in CPG III, EPA is proposing to designate the following 19 additional items: Construction Products; Nylon carpet with backing containing recovered materials; Carpet cushion; Flowable fill; Railroad grade crossing surfaces; Park and Recreation Products; Park benches and picnic tables; Playground equipment; Landscaping Products; Food waste compost; Plastic lumber landscaping timbers and posts; Non-Paper Office Products; Solid plastic binders; Plastic clipboards; Plastic file folders; Plastic clip portfolios; Plastic presentation folders; Miscellaneous; Absorbents and adsorbents; Awards and plaques; Industrial drums; Mats; Non-road signs, including sign supports and posts; and Manual-grade strapping. B. Contents of These Supporting Analyses This document, hereafter referred to as the proposed CPG III/Draft RMAN III background document, explains EPAs overall objectives, the process for designating procurement items, and the methodology used in recommending recovered materials content levels for items designated in the proposed CPG III. In addition, the proposed CPG III/Draft RMAN III background document lists the recommended procurement practices for designated items.
NTIS
Procurement; Recovery; Binders (Materials)

20050051865 Environmental Protection Agency, Washington, DC
Toxic Substances Control Act (TSCA): ASCII Text Data, January 2005, PMNNumber to EPA Accession Number Link (Raw Data on CD-ROM)
Jan. 2005; In English
Report No.(s): PB2005-500063; No Copyright; Avail: National Technical Information Service (NTIS)
The TSCA Chemical Substance Inventory provides chemical identity information for the 65,168 non-confidential substances on the TSCA Master Inventory File. The datafile contains no TSCA Confidential Business Information. New versions of the TSCA Inventory are issued at approximately six month intervals. The data provided for each chemical substance include the CAS Registry Number, Preferred CA Index Name, molecular formula, and other appropriate information, such as valid chemical names reported by submitters. The entries are in ascending CAS Registry Number order. The PMN Number to EPA Accession Number Link provides a cross-reference of these number for commenced PMNs on the confidential portion of the TSCA Master Inventory FIle. Neither this cross-reference nor the additional information included is TSCA Confidential Business Information.
NTIS
Toxicity; Data Bases; Inventories

20050051945 Brookhaven National Lab., Upton, NY
History of the Origin of the Chemical Elements and Their Discoverers
Holden, N. E.; 2001; 22 pp.; In English
Report No.(s): DE2004-782642; No Copyright; Avail: Department of Energy Information Bridge
The origin of the chemical elements show a wide diversity with some of these elements having their origin in antiquity. Still other elements have been synthesized within the past fifty years via nuclear reactions on heavy elements, because these other elements are unstable and radioactive and do not exist in nature. The names of the elements come from many sources including mythological concepts or characters; places, areas or countries; properties of the element or its compounds, such as color, smell or its inability to combine; and the names of scientists. There are also some miscellaneous names as well as some obscure names for particular elements. The claim of discovery of an element has varied over the centuries. Many claims, e.g. , the discovery of certain rare earth elements of the lanthanide series, involved the discovery of a mineral ore from which an element was later extracted. The honor of discovery has often been accorded not to the person who first isolated the element but to the person who discovered the original mineral itself, even when the ore was impure and contained many elements. The reason for this is that in the case of these rare earth elements, the ''earth'' now refers to oxides of a metal not to the metal itself. This fact was not realized at the time of their discovery, until the English chemist Humphry Davy showed that earths were compounds of oxygen and metals in 1808. In the early discoveries, the atomic weight of an element and spectral analysis of the element were not available. Later both of these elemental properties would be required before discovery of the element would be accepted. In general, the requirements for discovery claims have tightened through the years and claims that were previously accepted would no longer meet the minimum constraints now imposed. There are cases where the honor of discovery is not given to the first person to actually discover the element but to the first person to claim the discovery in print.

If a publication was delayed, the discoverer has often historically been 'scooped' by another scientist.
NTIS
Chemical Composition; Spectrum Analysis; Nuclear Reactions; Heavy Elements

20050060655 North Dakota Univ., Grand Forks, ND, USA
Task 3.1 - Low-Temperature Ash Sintering and Strength Development
Zygarlicke, C. J.; McColloer, D. P.; Kay, J. P.; Oct. 1999; 32 pp.; In English
Report No.(s): DE2004-824981; No Copyright; Avail: Department of Energy Information Bridge

The objective of the project is to develop fundamental sintering-viscosity relationships for coal-type ash at relatively low temperatures, with the end result being a simplified soot-blowing index for power systems. This involves correlating several important factors which control the ease of deposit removal, including deposit strength, deposit porosity, chemical composition, and temperature. Testing was performed on ashes derived from three coals and two biomass materials along with a standard soda-lime glass. The coals were selected because detailed analyses as well as ash samples were already available. Sintering characteristics of the ashes were to be determined by observation using an HSM and video recording system, with a stainless steel microscope stage chamber constructed to allow the use of corrosive gas atmospheres. The measurements would allow calculation of the viscosity of liquid phases as the sintering progressed, using the Frenkel and other sintering models. The sintering behavior and viscosity would be correlated with ash mineralogy and chemistry and information on bench-scale deposit strength and porosity to develop an initial relationship to predict deposit removability.
NTIS
Ashes; Biomass; Calcium Oxides; Coal; Deposits

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COMPOSITE MATERIALS

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

20050041916 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Oxide Material Systems for 1650 C Thermal/Environmental Barrier Coating Applications
Zhu, Dong-Ming; Fox, Dennis S.; Bansal, Narottam P.; Miller, Robert A.; December 2004; 15 pp.; In English; Fifth International Conference on High Temperature Ceramic Matrix Composites, 12-16 Sep. 2004, Seattle, WA, USA
Contract(s)/Grant(s): WBS 22-714-20-09; DA Proj. 1L1-61102-AF-20
Report No.(s): NASA/TM-2004-213219; ARL-TR-3298; E-14726; No Copyright; Avail: CASI; A03, Hardcopy

Advanced thermal and environmental barrier coatings (TEBCs) are being developed for low-emission SiC/SiC ceramic matrix composite (CMC) combustor and vane applications to extend the CMC liner and vane temperature capability to 1650 C (3000 F) in oxidizing and water-vapor-containing combustion environments. The advanced 1650 C TEBC system is required to have a better high-temperature stability, lower thermal conductivity, and more resistance to sintering and thermal stress than current coating systems under engine high-heat-flux and severe thermal cycling conditions. In this report, the thermal conductivity and water vapor stability of selected candidate hafnia-, pyrochlore- and magnetoplumbite-based TEBC materials are evaluated. The effects of dopants on the materials properties are also discussed. The test results have been used to downselect the TEBC materials and help demonstrate the feasibility of advanced 1650 C coatings with long-term thermal cycling durability.
Author
Oxides; Ceramic Matrix Composites; Thermal Control Coatings; Refractory Materials; Mechanical Properties

20050041935 NASA Glenn Research Center, Cleveland, OH, USA
Comparison of the Computational Efficiency of the Original Versus Reformulated High-Fidelity Generalized Method of Cells
Arnold, Steven M; Bednarcyk, Brett; Aboydi, Jacob; December 2004; 26 pp.; In English
Contract(s)/Grant(s): WBS 22-714-70-63
Report No.(s): NASA/TM-2004-213438; E-14973; No Copyright; Avail: CASI; A03, Hardcopy

The High-Fidelity Generalized Method of Cells (HFGMC) micromechanics model has recently been reformulated by Bansal and Pindera (in the context of elastic phases with perfect bonding) to maximize its computational efficiency. This reformulated version of HFGMC has now been extended to include both inelastic phases and imperfect fiber-matrix bonding. The present paper presents an overview of the HFGMC theory in both its original and reformulated forms and a comparison

of the results of the two implementations. The objective is to establish the correlation between the two HFGMC formulations and document the improved efficiency offered by the reformulation. The results compare the macro and micro scale predictions of the continuous reinforcement (doubly-periodic) and discontinuous reinforcement (triply-periodic) versions of both formulations into the inelastic regime, and, in the case of the discontinuous reinforcement version, with both perfect and weak interfacial bonding. The results demonstrate that identical predictions are obtained using either the original or reformulated implementations of HFGMC aside from small numerical differences in the inelastic regime due to the different implementation schemes used for the inelastic terms present in the two formulations. Finally, a direct comparison of execution times is presented for the original formulation and reformulation code implementations. It is shown that as the discretization employed in representing the composite repeating unit cell becomes increasingly refined (requiring a larger number of sub-volumes), the reformulated implementation becomes significantly (approximately an order of magnitude at best) more computationally efficient in both the continuous reinforcement (doubly-periodic) and discontinuous reinforcement (triply-periodic) cases.
Author
Micromechanics; Mathematical Models; Mechanical Properties; Composite Materials

20050041964 Adtech Systems Research, Inc., Beavercreek, OH, USA
Damage Prediction Models for Advanced Materials and Composites
Xie, Ming; Ahmad, Jalees; Grady, Joseph E., Technical Monitor; January 2005; 100 pp.; In English
Contract(s)/Grant(s): NAS3-27152; WBS 714-09-46
Report No.(s): NASA/CR-2005-213327; E-14787; No Copyright; Avail: CASI; A05, Hardcopy

In the present study, the assessment and evaluation of various acoustic tile designs were conducted using three-dimensional finite element analysis, which included static analysis, thermal analysis and modal analysis of integral and non-integral tile design options. Various benchmark specimens for acoustic tile designs, including CMC integral T-joint and notched CMC plate, were tested in both room and elevated temperature environment. Various candidate ceramic matrix composite materials were used in the numerical modeling and experimental study. The research effort in this program evolved from numerical modeling and concept design to a combined numerical analysis and experimental study. Many subjects associated with the design and performance of the acoustic tile in jet engine exhaust nozzle have been investigated.
Author
Damage; Mathematical Models; Ceramic Matrix Composites; Composite Materials; Acoustics

20050041969 NASA Glenn Research Center, Cleveland, OH, USA
Implementation of Improved Transverse Shear Calculations and Higher Order Laminate Theory Into Strain Rate Dependent Analyses of Polymer Matrix Composites
Zhu, Lin-Fa; Kim, Soo; Chattopadhyay, Aditi; Goldberg, Robert K.; December 2004; 29 pp.; In English; 45th Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): NCC3-1024; WBS 22-714-30-02
Report No.(s): NASA/TM-2004-213420; AIAA Paper 2004-1638; E-14946; No Copyright; Avail: CASI; A03, Hardcopy

A numerical procedure has been developed to investigate the nonlinear and strain rate dependent deformation response of polymer matrix composite laminated plates under high strain rate impact loadings. A recently developed strength of materials based micromechanics model, incorporating a set of nonlinear, strain rate dependent constitutive equations for the polymer matrix, is extended to account for the transverse shear effects during impact. Four different assumptions of transverse shear deformation are investigated in order to improve the developed strain rate dependent micromechanics model. The validities of these assumptions are investigated using numerical and theoretical approaches. A method to determine through the thickness strain and transverse Poisson's ratio of the composite is developed. The revised micromechanics model is then implemented into a higher order laminated plate theory which is modified to include the effects of inelastic strains. Parametric studies are conducted to investigate the mechanical response of composite plates under high strain rate loadings. Results show the transverse shear stresses cannot be neglected in the impact problem. A significant level of strain rate dependency and material nonlinearity is found in the deformation response of representative composite specimens.
Author
Deformation; Laminates; Mechanical Properties; Polymer Matrix Composites; Strain Rate; Mathematical Models; Shear Stress

20050042016 Army Research Lab., Hampton, VA, USA
Testing and Analysis of Composite Skin/Stringer Debonding under Multi-Axial Loading
Krueger, Ronald; Cvitkovich, Michael; OBrien, Kevin; Minguet, Pierre J.; Journal of Composite Materials; 2000; Volume 34, No. 15, pp. 1263-1300; In English; Copyright; Avail: CASI; A04, Hardcopy

A consistent step-wise approach is presented to investigate the damage mechanism in composite bonded skin/stringer constructions under uniaxial and biaxial (in-plane/out-of-plane) loading conditions. The approach uses experiments to detect the failure mechanism, computational stress analysis to determine the location of first matrix cracking and computational fracture mechanics to investigate the potential for delamination growth. In a first step, tests were performed on specimens, which consisted of a tapered composite flange, representing a stringer or frame, bonded onto a composite skin. Tests were performed under monotonic loading conditions in tension, three-point bending, and combined tension/bending to evaluate the debonding mechanisms between the skin and the bonded stringer. For combined tension/bending testing, a unique servohydraulic load frame was used that was capable of applying both in-plane tension and out-of-plane bending loads simultaneously. Specimen edges were examined on the microscope to document the damage occurrence and to identify typical damage patterns. For all three load cases, observed failure initiated in the flange, near the flange tip, causing the flange to almost fully debond from the skin. In a second step, a two-dimensional plane-strain finite element model was developed to analyze the different test cases using a geometrically nonlinear solution. For all three loading conditions, computed principal stresses exceeded the transverse strength of the material in those areas of the flange where the matrix cracks had developed during the tests. In a third step, delaminations of various lengths were simulated in two locations where delaminations were observed during the tests. The analyses showed that at the loads corresponding to matrix ply crack initiation computed strain energy release rates exceeded the values obtained from a mixed mode failure criterion in one location. Hence, unstable delamination propagation is likely to occur as observed in the experiments.
Author
Axial Loads; Stress Analysis; Debonding (Materials); Stringers; Composite Materials; Skin (Structural Member); Fracture Mechanics

20050050900 NASA Langley Research Center, Hampton, VA, USA
Highlights of NASA's Role in Developing State-of-the-Art Nondestructive Evaluation for Composites
[2001]; 11 pp.; In English; AHS International Structures Specialists' Meeting, 30 Oct. - 1 Nov. 2004, Williamsburg, VA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Since the 1970's, when the promise of composites was being pursued for aeronautics applications, NASA has had programs that addressed the development of NDE methods for composites. These efforts included both microscopic and macroscopic NDE. At the microscopic level, NDE investigations interrogated composites at the submicron to micron level to understand a composite's microstructure. A novel microfocus CT system was developed as well as the science underlying applications of acoustic microscopy to a composite's component material properties. On the macroscopic scale NDE techniques were developed that advanced the capabilities to be faster and more quantitative. Techniques such as stiffness imaging, ultrasonic arrays, laser based ultrasound, advanced acoustic emission, thermography, and novel health monitoring systems were researched. Underlying these methods has been a strong modeling capability that has aided in method development.
Author
Nondestructive Tests; Composite Materials; Microstructure

20050050939 Defence Science and Technology Organisation, Edinburgh, Australia
Ballistic and Material Testing Procedures and Test Results for Composite Samples for the TIGER Helicopter Vulnerability Project
Resnyansky, A. D.; Katselis, G.; September 2004; 27 pp.; In English
Report No.(s): DSTO-TR-1617; AR-013-192; Copyright; Avail: Other Sources

The report describes procedures established for ballistic and material testing of composite samples in relation to the project on Battle Damage Repair and Vulnerability Studies (support to AIR87). Material tests of the samples involve measurements of the strength properties with Split Hopkinson Pressure Bar. The device designed and built up in WSD is briefly described. The report summarizes the protocol and principal results of the ballistic and material tests.
Author
Ballistics; Materials Tests; Composite Materials; Vulnerability; Reconnaissance Aircraft

20050051041 University of South Alabama, Mobile, AL USA
Advanced Polymer Composite Molding Through Intelligent Process Analysis and Control
Minaie, Bob; Mamishev, Alex; Nov. 2004; 44 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0370
Report No.(s): AD-A428562; AFRL-SR-AR-TR-04-0613; No Copyright; Avail: CASI; A03, Hardcopy

In this project. process analysis of Resin Transfer Molding (RTM) was carried out and adaptive process control models were developed. In addition, a non-invasive sensor was manufactured to monitor the filling pattern and provide feedback during adaptive control. Adaptive process control strategies based on several control models including linear model and recursive least square model were developed. Some of these models were implemented within a LabVIEW user interface. Simulation methodologies were also developed for comprehensive analysis of the RTM process. A transparent and flexible sensor array was fabricated to non-invasively monitor the fill front location. To analyze the sensor signal, LabVIEW programs were written in modules that can be embedded into the data acquisition system. Another sensor array with multiple sensing elements was also designed to simultaneously monitor both the fill front location and the degree of cure. The multiplexing electronics needed for this multi-element sensor array was fabricated. The first generation of this senor system was-used to monitor the fill front location in molds of varying thickness and material. This report presents the aforementioned work in three separate sections: (1) process analysis and adaptive control modeling, (2) manufacturing of non-invasive sensor, end (3) list of publications resulting from this project.
DTIC
Casting; Composite Materials; Resin Transfer Molding

20050051096 Purdue Univ., West Lafayette, IN USA
Development of Composites Reinforced with Short Wavy Fibers
Sun, C. T.; Jan. 2004; 8 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0018
Report No.(s): AD-A428639; AFRL-SR-AR-TR-04-0636; No Copyright; Avail: CASI; A02, Hardcopy

In short fiber composites including nanocomposites, the load transfer efficiency among fibers is crucial in effecting superior composite properties. It is conceivable that this load transfer efficiency depends on the shape, aspect ratio, and surface area of the fiber. The effect of surface area of the reinforcing element is of particular importance because of the increasing use of nano particles in nanocomposites. It is well known that for the same volume, a material at nano scale possesses much greater surface areas than at larger scales. It is evident that more surface areas mean more load transfer paths and, thus, lower interfacial stresses between the reinforcement and the matrix. The lowering of interfacial stresses is expected to lead to higher composite strengths. In the previous period, we used model composite to reach the following conclusions: 1) Wavy fibers lower the interfacial stresses and thus increase the composite strength significantly, and 2) For the same fiber volume fraction, the composite with thinner fibers has higher strength than the composite with thicker fibers. In this reporting period, we continued to investigate the size effect of reinforcements. In addition to platelets, we also included spherical particulates of varying sizes. For the platelet reinforcement, composites are manufactured with steel platelets whose lateral dimensions are on the order of centimeters and thickness in the range of 0.01 -1.0 mm. Pull-out tests are conducted and micromechanics models are developed to understand the reinforcing mechanisms and to develop a strength prediction method. For particle reinforcements, glass beads of 2000 micronmeter, 500 micronmeter, 200 micronmeter, 70 micronmeter and 6 micronmeter in diameter (mean size) and alumina particles of 70 micronmeter, 20 um, 3 micronmeter, and 50 nm in diameter are used together with vinyl ester to make composites for evaluating the size effect on the composite stiffness and strength properties.
DTIC
Composite Materials; Fiber Composites

20050051207 Michigan Technological Univ., Houghton, MI USA
Micromechanical Analysis of Three-Dimensional Open-Cell Foams Using the Matrix Method for Space Frame Structures
Roy, A. K.; Li, K.; Gao, X. L.; Nov. 2004; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-M03R
Report No.(s): AD-A428834; AFRL-ML-WP-TP-2004-401; No Copyright; Avail: Defense Technical Information Center (DTIC)

A micromechanical model for three-dimensional open-cell foams is developed by using the matrix method for space frames in structural mechanics and tetrakaidcahedral unit cells. The effective elastic properties of foams are determined employing unit cells subjected to three different modes of loading. The thirty-six struts of each tetrakaidecahedral unit cell are treated as uniform slender beams, and the twenty-four vertices as rigid joints. All four-deformation mechanisms (i.e., stretching, shearing, bending and twisting) possible under the specified loadings are incorporated, and four different strut cross section shapes (i.e., circle, square, equilateral triangle and Plateau border) are treated in a unified manner. The formulas for determining the effective Young's modulus, Poisson's ratio and shear modulus of open-cell foams that are undergoing linearly

elastic deformations are derived using the composite homogentization theory. The new formulas include all necessary parameters, unlike those provided by existing models.
DTIC
Foams; Frames; Matrix Methods; Micromechanics; Structural Analysis

20050051223 Delaware Univ., Newark, DE USA
Modeling and Simulation of Liquid Molding Processes
Simacek, Pavel; Jul. 2003; 27 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428863; No Copyright; Avail: Defense Technical Information Center (DTIC)
Outline of presentation: LIMS simulation package development; changes and additions, LIMS UI extensions and development, and LIMS distribution made available; Addressing practical processing issues; Modeling issues, perform and distribution media deformation; Conclusions; The Road Ahead.
DTIC
Casting; Computerized Simulation; Simulation

20050051224 Delaware Univ., Newark, DE USA
Modeling and Simulation of Mold Filling with LIMS
Simacek, Pavel; Jul. 2003; 56 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428864; No Copyright; Avail: Defense Technical Information Center (DTIC)
Outline of presentation: What is the Computer Simulation (Modeling)? Why do we need simulation? Computer modeling-Basics: experimental characterization; process modeling, analytic and numeric; Computer modeling-Advanced: control and sensing; optimization; Putting the whole package together or the Art of Integration; Conclusions.
DTIC
Casting; Composite Materials; Computerized Simulation; Simulation

20050051228 Hunter Coll., New York, NY USA
NMR Studies of Polymer Nanocomposites
Greenbaum, Steve G.; Jan. 2001; 6 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0568
Report No.(s): AD-A428869; AFRL-SR-AR-TR-05-0003; No Copyright; Avail: CASI; A02, Hardcopy
Methods developed and refined to characterize ion and molecular transport process in disordered media are described. The primary tool is pulsed field gradient NMR. A static field gradient method was developed which makes possible variable pressure diffusion measurement, and the application to the important fuel cell membrane NAFION constitute the first results of their kind ever published. Standard ambient pressure results for lithium ion conducting polymer electrolytes containing nanoscopic silica are included, as well as the description of a novel scheme to produce highly conducting polymer electrolytes by magnetic field alignment of the polymer chains. Fuel cell membranes developed by collaborators at Wright-Patterson Air Force Base were also investigated.
DTIC
Fuel Cells; Methyl Alcohol; Nanocomposites; Nuclear Magnetic Resonance

20050051231 Delaware Univ., Newark, DE USA
New Control Approaches During VARTM
Glancey, James; Jul. 2003; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428874; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts only.
DTIC
Composite Materials; Quality Control; Resin Transfer Molding

20050051238 Delaware Univ., Newark, DE USA
Manufacturing of Composite Parts Via VARTM
Heider, D.; Gillespie, J. W.; Jul. 2003; 49 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428886; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts only.
DTIC
Composite Materials; Manufacturing; Resin Transfer Molding

20050051239 Delaware Univ., Newark, DE USA
SLIC Simulation-Based Liquid Injection Control
Hsiao, Kuang-Ting; Jul. 2003; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428887; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts only.
DTIC
Liquid Injection; Liquids; Simulation

20050051240 Delaware Univ., Newark, DE USA
VARTM Process Variability Study
Amouroux, Solange; Deffor, H.; Fuqua, M.; Heider, D.; Gillespie, J. W.; Jul. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428888; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts only.
DTIC
Resin Transfer Molding; Variability

20050051244 Hampton Univ., VA USA
Spectroscopy and Device Performance of Rare Earth Doped III-Nitrides
Hommerich, Uwe; Nov. 2002; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0317
Report No.(s): AD-A428892; ARO-40103-EL; No Copyright; Avail: Defense Technical Information Center (DTIC)
The recent demonstration of visible thin-film electroluminescence (TFEL) devices based on rare earth doped GaN has spurred great interest in this class of materials for possible applications in full color displays. Prime candidates for redgreen-blue (RGB) emission are the rare earth ions Eu3+ (red), Er3+ (green), and Tm3+ (blue). A full-color TFEL phosphor system based on RE doped GaN has been demonstrated with high brightness (500-1000 cd/m2) under direct current operation of GaN: Er films on Si and sapphire substrates. The recent results on RE doped GaN have shown that these materials are promising for electroluminescent devices operating at room temperature. However, the initial results also indicated that more fundamental studies on the incorporation and excitation mechanisms of RE ions in III-nitrides are necessary to optimize their device performance. In this final report, spectroscopic results focusing on the infrared and visible emission from Er3+ in GaN are presented. The results include a comparison of the optical properties of in -situ Er doped GaN prepared by metalorganic MBE and solid-source MBE. In addition, detailed spectroscopic studies on Er doped GaN prepared by SSMBE as a function of excitation wavelengths, temperature, and pump power are discussed. Finally, initial result on the optical properties of Eu doped GaN are summarized.
DTIC
Doped Crystals; Electroluminescence; Light Emitting Diodes; Nitrides; Spectroscopy

20050051245 Delaware Univ., Newark, DE USA
Design of Fire Safe Composite Structures
Tierney, J.; Paesano, A.; Gillespie, J. W., Jr; Jul. 2003; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428893; No Copyright; Avail: Defense Technical Information Center (DTIC)

Summary and future Work: 1) Hybrid composites show promise as an effective system for both structural performance and thermal protection; 2) Fire testing at UD-CCM showed that CIRTM laminates retained significant strength and stiffness after prolonged exposure to 2000-degree F open flame; 3) Future work will involve development of a series of genetic algorithms to solve the problem of optimizing navy deck structures using a model based design approach rather than extensive testing; 4) The optimization scheme will also take into account any weighted design variables such as the necessity to include additional fire protection materials, radar absorption material and a minimum damage resistance level.
DTIC
Composite Structures; Fire Prevention; Fires

20050051246 Delaware Univ., Newark, DE USA
Left Handed Materials in Magnetic Nanocomposites
Zhang, X. K.; Liu, Y. Y.; Chui, T.; Streilein, D.; Yalagadda, S.; Jul. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428894; No Copyright; Avail: Defense Technical Information Center (DTIC)
Conclusion and future work: 1) Magnetic nanocomposites are potential LHM: mLHM; 2) mLHM is different from current isotropic LHM: mLHM is anisotropic and chiral; 3) mLHM can be achieved in bulk quantities and have special applications; 4) Transmission spectra depends on the composition and external magnetic field; 5) Loss can be minimized using small magnetic nanoparticles; 6) Future work: demonstration of the negative of index in mLHM.
DTIC
Composite Materials; Dielectric Properties; Magnetic Materials; Nanocomposites; Nanotechnology

20050051247 Delaware Univ., Newark, DE USA
Multifunctional Materials and Structures
Yarlagadda, S.; Jul. 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428895; No Copyright; Avail: Defense Technical Information Center (DTIC)
Multifunctional composites enable transformation of the Navy: Combine best of both worlds. Passive properties: Strength - Stiffness - Toughness - Fire-hardness - Blast resistant - corrosion resistant - LO. Active properties: Sensors/Actuators - Networking and Communications - Active LO and Signature -Self-Healing - Health Monitoring - Electronics/CPUs. Manufacturing technologies to integrate multifunctionality are essential.
DTIC
Composite Materials; Composite Structures

20050051249 Delaware Univ., Newark, DE USA
Simulations for Design, Sensing and Control of Liquid Composite Molding Processes
Advani, Suresh G.; Jul. 2003; 112 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428897; No Copyright; Avail: Defense Technical Information Center (DTIC)
Issues and Challenges in Liquid Molding. Issues: Complete saturation and voids - Injection and vent locations - Process control - Reliability and repeatability. Challenges: Three dimensional flow modeling - Saturation physics - Dimensional tolerances - Flow control - Distribution media design - Location of resin injectors - Automation - Large and complex parts. Goal: Develop and apply tools in an intelligent manner to advance manufacturing by Liquid Composite Molding.
DTIC
Casting; Composite Materials; Detection; Resin Transfer Molding; Simulation

20050051705 NASA Glenn Research Center, Cleveland, OH, USA
Cryogenic Composite Tank Design for Next Generation Launch Technology
Abumen, Galib H.; Kosareo, Daniel N.; Roche, Joseph M.; [2004]; 15 pp.; In English; 40th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): NAS3-00145; 22-ENG-00-00; No Copyright; Avail: CASI; A03, Hardcopy
The structural performance of liquid hydrogen tanks made from composites is investigated. A computational method that judiciously combines structural analysis, composite mechanics, progressive fracture algorithm to evaluate damage tolerance,

durability, and fatigue and fracture is described. A tank design concept is introduced and evaluated. The composite tank is internally stiffened by incorporating additional stacks of laminates along its length to alternate rows of finite elements. The robustness of the proposed design concept is assessed by damage progression analysis. Damage initiates i the composite at an internal pressure that is nearly two times the design pressure. From the point of damage initiation, the designed tank can tolerate an increase in internal pressure that is nearly three and a half times the design pressure. Low cycle fatigue analysis is also performed to determine the effect of pressurization and de-pressurization on the structural integrity of the tank. Results show that the tank can sustain at least a 100 cycles before any failure take place.
Author
Cryogenic Tanks; Composite Materials; Liquid Hydrogen; Mechanical Properties; Reusable Launch Vehicles; Technology Utilization

20050051727 NASA Glenn Research Center, Cleveland, OH, USA
Hoop Tensile Properties of Ceramic Matrix Composite Cylinders
Verrilli, Michael J.; DiCarlo, James A.; Yun, HeeMan; Barnett, Terry; [2004]; 13 pp.; In English
Contract(s)/Grant(s): 714-30-18
Report No.(s): Paper-1234; Copyright; Avail: CASI; A03, Hardcopy

Tensile stress-strain properties in the hoop direction were obtained for 100-mm diameter SiC/SiC ceramic matrix composite cylinders using ring specimens machined form the cylinder ends. The cylinders were fabricated from 2D balanced SiC fabric with several material variants, including wall thickness (6,8, and 12 plies), SiC fiber type (Sylramic, Sylramic-iBN, Hi-Nicalon, and Hi-Nicalon S), fiber sizing type, and matrix type (full CVI SiC, and partial CVI SiC plus slurry cast + melt-infiltrated SiC-Si). Fiber ply splices existed in all the hoops. Tensile hoop measurements are made at room temperature and 1200 C using hydrostatic ring test facilities. The failure mode of the hoops, determined through microstructural examination, is presented. The hoop properties are compared with in-plane data measured on flat panels using same material variants, but containing no splices.
Author
Ceramic Matrix Composites; Hoops; Microstructure; Tensile Properties; Mechanical Properties; Fabrication; Circular Cylinders

20050051732 NASA Glenn Research Center, Cleveland, OH, USA
UHTC Composites for Leading Edges
Levine, Stanley R.; Opila, Elizabeth J.; [2004]; 26 pp.; In English; 2004 National Space and Missile Materials Symposium (NSMMS), 21-25 Jun. 2005, Seattle, WA, USA
Contract(s)/Grant(s): WBS 713-76-32; No Copyright; Avail: CASI; A03, Hardcopy

Ultrahigh temperature ceramics (UHTC) have performed unreliably due to material flaws and attachment design. These deficiencies are brought tot he fore by the low fracture tougness and thermal shock resistance of UHTC. In addition, poor oxidation resistance is a limitation on UHTC applicability to reusable launch vehicles. We have been addressing these deficiencies for the past two years via a small task at GRC that is in the Airframe part of the Next Generation Launch Technology Program. Our focus is on UHTC composite (UHTCC) constructions and functional grading to address the mechanical issues and on composition modification to address the oxidation issue. Processing, mechanical property, and oxidation resutls will be reported.
Author
Ceramics; Refractory Materials; Leading Edges; Mechanical Properties

20050051752 NASA Glenn Research Center, Cleveland, OH, USA
Microstructural Optimization of High Temperature SiC/SiC Composites
DiCarlo, James A.; [2004]; 6 pp.; In English; 5th International Conference on High Temperature Ceramic Matrix Composites, 12-16 Sep. 2004, Seattle, WA, USA
Contract(s)/Grant(s): 22-714-30-17; No Copyright; Avail: CASI; A02, Hardcopy

Advanced materials and process approaches are described that have allowed NASA to develop five state-of-the-art silicon carbide (SiC) fiber-reinforced hybrid-SiC matrix composite systems that can operate under mechanical loading and oxidizing conditions for hundreds of hours at upper use temperatures from 1200 to 1450 C. Key data are presented that demonstrate the

ability of these materials to meet the first-level property requirements for hot-section components in advanced gas turbine engines.
Author
Microstructure; Optimization; Silicon Carbides; Ceramic Matrix Composites; Refractory Materials; Mechanical Properties

20050051857 NASA Glenn Research Center, Cleveland, OH, USA
Fracture Toughness in Advanced Monolithic Ceramics - SEPB Versus SEVENB Methods
Choi, S. R.; Gyekenyesi, J. P.; March 2005; 6 pp.; In English; International Conference on Fracture, 20-25 Mar. 2005, Turin, Italy
Contract(s)/Grant(s): WBS 22-714-04-05; No Copyright; Avail: CASI; A02, Hardcopy

Fracture toughness of a total of 13 advanced monolithic ceramics including silicon nitrides, silicon carbide, aluminas, and glass ceramic was determined at ambient temperature by using both single edge precracked beam (SEPB) and single edge v-notched beam (SEVNB) methods. Relatively good agreement in fracture toughness between the two methods was observed for advanced ceramics with flat R-curves; whereas, poor agreement in fracture toughness was seen for materials with rising R-curves. The discrepancy in fracture toughness between the two methods was due to stable crack growth with crack closure forces acting in the wake region of cracks even in SEVNB test specimens. The effect of discrepancy in fracture toughness was analyzed in terms of microstructural feature (grain size and shape), toughening exponent, and stable crack growth determined using back-face strain gaging.
Author
Ceramics; Fracture Strength; Crack Propagation; Beams (Supports); V Grooves

20050051874 Ohio Aerospace Inst., Cleveland, OH, USA
The Effect of Fiber Architecture on Matrix Cracking in SiC/SiC CMC's
Morscher, Gregory N.; January 2005; 13 pp.; In English; High Temperature Ceramic Matrix Composites (HTCMC) 5, 12-15 Sep. 2004, Seattle, WA, USA
Contract(s)/Grant(s): NCC3-763; WBS 22-714-30-09; No Copyright; Avail: CASI; A03, Hardcopy

Applications incorporating silicon carbide fiber reinforced silicon carbide matrix composites (CMC's) will require a wide range of fiber architectures in order to fabricate complex shape. The stress-strain response of a given SiC/SiC system for different architectures and orientations will be required in order to design and effectively life-model future components. The mechanism for non-linear stress-strain behavior in CMC's is the formation and propagation of bridged-matrix cracks throughout the composite. A considerable amount of understanding has been achieved for the stress-dependent matrix cracking behavior of SiC fiber reinforced SiC matrix systems containing melt-infiltrated Si. This presentation will outline the effect of 2D and 3D architectures and orientation on stress-dependent matrix-cracking and how this information can be used to model material behavior and serve as the starting point foe mechanistic-based life-models.
Author
Silicon Carbides; Ceramic Matrix Composites; Crack Propagation; Fiber Composites; Fabrication

20050051958 NASA Glenn Research Center, Cleveland, OH, USA
Role of Probabilistic Micromechanics Modeling in Establishing Design Allowables in Composites
Mital, Subodh K.; Keith, Theo G., Jr.; Murthy, Pappu L. N.; Brewer, David N.; January 2005; 18 pp.; In English; ASME Turbo Expo 2004, 14-17 Jun. 2004, Vienna, Austria
Contract(s)/Grant(s): WBS 22-714-30-09; No Copyright; Avail: CASI; A03, Hardcopy

One of the major challenges in designing with any new material, and particularly with advanced composite materials, is the fidelity of material design allowables. In the case of composite materials, the concern arises from the inherent nature of these materials, i.e., their heterogeneous make-up and the various factors that affect their properties in a specific design environment. Composites have various scales - micro, macro, laminate and structural, as well as numerous other fabrication related parameters. Many advanced composites in aerospace applications involve complex two- and three-dimensional fiber architectures and requires high-temperature processing. Since there are uncertainties associated with each of these, the observed behavior of composite materials shows scatter. Evaluating the effect of each of these variables on the observed scatter in composite properties solely by teSting is cost and time prohibitive. One alternative is to evaluate these effects by computational simulation. The authors have developed probabilistic composite micromechanics techniques by combining woven composite micromechanics and Fast Probability Integration (FPI) techniques to address these issues. In this paper these techniques will be described and demonstrated through selected examples. Results in the form of cumulative distribution

functions (CDF) of the composite properties of a MI (melt-infiltrated) SiC/SiC (silicon carbide fiber in a silicon carbide matrix) Composite will be presented. A CDF is a relationship defined by the value of the property (the response variable) with respect to the cumulative probability of occurrence. Furthermore, input variables causing scatter are identified and ranked based upon their sensitivity magnitude. Sensitivity information is very valuable in quality control. How these results can be utilized to develop design allowables so that these materials may be used by structural analysts/designers will also be discussed.
Author
Composite Materials; Laminates; Composite Structures; Distribution Functions; Aerospace Engineering

20050057089 QSS Group, Inc., Cleveland, OH, USA
On-Orbit Repair of RCC Structures
Singh, M.; [2004]; 22 pp.; In English; 7th National Thermal Protection System (TPS) Workshop, 31 Aug. - 2 Sep. 2004, Dayton, OH, USA
Contract(s)/Grant(s): NAS3-00145; 376-70-50; No Copyright; Avail: CASI; A03, Hardcopy

On-orbit repair technologies for reinforced carbon-carbon composite (RCC) structures are critically needed for space shuttle return to flight (RTF) efforts. These technologies are also critically needed for the repair and refurbishment of thermal protection system of future Crew Entry Vehicles (CEV) of space exploration programs. GRABER (Glenn Adhesive Refractory for Bonding and Exterior Repair) has shown multiuse capability for in-space repair of both large repairs and small cracks in space shuttle Reinforced Carbon Carbon (RCC) leading edge material. The concept consists of preparing an adhesive paste and then applying the paste tot he damaged/cracked area of the RCC composites with caulking gun. The adhesive paste cures at 100-120 C and transforms into a high temperature ceramic during vehicle re-entry conditions. Further development and testing are underway to optimize the materials properties and extend the application temperature.
Author
Carbon-Carbon Composites; Reinforcing Materials; Spacecraft Maintenance; Composite Structures; Technology Utilization; Space Shuttles

20050060646 QSS Group, Inc., Cleveland, OH, USA
Advanced Ceramic Matrix Composites with Multifunctional and Hybrid Structures
Singh, Mrityunajay; Morscher, Gregory N.; [2004]; 19 pp.; In English; International Conference on Engineering Ceramics (Encera 2004), 32 Oct. - 2 Nov. 2004, Osaka, Japan
Contract(s)/Grant(s): NAS3-00145; NCC3-763; 22-376-70-30; No Copyright; Avail: CASI; A03, Hardcopy

Ceramic matrix composites are leading candidate materials for a number of applications in aeronautics, space, energy, and nuclear industries. Potential composite applications differ in their requirements for thickness. For example, many space applications such as 'nozzle ramps' or 'heat exchangers' require very thin (\h 1 mm) structures whereas turbine blades would require very thick parts (\g or = 1 cm). Little is known about the effect of thickness on stress-strain behavior or the elevated temperature tensile properties controlled by oxidation diffusion. In this study, composites consisting of woven Hi-Nicalon (trademark) fibers a carbon interphase and CVI SiC matrix were fabricated with different numbers of plies and thicknesses. The effect of thickness on matrix crack formation, matrix crack growth and diffusion kinetics will be discussed. In another approach, hybrid fiber-lay up concepts have been utilized to 'alloy' desirable properties of different fiber types for mechanical properties, thermal stress management, and oxidation resistance. Such an approach has potential for the C(sub I)-SiC and SiC(sub f)-SiC composite systems. CVI SiC matrix composites with different stacking sequences of woven C fiber (T300) layers and woven SiC fiber (Hi-Nicalon (trademark)) layers were fabricated. The results will be compared to standard C fiber reinforced CVI SiC matrix and Hi-Nicalon reinforced CVI SiC matrix composites. In addition, shear properties of these composites at different temperatures will also be presented. Other design and implementation issues will be discussed along with advantages and benefits of using these materials for various components in high temperature applications.
Author
Ceramic Matrix Composites; Hybrid Structures; Thickness; Fiber Composites; Stress-Strain Relationships

20050060690 Ohio Aerospace Inst., Cleveland, OH, USA
Creep and Stress-Strain Behavior after Creep from SiC Fiber Reinforced, Melt-Infiltrated SiC Matrix Composites
Morscher, Gregory N.; Pujar, Vijay; [2004]; 10 pp.; In English; American Ceramics Society Fifth International Conference on High Temperature Ceramic Matrix Composites (HTCMC5), 12-16 Sep. 2004, Seattle, WA, USA
Contract(s)/Grant(s): NCC3-763; WBS 22-744-04-10; No Copyright; Avail: CASI; A02, Hardcopy

Silicon carbide fiber (Hi-Nicalon Type S, Nippon Carbon) reinforced silicon carbide matrix composites containing melt-infiltrated Si were subjected to creep at 1315 C for a number of different stress conditions, This study is aimed at understanding the time-dependent creep behavior of CMCs for desired use-conditions, and also more importantly, how the stress-strain response changes as a result of the time-temperature-stress history of the crept material. For the specimens that did not rupture, fast fracture experiments were performed at 1315 C or at room temperature immediately following tensile creep. In many cases, the stress-strain response and the resulting matrix cracking stress of the composite change due to stress-redistribution between composite constituents during tensile creep. The paper will discuss these results and its implications on applications of these materials for turbine engine components.
Author
Creep Properties; Stress-Strain Relationships; Silicon Carbides; Reinforcing Materials; Matrix Materials; Fiber Composites

20050061021 NASA Glenn Research Center, Cleveland, OH, USA
High Temperature Wear of Advanced Ceramics
DellaCorte, C.; January 2005; 1 pp.; In English; 2005 International Tribology Conference, 29 May - 2 Jun. 2005, Kobe, Japan
Contract(s)/Grant(s): WBS 22-714-09-17
Report No.(s): E-14970; No Copyright; Avail: CASI; A01, Hardcopy

It was initially hypothesized that advanced ceramics would exhibit favorable high te- friction and wear properties because of their high hot hardness and low achievable surface roughness welding observed in metals does not occur in ceramics. More recent tribological studies of many nitride, carbide, oxide and composite ceramics, however, have revealed that ceramics often exhibit high friction and wear in non-lubricated, high temperature sliding contacts. A summary is given to measure friction and wear factor coefficients for a variety of ceramics from self mated ceramic pin-on-disk tests at temperatures from 25 to up to 1200 C. Observed steady state friction coefficients range from about 0.5 to 1.0 or above. Wear factor coefficients are also very high and range from about to 10(exp -5) to 10(exp -2) cubic millimeters per N-m. By comparison, oil lubricated steel sliding results in friction coefficients of 0.1 or less and wear factors less than 10(exp -9) cubic millimeters per N-m.
Derived from text
Ceramics; High Temperature; Wear; Tribology

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INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20050041944 Battelle Memorial Inst., Columbus, OH, Pacific Northwest National Lab., Richland, WA, USA, National Energy Technology Lab., Pittsburgh, PA
Interaction of Rock Minerals with Carbon Dioxide and Brine: A Hydrothermal Investigation
Sass, B. M.; Gupta, N.; Engelhard, M. H.; Bergman, P.; Byrer, C.; 2004; In English
Report No.(s): DE2004-15007378; No Copyright; Avail: National Technical Information Service (NTIS)

This paper presents interim results of a feasibility study on carbon dioxide (CO2) sequestration in deep saline formations. The focus of the investigation is to examine factors that may affect chemical sequestration of CO2 in deep saline formations. Findings of the first phase of this investigation were presented in a topical report. Preliminary results of the second phase, now underway, have been reported elsewhere. Evaluations of the suitability of Mt. Simon formation for sequestering CO2 and economic issues are reported. This study is sponsored by the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) under a Novel Concepts project grant. The overall objectives of Phase II experiments were to determine: (1) the potential for long-term sequestration of CO(sub 2) in deep, regional host rock formations; and (2) the effectiveness of overlying caprock as a barrier against upward migration of the injected CO(sub 2). To meet these goals, experiments were conducted using rock samples from different potential host reservoirs and overlying rocks. In addition, pure mineral samples were used in some experimental runs to investigate specific mineralogical reactions. Due to space limitations, the scope of this paper will be limited to two types of equilibration experiments using pure minerals. Implications for more complex natural systems will be discussed in the report for Phase II being finalized at this time.
NTIS
Carbon Dioxide; Mineralogy; Minerals

20050041951 Michigan Univ., Ann Arbor, MI, USA

Understanding the Mechanisms Controlling Environmentally-Assisted Intergranular Cracking of Nickel-Base Alloys

Was, G. S.; Feb. 2004; In English

Report No.(s): DE2004-821304; No Copyright; Avail: National Technical Information Service (NTIS)

Creep and IG cracking of nickel-base alloys depend principally on two factors--the deformation behavior and the effect of the environment. We have shown that both contribute to the observed degradation in primary water. The understanding of cracking does not lie wholly within the environmental effects arena, nor can it be explained only by intrinsic mechanical behavior. Rather, both processes contribute to the observed behavior in primary water. In this project, we had three objectives: (1) to verify that grain boundaries control deformation in Ni-16Cr-9Fe at 360 C, (2) to identify the environmental effect on IGSCC, and (3) to combine CSLBs and GBCs to maximize IGSCC resistance in Ni-Cr-Fe in 360 C primary water. Experiments performed in hydrogen gas at 360 C confirm an increase in the primary creep rate in Ni-16Cr-9Fe at 360 C due to hydrogen. The creep strain transients caused by hydrogen are proposed to be due to the collapse of dislocation pile-ups, as confirmed by observations in HVEM. The observations only partially support the hydrogen-enhanced plasticity model, but also suggest a potential role of vacancies in the accelerate creep behavior in primary water.

NTIS

Deformation; Nickel Alloys; Mechanical Properties

20050041971 NASA Langley Research Center, Hampton, VA, USA

Review of HxPyOz-Catalyzed H + OH Recombination in Scramjet Nozzle Expansions; and Possible Phosphoric Acid Enhancement of Scramjet Flameholding, from Extinction of H3PO4 + H2 - Air Counterflow Diffusion Flames

Pellett, Gerald; January 2005; 16 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Recent detailed articles by Twarowski indicate that small quantities of phosphorus oxides and acids in the fuel-rich combustion products of H2 + phosphine (PH3) + air should significantly catalyze H, OH and O recombination kinetics during high-speed nozzle expansions -- to reform H2O, release heat, and approach equilibrium more rapidly and closely than uncatalyzed kinetics. This paper is an initial feasibility study to determine (a) if addition of phosphoric acid vapor (H3PO4) to a H2 fuel jet -- which is much safer than using PH3 -- will allow combustion in a high-speed scramjet engine test without adverse effects on localized flameholding, and (b) if phosphorus-containing exhaust emissions are environmentally acceptable. A well-characterized axisymmetric straight-tube opposed jet burner (OJB) tool is used to evaluate H3PO4 addition effects on the air velocity extinction limit (flame strength) of a H2 versus air counterflow diffusion flame. Addition of nitric oxide (NO), also believed to promote catalytic H-atom recombination, was evaluated for comparison. Two to five mass percent H3PO4 in the H2 jet increased flame strength 4.2%, whereas airside addition decreased it 1%. Adding 5% NO to the H2 caused a 2% decrease. Products of H-atom attack on H3PO4 produced an intense green chemiluminescence near the stagnation point. The resultant exothermic production of phosphorus oxides and acids, with accelerated H-atom recombination, released sufficient heat near the stagnation point to increase flame strength. In conclusion, the addition of H3PO4 vapor (or more reactive P sources) to hydrogen in scramjet engine tests may positively affect flameholding stability in the combustor and thrust production during supersonic expansion -- a possible dual benefit with system design / performance implications. Finally, a preliminary assessment of possible environmental effects indicates that scramjet exhaust emissions should consist of phosphoric acid aerosol, with gradual conversion to phosphate aerosol. This is compared to various natural abundances and sources.

Author

Catalysis; Counterflow; Diffusion Flames; Phosphoric Acid; Supersonic Combustion Ramjet Engines; Nozzle Geometry; Expansion; Recombination Reactions; Hydrogen; Hydroxides; Oxygen

20050041990 NASA Langley Research Center, Hampton, VA, USA

Fragmentation of 200 and 244 MeV/u Carbon Beams in Thick Tissue-Like Absorbers

Golovchenko, A. N.; Skvar, J.; Ili, R.; Sihver, L.; Bamblevski, V. P.; Tretyskova, S. P.; Schardt, D.; Tripathi, R. K.; Wilson, J. W.; Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms; 1999; Volume 159, No. 4, pp. 233-240; In English; Copyright; Avail: CASI; A03, Hardcopy

Stacks consisting of thin CR-39 sheets sandwiched between thick Lucite and water absorbers were perpendicularly bombarded by C-12 ions at 200 and 244 MeV/u. Track radius distributions representing the charge composition of the fragmented beams were automatically measured by a particle track analysis system. After analysis of the nuclear charge distributions, the total charge removal cross sections and elemental production cross sections of fragments with atomic numbers from 5 to 3, were obtained down to the lower energies (approximately 50 and 100 MeV/u, respectively). It has been found that the measured total charge removal cross section agrees with theoretical predictions within approximately 10% and

very well with previous experiments in corresponding energy regions. Two model calculations for production of B fragment are in good agreement with our measured data while a third model overestimates it by approximately 12%. Theoretical cross sections for Be and Li fragments differ strongly among the different models and from measured values.
Author
Fragmentation; Absorbers (Materials); Carbon 12; Mathematical Models; Beams (Radiation)

20050042006 Vista Engineering Technologies, LLC, Kennewick, WA, USA
Corrosion Monitoring of Plutonium Oxide and SNF
Douglas, D. G.; Haas, C. M.; Ohl, P. C.; 2003; 10 pp.; In English
Report No.(s): DE2004-825977; No Copyright; Avail: Department of Energy Information Bridge

While developing a method to measure pressure in totally sealed stainless steel containers holding spent nuclear fuel at the U.S. DOE Hanford Site, Vista Engineering Technologies, LLC (Vista Engineering) personnel adapted the central concept to corrosion monitoring techniques for the same containers. The ability to monitor corrosion within vessels containing spent nuclear fuel, plutonium and other hazardous materials is imperative for safe storage. Vista Engineering personnel have devised a way to monitor corrosion in a totally sealed stainless steel container using a Magnetically Coupled Corrosion Gauge (MCCG) Patent Pending. The MCCG can be used to detect corrosion as well as measure corrosion rate and does not require any penetration of the containment vessel, which minimizes pressure boundary surface area and sensitive weld materials in the vessels.
NTIS
Plutonium Oxides; Corrosion; Stainless Steels

20050042023 Nanjing Agricultural Univ., China, Missouri Univ., Columbia, MO, USA, Pacific Northwest National Lab., Richland, WA, USA
Influence of Illite and Kaolin on Chromium(VI) Reduction by Sulfide
Lan, Y.; Kim, C.; Deng, B.; Thornton, E. C.; Apr. 2004; In English
Report No.(s): DE2004-826001; No Copyright; Avail: National Technical Information Service (NTIS)

Use of hydrogen sulfide for reductive chromate immobilization requires us to understand how the minerals in the subsurface environment will affect the reaction. In this study, we examined the effects of illite and kaolin on the reduction of Cr(VI) by hydrogen sulfide under the anaerobic condition at pH ranging from 7.67 to 9.07. The results showed that extremely low concentration of iron dissolved from illite could greatly accelerate the rate of Cr(VI) reduction. An electron cycling process between Fe(II)/Fe(III) was believed to be responsible for the catalysis. The effect of iron could be completely blocked by phenanthroline that formed a strong complex with Fe(II). Elemental sulfur produced as a reaction product was also able to catalyze the reaction in the heterogeneous system. In the kaolin suspension, however, the effect of elemental sulfur could be completely eliminated because of the adsorption of elemental sulfur by kaolin.
NTIS
Illite; Minerals; Chromates; Water Pollution; Catalysts; Kaolinite

20050042025 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Data Preference PTE Ltd., Singapore, Electric Power Research Inst., Palo Alto, CA, USA, Academia Sinica, Shenyang, China
High Temperature Degradation by Erosion-Corrosion in Bubbling Fluidized Bed Combustors
Hou, P. Y.; MacAdam, S.; Niu, Y.; Stringer, J.; 2003; 18 pp.; In English
Report No.(s): DE2004-826095; No Copyright; Avail: Department of Energy Information Bridge

Heat-exchanger tubes in fluidized bed combustors (FBCs) often suffer material loss due to combined corrosion and erosion. Most severe damage is believed to be caused by the impact of dense packets of bed material on the lower parts of the tubes. In order to understand this phenomenon, a unique laboratory test rig at Berkeley was designed to simulate the particle hammering interactions between in-bed particles and tubes in bubbling fluidized bed combustors. In this design, a rod shaped specimen is actuated a short distance within a partially fluidized bed. The downward specimen motion is controlled to produce similar frequencies, velocities and impact forces as those experienced by the impacting particle aggregates in practical systems. Room temperature studies have shown that the degradation mechanism is a three-body abrasion process. This paper describes the characteristics of this test rig, reviews results at elevated temperatures and compares them to field experience. At higher temperatures, deposits of the bed material on tube surfaces can act as a protective layer. The deposition depended strongly on the type of bed material, the degree of tube surface oxidation and the tube and bed temperatures. With

HCl present in the bed, wastage was increased due to enhanced oxidation and reduced oxide scale adherence.
NTIS
Erosion; Carbon Steels; Combustion Chambers

20050042030 Helsinki Univ., Helsinki, Finland
Testing of CoTreat Inorganic Ion Exchange Media for the Removal of Co-60 from Thorp Pond Water
Harjula, R.; Paajanen, A.; Lehto, J.; Tusa, E.; Standring, P.; Feb. 2003; In English
Report No.(s): DE2004-825981; No Copyright; Avail: National Technical Information Service (NTIS)

CoTreat, a new inorganic ion exchange media, has been studied in the laboratory to support its application as a pre- coat to existing Funda filters in THORP feed pond plant (Sellafield, UK). This is a novel way of application of CoTreat, which is usually utilized in fixed-bed ion exchange columns in a granular form. The results present the effect of operating conditions (CoTreat dose, pond water chemistry) on CoTreat performance for the removal of Co-57 tracer from simulated pond water. Major findings include the strong dependence of Co-57 decontamination factor (DF) on feed activity. At the 200 Bq/L feed level, the observed DF was 10-20 but rose to 1000 and above when the feed level was increased to 20000 Bq/L. Calcium present in the feed was found to decrease the DF at concentrations higher than 1 ppm. The laboratory studies showed significantly higher DF's than what has been observed in large-scale THORP tests. This discrepancy is likely to be due to the technique used in applying the Co Treat layer to the Thorp HEFP Funda filter. Options for improving Co Treat performance (i.e. application technique) under Funda filter operating conditions are being investigated by BNFL based on this laboratory work.
NTIS
Cobalt 60; Decontamination; Ion Exchanging

20050042046 NASA Langley Research Center, Hampton, VA, USA
CARS Temperature and Species Concentration Measurements in a Supersonic Combustor with Normal Injection
Tedder, S. A.; OByrne, S.; Danehy, P. M.; Cutler, A. D.; [2005]; 16 pp.; In English; 43rd Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Report No.(s): AIAA Paper 2005-0616; Copyright; Avail: CASI; A03, Hardcopy

The dual-pump coherent anti-Stokes Raman spectroscopy (CARS) method was used to measure temperature and the absolute mole fractions of N2, O2 and H2 in a supersonic combustor. Experiments were conducted in the NASA Langley Direct-Connect Supersonic Combustion Test Facility. CARS measurements were performed at the facility nozzle exit and at three planes downstream of fuel injection. Processing the CARS measurements produced maps of the mean temperature, as well as quantitative N2 and O2 and qualitative H2 mean mole fraction fields at each plane. The CARS measurements were also used to compute correlations between fluctuations of the different simultaneously measured parameters. Comparisons were made between this 90 degree angle fuel injection case and a 30 degree fuel injection case previously presented at the 2004 Reno AIAA Meeting.
Author
Fuel Injection; Raman Spectroscopy; Temperature Measurement; Nitrogen; Hydrogen; Oxygen; Supersonic Combustion

20050051014 Louisville Univ., KY USA
A Novel Processing Technique for Growing Bulk Gallium Nitride Ingots From Gallium Melt
Sunkara, Mahendra K.; Li, Hongwei; Chandrasekaran, Hari; Vaddiraju, Sreeram; Dec. 2004; 47 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0310; Proj-3484
Report No.(s): AD-A428486; AFRL-SR-AR-TR-04-0646; No Copyright; Avail: CASI; A03, Hardcopy

In summary, a new process is being developed to obtain free standing, large area, near single crystal quality GaN flake (highly oriented GaN films) promising as native substrates for homoepitaxial growth of device quality, low-defect density GaN layers. However, the experiments to date resulted only in GaN flakes of sizes around 1 sq cm due to the following reasons: (a) the wetting and flow of molten Ga affected the flatness of the Ga film surfaces during the nucleation and coalescence of GaN crystals (b) the flow of Ga through cracks or discontinuities within the films limited the area of highly oriented GaN films. Currently, two types of experiments involving substrate stage rotation and in-Situ Ga delivery are being conducted to overcome the above difficulties. Similarly, MOCVD deposition studies onto GaN flakes are planned for making several mm thick ingots.
DTIC
Gallium; Gallium Nitrides; Ingots

20050051086 Montana State Univ., Bozeman, MT USA

Ultra-Stable Gallium Nitride and Infrared Laser Frequency Standards Based on Spectral Hole Burning

Cone, Rufus L.; Nov. 2004; 89 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0314

Report No.(s): AD-A428621; AFRL-SR-AR-TR-04-0634; No Copyright; Avail: CASI; A05, Hardcopy

Our development of compact optical frequency standards and stable lasers opens new applications particularly to vibrometry and analog optical signal processing with high bandwidth and time-bandwidth products. Lasers are stabilized to spectral holes' as frequency references; devices deliver 20 Hz range stability potentially in compact packages. We stabilized diode lasers at 1.5 micron communication wavelengths, developed and characterized devices, and worked to develop compact packages for advanced systems. Hole burning materials were designed and identified that produce frequency references in the infrared, visible, and near ultraviolet spectral ranges. Frequency standards are programmable, readily mass produced, and transportable; multiple frequency values or intervals can be programmed in the same piece of material. We have state of the art facilities for spectroscopy, development, and characterization of optical materials. We have defined the limits of precision in optical spectroscopy of solids (73Hz). Scientific Materials Corporation of Bozeman, MT, is a partner in materials development, allowing for rapid refinement of new materials and material concepts. Training of optics professionals is a basic part of this project and encompasses undergraduate and graduate students and post-doctoral fellows. Graduates from our laboratory have become DoD contractors, industrial scientists, faculty, and scientists at national labs.

DTIC

Frequency Standards; Gallium Nitrides; Hole Burning; Infrared Lasers; Laser Outputs; Semiconductor Lasers; Spectra; Vibration Meters

20050051098 Iowa Univ., Iowa City, IA USA

Investigation of Nitrogen-Rich Carbon Nitride Networks as Redox-Active Metal Catalyst Support Materials

Gillan, Edward; Leddy, Johna; Miller, Dale; Dunwoody, Drew; Oct. 2004; 28 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0274

Report No.(s): AD-A428642; ARO-45456.1-CH; No Copyright; Avail: Defense Technical Information Center (DTIC)

This one-year feasibility study was designed to examine the thermal, chemical, and electrochemical properties of novel nitrogen-rich carbon nitride (C(sub 3)N(sub 4+x)) network materials for use as catalysts in proton exchange membrane (PEM) fuel cell electrodes. We have produced carbon nitride materials and carbon composites thereof; particularly we discovered a rapid, facile method to make carbon nitride carbon black composites in a single step. This in-situ method is an effective strategy to produce homogeneous electrically conducting composite materials. As expected, the electrical conductivity of the semiconducting carbon nitride greatly improves when it is mixed with conducting carbon black. We have determined that carbon nitride and its composites with carbon black are electrochemically inert in neutral and acidic environments and do not impede oxidation-reduction reactions. Catalytically active metals were deposited onto the carbon nitride powders using solution and hydrogen reduction strategies. Platinum metal containing carbon nitrides showed appreciable electroactivity in O2, CO and methanol aqueous environments. In some cases, the current densities achieved for these Pt-carbon nitride composites exceed those observed for Pt on carbon obtained from commercial sources. Other metal catalysts such as Ni also showed promising electrochemical events in O2, CO, and methanol environments.

DTIC

Carbon Nitrides; Catalysts; Electrochemistry; Fuel Cells; Nitrides; Nitrogen; Oxidation-Reduction Reactions

20050051126 Florida Univ., Gainesville, FL USA

III-Nitride Metalorganic Chemical Vapor Deposition System for Development of High Power Electronics

Bernathy, Cammy R.; Nov. 2004; 20 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0275

Report No.(s): AD-A428701; AFRL-SR-AR-TR-04-0621; No Copyright; Avail: CASI; A03, Hardcopy

This award provided funding to purchase a new metal organic chemical vapor deposition (MOCVD) system for growth of GaN-based materials and devices. By combining the money provided by the DURIP award with donations from industry and matching funds from the University of Florida, an epitaxial facility worth $1 M has been constructed. This facility will be used to provide device structures for fabrication of high power GaN-based HEMTs and MOSFETs. This facility will benefit multiple DOD programs including two currently funded by the electronics programs at the U.S. Office of Naval Research (Development Of GaN MOSFETS And MISFETS, US Navy NOOOl4-98-l-0204, Dr. Harry Dietrich) and the U. S. Air Force Office of Scientific Research (Development Of Passivation Technology For Improved GaN/AlGaN HEMT Performance And

Reliability, U. S. Air Force F4962O-O2-l-0366, Dr. Gerald Witt). These contracts are aimed at developing improved dielectrics for high power GaN devices and to date have produced significant advances in the quality and effectiveness of dielectric/GaN interfaces. Because of this award, we can now capitalize on the successful oxide development generated by these programs. This equipment will provide a controlled in-house supply of GaN/AlGaN device material in order to identify much more precisely the role of a variety of material parameters as well as device layer structure in the performance of devices containing oxide/nitride interfaces. Acquisition of this system will also enable new avenues of investigation including resistance to thermal, electrical and radiation degradation for both all-nitride and nitride/oxide devices. Finally, acquisition of this MOCVD system will now allow development of a well controlled in-house device technology of the type needed to fabricate more advanced structures and prototypes including ultra-broadband high power and high dynamic range direct- conversion RF transmitters and high temperature III-nitride based gas sensors.
DTIC
Metalorganic Chemical Vapor Deposition; Nitrides; Systems Engineering; Vapor Deposition

20050051220 Freie Univ., Berlin, Germany
International Conference on Low Temperature Chemistry, LTC5, (5th) Held in Berlin-Dahlem, Germany on September 7-10, 2004. Final Proceedings Abstracts
Schwentner, Nikolaus; Twesten, Ingeborg; Sep. 2004; 124 pp.; In English
Contract(s)/Grant(s): FA8655-04-1-5082
Report No.(s): AD-A428858; EOARD-CSP-04-5082; No Copyright; Avail: Defense Technical Information Center (DTIC)
The Final Proceedings for Fifth International Conference on Low Temperature Chemistry (LTC5) 7 September 2004 - 10 September 2004. The proceedings are abstracts only. Topics covered include: Quantum solid: hydrogens and condensates, Quantum liquid: helium and nanodroplets, Tunneling and transport processes, Coherence and quantum chemical dynamics, Dynamics and femtochemistry, STM induced chemistry, Chemistry on surfaces and in nano materials, Reactions in clusters, Matrix isolation, Rare gas compounds, Cooled biomolecules, Astro- and stratospheric chemistry.
DTIC
Abstracts; Conferences; Germany; Low Temperature

20050051235 Naval Research Lab., Washington, DC USA
Sensitive Capillary Electrophoresis Microchip Determination of Trinitroaromatic Explosives in Nonaqueous Electrolyte Following Solid Phase Extraction
Lu, Qin; Collins, Greg E.; Smith, Matthew; Wang, Joseph; Jul. 2002; 8 pp.; In English
Report No.(s): AD-A428880; No Copyright; Avail: CASI; A02, Hardcopy
A capillary electrophoresis (CE) microchip is utilized for the sensitive separation and detection of three trinitroaromatic explosives: 1,3 5-trinitrotoluene (TNT), 1,3 ,5-trinitrobenzene (TNB) and 2,4,6-trinitrophenyl-N-methylnitramine (tetryl), in the presence of 10 other explosives and explosive derivatives in nonaqueous electrolyte (acetonitrile/methanol 87.5/12.5 (v/v), 2. 5 mM NaOH, 1 mM sodium dodecyl sulfate (sDs)). The chemical reaction of bases, e.g. hydroxide or methoxide ions, with trinitroaromatic compounds forms red colored derivatives that can be easily detected using a green light emitting diode (LED) on the microchip. Two surfactants bearing opposite charge, cetyltrimethylammonium bromide (CTAB) and SDS are compared with respect to their effect on separation times, detection limits and resolving powers for separating these explosives. All microchip separations were achieved in \h20s. In the absence of solid phase extraction (SPE), the detection limits obtained for the trinitroaromatic explosives were as follows: TNB, 60 mug/l; TNT, 160 mug/l and tetryl, 200 mug/l.
DTIC
Chips (Electronics); Electrophoresis; Explosives; Extraction; Nonaqueous Electrolytes; Sensitivity; Solid Phases

20050051251 New Mexico Univ., Albuquerque, NM USA
Infrared Stark Effect Spectroscopy for Interface Characterization
Niemozyk, Thomas M.; Nov. 2002; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428899; ARO-40036-MS; No Copyright; Avail: Defense Technical Information Center (DTIC)
The aim of this project is to develop a technique that can be used to obtain information concerning the formation of chemical bonds, which relate to adhesion strength, at interfaces. The technique being developed is based on the application of a large electric field in the interface region of a multiplayer structure, and then using the field to Stark shift the infrared signals from the chemical bonds between the layers. Much of the work conducted over this report period was focused on improving the signal-to-noise ratio performance of the Stark shift infrared spectrometer. Significant noise sources were

identified and a new interleaved operational mode of the spectrometer implemented that avoids the largest of the noise components. We also discuss the use of an epitaxially grown layer of silicon as an adhesion layer for structures consisting of a silica sol-gel film on a crystalline germanium substrate. The very thin silicon layer does not measurably affect the optical properties of these composite systems and solves the delamination problem that has limited the utility of these structures. We are now focusing on the application of the new infrared technique to polymer/metal systems and to the study of self-assembled monolayer systems with unique properties such as temperature driven phase transitions.
DTIC
Characterization; Chemical Bonds; Human-Computer Interface; Infrared Spectroscopy; Stark Effect

20050051403 NASA Kennedy Space Center, Cocoa Beach, FL, USA
High Temperature Decomposition of Hydrogen Peroxide
Parrish, Clyde F., Inventor; September 21, 2004; 7 pp.; In English
Patent Info.: Filed 6 Dec. 2001
Report No.(s): US-Patent-6,793,903; US-Patent-Appl-SN-014140; NASA-Case-KSC-12235; US-Patent-Appl-SN-276260; No Copyright; Avail: CASI; A02, Hardcopy

Nitric oxide (NO) is oxidized into nitrogen dioxide (NO2) by the high temperature decomposition of a hydrogen peroxide solution to produce the oxidative free radicals, hydroxyl and hydropemxyl. The hydrogen peroxide solution is impinged upon a heated surface in a stream of nitric oxide where it decomposes to produce the oxidative free radicals. Because the decomposition of the hydrogen peroxide solution occurs within the stream of the nitric oxide, rapid gas-phase oxidation of nitric oxide into nitrogen dioxide occurs.
Official Gazette of the U.S. Patent and Trademark Office
High Temperature; Nitric Oxide; Nitrogen Dioxide; Oxidation; Decomposition; Hydrogen Peroxide

20050051553 Naval Undersea Warfare Center, Newport, RI USA
Method to Accelerate Wetting of an Ion Exchange Membrane in a Semi-Fuel Cell
Carreiro, Louis G., Inventor; Aug. 2004; 10 pp.; In English
Report No.(s): AD-D020166; No Copyright; Avail: CASI; A02, Hardcopy

A new treatment method for ion exchange membranes used in semi-fuel cells that accelerates the wetting of the membranes by aqueous electrolyte solutions, thus reducing the start up time for metal/hydrogen peroxide-based semi-fuel cells. Specifically, a Nafion(registered) membrane that is intended for dry a storage in a semi-fuel cell is treated with glycerin (glycerol) to enhance its rate of absorption of electrolyte solution when the semi-fuel cell is activated.
DTIC
Fuel Cells; Glycerols; Ion Exchange Membrane Electrolytes; Ion Exchanging; Polymers; Wetting

20050051585 NASA Glenn Research Center, Cleveland, OH, USA
Organic Modification of a Layered Silicate by Co-Ion Exchange of an Alkyl Ammonium and a Mono-Protonated Diamine
Campbell, Sandi G., Inventor; December 07, 2004; 9 pp.; In English
Patent Info.: Filed 20 Sep. 2002; US-Patent-6,828,367; US-Patent-Appl-SN-251195; NASA-Case-LEW-17339-1; No Copyright; Avail: CASI; A02, Hardcopy

Co-Ion exchange of the interlayer cations of a layered silicate with a mono-protonated aromatic diamine and an alkyl ammonium ion into the silicate galleries. The presence of the alkyl ammonium ion provides low oligomer melt viscosity during processing. The presence of the diamine allows chemical reaction between the silicate surface modification and the monomers. This reaction strengthens the polymer silicate interface, and ensures irreversible separation of the individual silicate layers. Improved polymer thermal oxidative stability and mechanical properties are obtained.
Official Gazette of the U.S. Patent and Trademark Office
Alkyl Compounds; Ammonia; Diamines; Ion Exchanging; Silicates

20050051643 Defence Research and Development Suffield, Suffield, Alberta Canada
Long-Term Sequelae From Acute Exposure to Chlorine Gas: A Review
Bjarnason, Stephen G.; Sep. 2004; 27 pp.; In English
Contract(s)/Grant(s): ST000016QB40
Report No.(s): AD-A428860; DRDC-SUFFIELD-TM-2004-163; No Copyright; Avail: CASI; A03, Hardcopy

Chlorine (Cl2; CASRN 7782-50-5) was the first gas to be used as a chemical warfare agent during the First World War and is widely utilized today in industry (e.g. oxidizing agent in water treatment; pulp mills). The immediate effects from acute exposure are well documented but the long term sequelae from an acute exposure are not well understood. Several studies were reviewed that discuss the long term outcome of an acute exposure to chlorine gas and their conclusions appear contradictory. This may be due to different endpoints being assessed, to the existence of lung diseases prior to exposure, or even the effects of smoking. The concentration and duration of chlorine exposure would also play a role in the potential for long term sequelae and few of the studies reviewed provided this information. Animal inhalation toxicology experiments that studied the potential for long term effects after an acute exposure to chlorine noted that the observed effects may resolve over time. An intrinsic limitation of animal studies is the difficulty of extrapolating to humans. Thus, from peer-review human and animal literature, it is difficult to conclusively determine if there are long term effects after an acute exposure to chlorine gas. DTIC

Chlorine; Exposure; Toxicity

20050051733 NASA Glenn Research Center, Cleveland, OH, USA

Oxidation of ZrB2-and HIB2-Based Ultra-High Temperature Ceramics: Effects of Ta Additions

Opila, Elizabeth; Levine, Stanley; Lorinez, Jonathan; [2003]; 33 pp.; In English; Ultra High Temperature Ceramics Program Review, AFOSR, 5-7 Nov. 2003, Wintergreen, VA, USA

Contract(s)/Grant(s): 794-40-4S; Copyright; Avail: CASI; A03, Hardcopy

Several compositions of ZrB2- and HfB2-based Ultra-High Temperature Ceramics (UHTC) were oxidized in stagnant air at 1627 C in ten minute cycles for times up to 100 minutes. These compositions include: ZrB2 - 20v% SiC, HfB2 - 20v% SiC, ZrB2 - 20v% SiC - 20v% TaSi2, ZrB2 - 33v% SiC, HfB2 - 20v% SiC - 20v% TaSi2, and ZrB2 - 20v% SiC - 20v% TaC. The weight change due to oxidation was recorded. The ZrB2 - 20v% SiC - 20v% TaSi2 composition was also oxidized in stagnant air at 1927 C and in an arc jet atmosphere. Samples were analyzed after oxidation by x-ray diffraction, field emission scanning electron microscopy, and energy dispersive spectroscopy to determine the reaction products and to observe the microstructure. The ZrB2 - 20v% SiC - 20v% TaSi2 showed the lowest oxidation rate at 1627 C, but performed poorly under the more extreme tests due to liquid phase formation. Effects of Ta-additions on the oxidation of the diboride-based UHTC are discussed. Author

Oxidation; Zirconium Compounds; Tantalum; Hafnium Compounds; Ceramics; Refractory Materials; Borides

20050051841 Institute of Atomic Energy, Beijing, China

Study of Radioiodine Sorption and Diffusion on Minerals

Feb. 2002; 18 pp.; In English

Report No.(s): DE2004-828334; No Copyright; Avail: Department of Energy Information Bridge

In this paper, the performance of adsorbing and retarding 125I (substituted for 129I) for mixed minerals as buffer, backfill material was investigated. The distribution coefficient Kds by batch sorption experiments were determined for four kinds of minerals and one kind of bentonite under atmosphere. Sorption and desorption of radioiodine on several minerals were studied under low oxygen ambience at first time in the domestic, and apparent diffusion coefficient Da of 125I- was determined for mixed minerals under atmosphere. NTIS

Iodine; Sorption; Diffusion Coefficient; Minerals

20050051842 SIA Radon, Moscow, Russia

Mathematical Simulation of the Gas-Particles Reaction Flows in Incineration of Metal-Containing Waste

Ojovan, M. I.; Klimov, V. L.; Karlina, O. K.; Feb. 2002; 12 pp.; In English

Report No.(s): DE2004-828318; No Copyright; Avail: Department of Energy Information Bridge

A quasi-equilibrium approach for thermodynamic calculation of chemical composition and properties of metal-containing fuel combustion products has been developed and used as a part of the mathematical model of heterogeneous reacting flow which carry burning and/or evaporating particles. By using of this approach, the applicable mathematical model has been devised, which allows defining the change in chemical composition and thermal characteristics of combustion products along the incineration chamber. As an example, the simulation results of the reacting flow of magnesium-sodium nitrate-organic mixture are presented. The simulation results on the gas phase temperature in the flow of combustion products are in good agreement with those obtained experimentally. NTIS

Chemical Composition; Mathematical Models; Gas Flow; Incinerators; Waste Disposal

20050051855 Academy of Sciences (Russia), Moscow, Russia
Processing NPP Bottoms by Ferrocyanide Precipitation
Slastennikov, S. A. E.; Sinyakin, Y. T.; 2002; 14 pp.; In English
Report No.(s): DE2004-828291; No Copyright; Avail: Department of Energy Information Bridge

The purpose of work is a laboratory test of a technological scheme for cleaning bottoms from radionuclides by use of ozonization, ferrocyanide precipitation, filtration and selective sorption. At carrying out the ferrocyanide precipitation after ozonization, the specific activity of bottoms by Cs-137 is reduced in 100-500 times. It has been demonstrated that the efficiency of ferrocyanide precipitation depends on the quality of consequent filtration. Pore sizes of a filter has been determined to be less than 0.2 microns for complete separation of ferrocyanide residue. The comparison of two technological schemes for cleaning bottoms from radionuclides, characterized by presence of the ferrocyanide precipitation stage has been performed. Application of the proposed schemes allows reducing volumes of radioactive waste in many times.
NTIS
Cleaning; Radioactive Wastes; Cesium 137

20050051930 Southwest Research Inst., San Antonio, TX, Clock Spring Co., L.P., Houston, TX, USA
Monitoring Technology for Early Detection of Internal Corrosion for Pipeline Integrity
Light, G. M.; Kim, S. Y.; Spinks, R. L.; Kwun, H.; Porter, P. C.; 2003; In English
Report No.(s): DE2004-825854; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the laboratory and field evaluation of a technology called 'magnetostrictive sensor (MsS)' for monitoring and early detection of internal corrosion in known susceptible sections of transmission pipelines. With the MsS technology a pulse of a relatively low frequency (typically under 100-kHz) mechanical wave (called guided wave) is launched along the pipeline and signals reflected from defects or welds are detected at the launch location in the pulse-echo mode. This technology can quickly examine a long length of piping for defects, such as corrosion wastage and cracking in circumferential direction, from a single test location, and has been in commercial use for inspection of above-ground piping in refineries and chemical plants. The MsS technology is operated primarily in torsional guided waves using a probe consisting of a thin ferromagnetic strip (typically nickel) bonded to a pipe and a number of coil-turns (typically twenty or so turns) wound over the strip. The MsS probe is relatively inexpensive compared to other guided wave approaches, and can be permanently mounted and buried on a pipe at a modest cost to allow long-term periodic data collection and comparison for accurate tracking of condition changes for cost-effective assessment of the integrity of the susceptible sections of pipeline.
NTIS
Corrosion; Detection; Pipelines

20050051941 North Dakota Univ., Grand Forks, ND, USA
Corrosion of High-Temperature Alloys
Hurley, J. P.; Kay, J. P.; Oct. 1999; 24 pp.; In English
Report No.(s): DE2004-824979; No Copyright; Avail: Department of Energy Information Bridge

Five alloys were tested in the presence of water vapor and water vapor with HCl for 1000 hours using simulated combustion gas. Samples were removed at intervals during each test and measured for determination of corrosion rates. One sample of each alloy was examined with a SEM after the completion of each test. Cumulative corrosion depths were similar for the superstainless alloys. Corrosion for Alloy TP310 roughly doubled. Corrosion for the enhanced stainless alloys changed dramatically with the addition of chlorine. Corrosion for Alloy RA85H increased threefold, whereas Alloy TP347HFG showed an eightfold increase. SEM examination of the alloys revealed that water vapor alone allowed the formation of chromium oxide protective layers on the superstainless alloys. The enhanced stainless alloys underwent more corrosion due to greater attack of sulfur. Iron-rich oxide layers were more likely to form, which do not provide protection from further corrosion. The addition of chlorine further increased the corrosion because of its ability to diffuse through the oxide layers and react with iron. This resulted in a broken, discontinuous, and loose oxide layer that offered less protection. Niobium, although added to aid in creep strength, was found to be detrimental to corrosion resistance. The niobium tended to be concentrated in nodules and was easily attacked through sulfidation, providing conduits for further corrosion deep into the alloy. The alloys that displayed the best corrosion resistance were those which could produce chromium oxide protective layers.
NTIS
Corrosion; Corrosion Resistance; Heat Resistant Alloys

20050051950 Department of Energy, Aiken, SC, USA

Savannah River Site High Level Waste Salt Disposition Systems Engineering Team. Position Paper on Sludge Batch 2 Qualification Strategy and Simulant Composition

May 2000; 30 pp.; In English

Report No.(s): DE2004-786669; HLW-SDT-2000-00128; No Copyright; Avail: Department of Energy Information Bridge

In early calendar year 2001 the Defense Waste Processing Facility (DWPF) will begin processing sludge batch 2. Prior to receiving this sludge, the batch will be qualified by testing with non-radioactive simulants and process simulation with the actual waste. This report targets the sludge compositions used for glass testing (the 'Variability Study'), cold process simulation and makes recommendations as to sampling and qualification strategy. The overall strategy is to base the variability study and non-radioactive processing compositions on the information in the HLW Database.

NTIS

Sludge; Glass; Tests

20050051957 Pacific Northwest National Lab., Richland, WA, USA

Subsurface Flow and Transport Experimental Laboratory: A New Department of Energy User's Facility for Intermediate-Scale Experimentation

Oostrom, M.; Wietsma, T. M.; Foster, N. S.; 2004; In English

Report No.(s): DE2004-15007645; No Copyright; Avail: National Technical Information Service (NTIS)

Intermediate-scale experiments (ISEs) for flow and transport are a valuable tool for simulating subsurface features and conditions encountered in the field at government and private sites. ISEs offer the ability to study, under controlled laboratory conditions, complicated processes characteristic of mixed wastes and heterogeneous subsurface environments, in multiple dimensions and at different scales. ISEs may, therefore, result in major cost savings if employed prior to field studies. A distinct advantage of ISEs is that researchers can design physical and/or chemical heterogeneities in the porous media matrix that better approximate natural field conditions and therefore address research questions that contain the additional complexity of processes often encountered in the natural environment. A new Subsurface Flow and Transport Experimental Laboratory (SFTEL) has been developed for ISE users in the Environmental Molecular Sciences Laboratory (EMSL) at Pacific Northwest National Laboratory (PNNL). The SFTEL offers a variety of columns and flow cells, a new state-of-the-art dual-energy gamma system, a fully automated saturation-pressure apparatus, and analytical equipment for sample processing. The new facility, including qualified staff, is available for scientists interested in collaboration on conducting high-quality flow and transport experiments, including contaminant remediation. Close linkages exist between the SFTEL and numerical modelers to aid in experimental design and interpretation. In this paper, the new facility and recently conducted research are described.

NTIS

Environmental Laboratories; Experiment Design; Contaminants

20050051968 Montpellier Univ., France

Temperature and Pollution Control in Flames

Debiane, L.; Ivorra, B.; Mohammadi, B.; Nicoud, F.; Ern, A.; Poinsot,T.; Pitsch, H.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 367-375; In English; See also 20050051959; No Copyright; Avail: CASI; A02, Hardcopy

Controlling flame shapes and emissions is a major objective for all combustion engineers. Considering the complexity of reacting flows, novel optimization methods are requried: this paper explores the application of control theory for partial differential equations to combustion. Both flare temperature and pollutant levels are optimized in a laminar Bunsen burner computed with complex chemistry schemes. The optimization procedure is coupled with mesh adaptation to provide grid-independent results. Finally, a recursive semi-deterministic global optimization approach is tested.

Author

Combustion Chemistry; Flame Temperature; Temperature Control; Pollution Control; Flames; Control Theory

20050060627 NASA Glenn Research Center, Cleveland, OH, USA

Thermodynamics of the Si-O-H System

Jacobson, Nathan S.; Opila, Elizabeth J.; Myers, Dwight; Copland, Evan; [2004]; 17 pp.; In English; Gordon Research Conference on High Temperature Materials, Processes and Diagnostics, 1-6 Aug. 2004, Waterville, ME, USA

Contract(s)/Grant(s): WBS 22-714-30-05

Report No.(s): E-14940; Copyright; Avail: CASI; A03, Hardcopy

Thermodynamic functions for Si(OH)4(g) and SiO(OH)2(g) have been measured using the transpiration method. A second law enthalpy of formation and entropy and a third law enthalpy of formation has been calculated for Si(OH)4. The results are in very good agreement with previous experimental measurements, ab-initio calculations, and estimates.
Author
Thermodynamics; Physical Chemistry; Silicon Compounds; Hydroxyl Compounds; Molecular Dynamics

20050060633 West Virginia Univ., Morgantown, WV, USA
Production of Foams, Fibers and Pitches using a Coal Extraction Process
Chen, C.; Kennel, E. B.; Magean, L.; Stansberry, P. G.; 2004; In English
Report No.(s): DE2004-827482; No Copyright; Avail: National Technical Information Service (NTIS)

This Department of Energy National Energy Technology Laboratory sponsored project developed processes for converting coal feedstocks to carbon products, including coal-derived pitch, coke foams and fibers based on solvent extraction processes. A key technology is the use of hydrogenation accomplished at elevated temperatures and pressures to obtain a synthetic coal pitch. Hydrogenation, or partial direct liquefaction of coal, is used to modify the properties of raw coal such that a molten synthetic pitch can be obtained. The amount of hydrogen required to produce a synthetic pitch is about an order of magnitude less than the amount required to produce synthetic crude oil. Hence the conditions for synthetic pitch production consume very little hydrogen and can be accomplished at substantially lower pressure. In the molten state, hot filtration or centrifugation can be used to separate dissolved coal chemicals from mineral matter and insolubles (inertinite), resulting in the production of a purified hydrocarbon pitch.
NTIS
Coal; Solvent Extraction

26
METALS AND METALLIC MATERIALS

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

20050041978 California Inst. of Tech., Pasadena, CA
Improved Processes to Remove Naphthenic Acids. Annual Technical Progress Report
Zhang, A.; Ma, Q.; Goddard, W. A.; Tang, Y.; Apr. 28, 2004; In English
Report No.(s): DE2004-825290; No Copyright; Avail: National Technical Information Service (NTIS)

In the first year of this project, we have established our experimental and theoretical methodologies for studies of the catalytic decarboxylation process. We have developed both glass and stainless steel micro batch type reactors for the fast screening of various catalysts with reaction substrates of model carboxylic acid compounds and crude oil samples. We also developed novel product analysis methods such as GC analyses for organic acids and gaseous products; and TAN measurements for crude oil. Our research revealed the effectiveness of several solid catalysts such as NA-Cat-1 and NA-Cat-2 for the catalytic decarboxylation of model compounds; and NA-Cat-5(approx)NA-Cat-9 for the acid removal from crude oil.
NTIS
Carboxylic Acids; Decarboxylation

20050042018 California Univ., Berkeley, CA, Stanford Linear Accelerator Center, CA, USA
Mn Oxide Biogenesis and Metal sequestration in the Presence of CO (II) and CU (II) By Bacillus SG-1 Bacterial Spores
Bayat, N.; 2004; 20 pp.; In English
Report No.(s): DE2004-826724; SLAC-PUB-9393; No Copyright; Avail: Department of Energy Information Bridge

Mn oxides play an important role in degrading contaminants and cycling nutrients in soils and natural waters. The process in which Mn (II) oxidizes to form MnO, is slow; however, Bacillus SG-1 bacterial spores can catalyze the process and allow it to proceed up to five orders of magnitude faster. This experiment explored the affects of co-ion metal concentrations on Biogenic Mn oxide production and their ability to sequester metal cations. Spore solutions were prepared with different ratios of Metal (II): Mn (II) added over a three-week period; this was done separately for Co (II) and Cu (II). The copper solutions were analyzed with ICP/AES to check for the amount of copper and manganese left in solution after biogenic MnO, production. ICP/AES was used to analyze the ratio of Co: Mn in spores where Co was the co-ion metal. Observations showed very little dissolved Cu and Mn exist in solutions with low copper concentrations, but a large amount of Cu and Mn were left in solutions where higher Cu concentrations were used. This shows that high Cu concentration inhibits biogenic Mn oxide production and Cu sequestration. For the experiments with Co as the co-ion metal, it was observed that the ratio of Co: Mn

in the spores is relatively similar to the ratios added; however, an exception to this rule was experiments where high concentrations of Co were used. The inconsistency in Co: Mn ratios at high Co concentrations showed that high Co concentrations also inhibit biogenic Mn oxide production.
NTIS
Manganese; Oxides; Bacteria; Biological Evolution

20050051143 Michigan State Univ., East Lansing, MI USA
Mesoscopic Measurement and Modeling of Slip Transfer Across Boundaries in Anisotropic Metallic Systems
Beiler, Thomas R.; Jan. 2001; 12 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0116
Report No.(s): AD-A428729; AFRL-SR-AR-TR-04-0649; No Copyright; Avail: CASI; A03, Hardcopy

An integrated experimental and theoretical approach to measure and model deformation transfer and microcrack initiation at grain boundaries is being developed. Electron channeling contrast imaging (ECCI) was used to directly image deformation defects associated with strain transfer and/or crack nucleation at grain boundaries. ECCI observations were correlated with mesoscale crystallographic texture information measured by selected area channeling patterns (SACPs), electron backscattered diffraction (EBSD) and x-ray texture measurements. To interpret and model these observed grain boundary deformation and strain accommodation phenomena, a nonlinear variational model of plastic deformation in a bicrystal that couples bulk grain deformation with compatibility enforced at the grain boundary was partially developed.
DTIC
Anisotropy; Grain Boundaries; Imaging Techniques; Microcracks; Plastic Deformation

20050051173 Defense Science Board, Washington, DC USA
Defense Science Board Report on Corrosion Control
Oct. 2004; 94 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428767; No Copyright; Avail: Defense Technical Information Center (DTIC)

Weapons system readiness and safety are among the highest priority challenges for the Department of Defense (DoD). As it continues to receive a large number of mission taskings, it is imperative that DoD equipment be maintained at an acceptable level of material condition so that it may be employed safely and effectively when required, often in harsh and physically demanding environments. However, both the material condition and safety of DoD equipment are routinely being undermined by the effects of corrosion. The dollar cost of corrosion to DoD has been estimated by the Government Accountability Office (GAO) to be $10-20 billion per year. Aggressive action is needed at every stage in the life cycle of this equipment during design, materials selection, construction, operation, and maintenance to reduce the negative effects of corrosion. At the request of the Acting Under Secretary of Defense for Acquisition, Technology and Logistics (USDAT&L) and the Deputy Under Secretary of Defense for Logistics and Materiel Readiness, the Defense Science Board (DSB) formed a task force to address corrosion control efforts within the DoD. There are two major areas of concern with respect to corrosion for DoD the Services' weapon systems, including platforms, electronics and munitions, and the supporting infrastructure, including facilities, bases, and ports. Due to the direct impact of weapon system corrosion on combat readiness, the Task Force focused its attention on the former, although both areas are critical to DoD, and much of the subsequent discussion applies to both.
DTIC
Corrosion; Corrosion Prevention; Logistics Management; Maintainability; Weapon Systems

20050051192 Air Force Research Lab., Wright-Patterson AFB, OH USA
Coarsening Behavior of an Alpha-Beta Titanium Alloy
Semiatin, S. L.; Kirby, B. C.; Salishchev, G. A.; Nov. 2004; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-M02R
Report No.(s): AD-A428814; AFRL-ML-WP-TP-2004-400; No Copyright; Avail: Defense Technical Information Center (DTIC)

The static-coarsening behavior of the alpha-beta titanium alloy, Ti-6Al-4V, was established via a series of heat treatments at typical forging-preheat and final-heat-treatment temperatures followed by quantitative metallography. For this purpose, samples of an ultra-fine-grain-size (UFG) billet with a microstructure of equiaxed alpha in a beta matrix were heated at temperatures of 843,900,955, and 982 C for times between 0.25 and 144 h followed by water quenching. The coarsening of the primary alpha particles was found to follow r3-vs-time kinetics, typical of volume-diffusion-controlled behavior, at the

three lower temperatures. At the highest temperature, the kinetics appeared to be fit equally well be an r3 of r4 dependence on time. The observations were interpreted in terms of the modified LSW theory considering the effects of volume fraction on kinetics and the fact that the phases are not terminal solid solutions. Prior models which take into account the overall source/sink effects of all particles on each other provided the best description of the observed dependence of coarsening on the volume fraction of primary alpha. In addition, the volume-diffusion kinetics derived for the UFG material were found to be capable of describing the coarsening behavior observed for industrial-scale billet of Ti-6Al-4V with a coarser starting equiaxed-alpha microstructure.
DTIC
Metallography; Microstructure; Titanium Alloys

20050051620 NASA Johnson Space Center, Houston, TX, USA
Heat Treatment of Friction Stir Welded 7X50 Aluminum
Petter, George E., Inventor; Figert, John D., Inventor; Rybicki, Daniel J., Inventor; Burnes, Timothy H., Inventor; October 12, 2004; 9 pp.; In English
Patent Info.: Filed 17 Mar. 2003; US-Patent-6,802,444; US-Patent-Appl-SN-390678; NASA-Case-MSC-23472-1; No Copyright; Avail: CASI; A02, Hardcopy

A method for treating alloy before and after friction stir welding, the method comprising the following steps. First solution heat treating a multiplicity of aluminum-zinc alloy engineered components for a first time period at a first temperature. First air cooling the components in ambient air at room temperatwe until the components are cooled to room temperature. Friction stir welding the components to form an assembly. Second solution heat treating the assembly for a second time period at a second temperature. Additional steps and embodiments are considered.
Official Gazette of the U.S. Patent and Trademark Office
Friction Stir Welding; Heat Treatment; Aluminum Alloys

20050051725 NASA Glenn Research Center, Cleveland, OH, USA
Cyclic Oxidation Modeling and Life Prediction
Smialek, James L.; [2004]; 8 pp.; In English; Conference on High Temperature Corrosion and Protection of Materials, 16-21 May 2004, Les Embiez, France
Contract(s)/Grant(s): 714-30-09; No Copyright; Avail: CASI; A02, Hardcopy

The cyclic oxidation process can be described as an iterative scale growth and spallation sequence by a number of similar models. Model input variable include oxide scale type and growth parameters, spalling geometry, spall constant, and cycle duration. Outputs include net weight change, the amounts of retained and spalled oxide, the total oxygen and metal consumed, and the terminal rates of weight loss and metal consumption. All models and their variations produce a number of similar characteristic features. In general, spalling and material consumption increase to a steady state rate, at which point the retained scale approaches a constant and the rate of weight loss becomes linear. For one model, this regularity was demonstrated as dimensionless, universal expressions, obtained by normalizing the variables by critical performance factors. These insights were enabled through the use of the COSP for Windows cyclic oxidation spalling program.
Author
Life (Durability); Oxidation; Mathematical Models; Spalling

20050051728 NASA Glenn Research Center, Cleveland, OH, USA
Atomistic Modeling of Pd Site Preference in NiTi
Bozzolo, Guillermo; Noebe, Ronald D.; Mosca, Hugo O.; [2004]; 31 pp.; In English
Contract(s)/Grant(s): WBS 708-04-03-05; Copyright; Avail: CASI; A03, Hardcopy

An analysis of the site subsitution behavior of Pd in NiTi was performed using the BFS method for alloys. Through a combination of Monte Carlo simulations and detailed atom-by-atom energetic analyses of various computational cells, representing compositions of NiTi with up to 10 at% Pd, a detailed understanding of site occupancy of Pd in NiTi was revealed. Pd subsituted at the expense of Ni in a NiTi alloy will prefer the Ni-sites. Pd subsituted at the expense of Ti shows a very weak preference for Ti-sites that diminishes as the amount of Pd in the alloy increases and as the temperature increases.
Author
Nickel Alloys; Titanium Alloys; Atomic Structure; Palladium Alloys

20050051738 Case Western Reserve Univ., Cleveland, OH, USA
Measuring the Thermodynamics of the Alloy/Scale Interface
Copland, Evan; October 2004; 9 pp.; In English; Symposium on High Temperature Corrosion and Materials Chemistry and Electrochemical Society 20th Meeting, 6-7 Oct. 2001, Honolulu, HI, USA
Contract(s)/Grant(s): NNC04AA7A; NCC3-850; WBS 22-714-30-05; No Copyright; Avail: CASI; A02, Hardcopy

A method is proposed for the direct measurement of the thermodynamic properties of the alloy and oxide compound at the alloy/scale interface observed during steady-state oxidation. The thermodynamic properties of the alloy/scale interface define the driving force for solid-state transport in the alloy and oxide compound. Accurate knowledge of thermodynamic properties of the interface will advance our understanding of oxidation behavior. The method is based on the concept of local equilibrium and assumes that an alloy+scale equilibrium very closely approximates the alloy/scale interface observed during steady-state oxidation. The thermodynamics activities of this alloy+scale equilibrium are measured directly by Knudsen effusion-cell mass spectrometer (KEMS) using the vapor pressure technique. The theory and some practical considerations of this method are discussed in terms of beta-NiAl oxidation.
Author
Thermodynamic Properties; Scale (Corrosion); Nickel Alloys; Aluminum; Oxidation

20050060645 General Electric Co., Schenectady, NY, USA, Framatome Cogema Fuels, Las Vegas, NV, USA
Constant Load SCC Initiation Response of Alloy 22 (UNS N06022), Titanium Grade 7 and Stainless Steels at 105 degree C
Young, L. M.; Catlin, G. M.; Andresen, P. L.; 2004; 20 pp.; In English
Report No.(s): DE2004-808012; No Copyright; Avail: Department of Energy Information Bridge

This paper provides an update on research addressing the effects of material condition and applied stress on stress corrosion cracking (SCC) in waste package and drip shield materials for the Yucca Mountain Project. Time-to-failure experiments are being performed on smooth bar tensile specimens in a hot, concentrated, mixed-salt solution chosen to simulate concentrated Yucca Mountain water. The effects of applied stress, welding, surface finish, shot peening, cold work, crevicing, and aging treatment are being investigated for Alloy 22 (UNS N06022). Aging treatments were designed to produce topologically close-packed phases (TCP) and long-range ordering (LRO) and are under investigation as worse-case scenarios for possible microstructures in Alloy 22 (UNS N06022). Titanium Grade 7 and 3 16NG stainless steel are included in the matrix, as they are identified for drip shield and waste package components, respectively. Sensitized 304SS specimens are included in the test matrix to provide benchmark data. This research complements high-resolution crack-growth-rate experiments currently being performed in a parallel research project.
NTIS
Stress Corrosion Cracking; Stainless Steels; Crack Propagation; Titanium

20050060704 NASA Glenn Research Center, Cleveland, OH, USA, Case Western Reserve Univ., Cleveland, OH, USA
Mechanical Behavior of Gamma-Met PX under Uniaxial Loading at Elevated Temperatures and High Strain Rates
Shazly, Mostafa; Prakash, Vikas; Draper, Susan; [2005]; 34 pp.; In English
Contract(s)/Grant(s): NAG3-2677; NSF CMS-99-08189; NSF CMS-00-79458; WBS 22-708-24-01
Report No.(s): E-14659; No Copyright; Avail: CASI; A03, Hardcopy

Gamma titanium aluminides have received considerable attention over the last decade. These alloys are known to have low density, good high temperature strength retention and good oxidation and corrosion resistance. However, poor ductility and low fracture toughness have been the key limiting factors in the full utilization of these alloys. More recently, a new generation of gamma titanium aluminide alloys, commonly referred to as Gamma-met PX, has been developed by GKSS, Germany. These alloys have been observed to have superior strength and better oxidation resistance at elevated temperatures when compared with conventional gamma titanium aluminides. The present paper discusses results of a study to understand the uniaxial mechanical behavior in both compression and tension of Gamma-Met PX at elevated temperatures and high strain rates. The compression and tensile tests are conducted using a modified split-Hopkinson bar apparatus at test temperatures ranging from room temperature to 900 C and strain rates of up to 3500/s. Under uniaxial compression, in the temperature range from room to 600 C, the flow stress is observed to be nearly independent of test temperature. However, at temperatures higher than 600 C thermal softening is observed at all strain rates with the rate of thermal softening increasing dramatically between 800 C and 900 C. The room temperature tensile tests show negligible strain-rate dependence on both yield stress and flow stress. With an increase in test temperature from room to 900 C the material shows a drop in both yield and flow stress at all levels of plastic strain. However, the measured flow stress is still higher when compared to nickel based super-alloys and other

gamma titanium aluminides under similar test conditions. Also, no anomaly in yield stress is observed up to 900 C.
Author
Compression Tests; Tensile Tests; High Temperature; Titanium Aluminides; Mechanical Properties; Nickel Alloys

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*.

20050041810 Utah Univ., Salt Lake City, UT, USA
Translocation of a Polymer Chain across a Nanopore: A Brownian Dynamics Simulation Study
Tian, Pu; Smith, Grant D.; Journal of Chemical Physics; December 1, 2003; ISSN 0021-9606; Volume 119, No. 21, pp. 11475-11483; In English
Contract(s)/Grant(s): NCC2-5516; Copyright; Avail: Other Sources

We carried out Brownian dynamics simulation studies of the translocation of single polymer chains across a nanosized pore under the driving of an applied field (chemical potential gradient). The translocation process can be either dominated by the entropic barrier resulted from restricted motion of flexible polymer chains or by applied forces (or chemical gradient across the wall), we focused on the latter case in our studies. Calculation of radius of gyrations at the two opposite sides of the wall shows that the polymer chains are not in equilibrium during the translocation process. Despite this fact, our results show that the one-dimensional diffusion and the nucleation model provide an excellent description of the dependence of average translocation time on the chemical potential gradients, the polymer chain length and the solvent viscosity. In good agreement with experimental results and theoretical predictions, the translocation time distribution of our simple model shows strong non-Gaussian characteristics. It is observed that even for this simple tubelike pore geometry, more than one peak of translocation time distribution can be generated for proper pore diameter and applied field strengths. Both repulsive Weeks-Chandler-Anderson and attractive Lennard-Jones polymer-nanopore interaction were studied, attraction facilitates the translocation process by shortening the total translocation time and dramatically improve the capturing of polymer chain. The width of the translocation time distribution was found to decrease with increasing temperature, increasing field strength, and decreasing pore diameter.
Author
Brownian Movements; Simulation; Polymerase Chain Reaction; Biopolymers; Mathematical Models; Porosity; Nanotechnology

20050041908 Meadow River Enterprises, Inc., Lewisburg, WV, USA, Marshall Univ., Huntington, WV, USA, Osram Sylvania, Inc., Towanda, PA, USA, Alfred Univ., NY, USA
Solid-State Ceramic Lighting Project
Brown, W. D.; 2004; In English
Report No.(s): DE2004-825271; No Copyright; Avail: National Technical Information Service (NTIS)

Meadow River Enterprises, Inc. (MRE) and the New York State College of Ceramics at Alfred University (NYSCC) received a DOE cooperative agreement award in September 1999 to develop an energy-efficient Solid-State Ceramic Lamp (SSCL). The program spanned a nominal two(2) year period ending in February of 2002. The federal contribution to the program totaled $1.6 million supporting approximately 78% of the program costs. The SSCL is a rugged electroluminescent lamp designed for outdoor applications. MRE has filed a provisional patent for this 'second generation' technology and currently produces and markets blue-green phosphor SSCL devices. White phosphor SSCL devices are also available in prototype quantities. In addition to reducing energy consumption, the ceramic EL lamp offers several economic and societal advantages including lower lifecycle costs and reduced 'light pollution'. Significant further performance improvements are possible but will require a dramatic change in device physical construction related to the use of micro-powder materials and processes. The subject 'second-generation' program spans a 27 month period and combines the materials and processing expertise of NYSCC, the manufacturing expertise of Meadow River Enterprises, and the phosphor development expertise of OSRAM Sylvania to develop an improved SSCL system. The development plan also includes important contributions by Marshall University (a part of the West Virginia University system). All primary development objectives have been achieved with the exception of improved phosphor powders. The performance characteristics of the first generation SSCL devices were

carefully analyzed in year 1 and a second generation lamp was defined and optimized in year 2.
NTIS
Ceramics; Illuminating; Solid State; Electroluminescence

20050041954 Alfred Univ., NY, USA
Selective Batching for Improved Commercial Glass Melting
2004; 24 pp.; In English
Report No.(s): DE2004-821965; No Copyright; Avail: Department of Energy Information Bridge

The overall goal of the project was to determine if alternative batching methods used in the commercial glass industry would result in improved melting behavior. Improved melting would enable shorter residence times in the glass tank, translating into direct reductions in energy intensity. We proposed that initial reactions between alkali and alkaline earth salts in the batch create a low viscosity melt that segregates from quartz particles, resulting in a mixture that must then be re-homogenized in the tank. The thesis of this project was that segregation can be limited by narrowing the range of melting points of the batch constituents and by increasing the viscosity of the molten phase formed during heating. To control the melting sequence and consequently the viscosity of the molten phase(s), we proposed to selectively batch raw materials into mixtures that form higher viscosity 'endpoints,' instead of simply mixing all of the batch components together prior to charging. Specifically, the idea is to eliminate high-temperature segregation within the batching process, rather than allow the melting process to dictate the composition of the segregated species. The general approach taken to control segregation was to separate the reactions between quartz and soda ash and quartz and limestone/dolomite. This was tested using two methods: (I) selectively batch and pelletize to form small 'reaction volumes' that react initially to form an intermediate reaction product; or (II) pre-react selective batch components to form an intermediate feedstock. Feedstocks for Approach I were produced by spray drying two binary mixtures of quartz+ soda ash and quartz+ limestone/dolomite. For Approach II, the same mixtures were heated to 1400 C and quenched. Feedstocks for both approaches were then mixed and heated in crucibles until a batch-free melt was produced. The current mixed batch formulation from Guardian Glass was used as a control.
NTIS
Glass; Heating; Melting Points; Viscosity

20050042048 Louisiana Tech Univ., Ruston, LA, USA
Continuity Diaphragm for Skewed Continuous Span Precast Prestressed Concrete Girder Bridges
Saber, A.; Toups, J.; Guice, L.; Tayebi, A.; Oct. 2004; 324 pp.; In English
Report No.(s): PB2005-101491; FHWA/LA-04/383; No Copyright; Avail: CASI; A14, Hardcopy

Continuity diaphragms used on skewed bents in prestressed girder bridges cause difficulties in detailing and construction. Details for bridges with large diaphragm skew angles (\g30DG) have not been a problem for LA DOTD. However, as the skew angle decreases or when the girder spacing decreases, the connection and the construction become more difficult. Even the effectiveness of the diaphragms is questionable at these high skews. Thus, the need for continuity diaphragms for skewed continuous span precast prestressed concrete girder bridges is investigated. The bridge parameters considered in this study are based on results of a survey sent to other states' bridge engineers and design of experiment techniques. The parameters include girder type, bridge skew angle, girder spacing, span length, and diaphragm skew angle. The effects of continuity diaphragms on stresses and deflections from truck and lane loading on continuous skewed bridges are evaluated and results provide a fundamental understanding of the load transfer mechanism in diaphragms of skewed bridges. The effectiveness of continuity diaphragms for skewed continuous bridges is limited. The outcome of the research will reduce the construction and maintenance costs of bridges in the state of Louisiana and the nation.
NTIS
Bridges (Structures); Prestressing; Concretes

20050051122 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Total Evaporative Resistance of Selected Clothing Ensembles
Caravello, Victor; Jul. 2004; 167 pp.; In English
Report No.(s): AD-A428695; CI04-908; No Copyright; Avail: CASI; A08, Hardcopy

With regard to heat stress, the limiting factor inherent in clothing ensembles is the total evaporative resistance. For the same work demands, clothing with higher evaporative resistance impedes the ability to cool by sweat evaporation. Knowing the evaporative resistance provides a means to compare candidate ensembles. Further, a value for evaporative resistance means that a rational method can be used to assess the heat stress exposure. Evaporative resistance of five clothing ensembles (cotton

work clothes, cotton coveralls, and three coveralls of particle barrier, liquid barrier and vapor barrier properties) was determined empirically from wear tests during two study phases. For Phase 1, the metabolic rate was held constant at 160 W/sq m, and three levels of humidity (20, 50, 70% rh) were explored. Fourteen heat-acclimated participants (9 men and 5 women) completed trials for all combinations of clothing ensemble and environment. In the Phase 2 study, the humidity was held constant at 50% rh, and three levels of metabolic rate (114, 176, 250 W/sq m) were explored. Fifteen heat-acclimated participants (11 men and 4 women) completed trials for all combinations of clothing ensemble and environment. The data from both phases were analyzed separately using ANOVA. Significant differences were found among ensembles (p\h0.0001). The vapor barrier ensemble had the highest resistance at 0.026 kPa sq m/W. The liquid barrier was next at 0.018; followed by the particle barrier and cotton coveralls at 0.016 Work clothes was 0.014 kPa sq m/W. Pair-wise comparisons adjusted for multiple comparisons were used to locate the differences among ensembles. Vapor and liquid barrier ensembles were found to be significantly different from other ensembles. Data from both studies support the conclusion that there are differences in evaporative resistances among selected ensembles tested.
DTIC
Clothing; Evaporation; Evaporative Cooling

20050051225 Delaware Univ., Newark, DE USA
Introduction to RTM Workstation
Lawrence, Jeffrey M.; Devillard, Mathieu; Friede, Peter; Advani, Suresh G.; Jul. 2003; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428865; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts on presentation of an introduction to RTM workstations, including objective and motivation, design concepts, current lab scaled implementation, on-line mixing of resin, and extension of applications.
DTIC
Computer Aided Manufacturing; Resin Transfer Molding; Workstations

20050051227 Delaware Univ., Newark, DE USA
RTM And VARTM Design, Optimization, And Control With SLIC
Hsiao, Kuang-Ting; Jul. 2003; 31 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428868; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts from presentation on RTM and VARTM design, optimization and control with SLIC.
DTIC
Computer Aided Manufacturing; Design Optimization; Resin Transfer Molding

20050051259 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Stuttgart, Germany
Properties of Laser Ablation Products of Delrin with CO2 Laser
Schall, Wolfgang O.; Eckel, Hans-Albert; Tegel, Jochen; Waiblinger, Frank; Walther, Sebastian; Jul. 2004; 79 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8655-03-1-3061
Report No.(s): AD-A428948; EOARD-SPC-03-3061; No Copyright; Avail: Defense Technical Information Center (DTIC)
A requirement for efficient pulsed laser propulsion from ground to LEO is the achievement of a specific impulse of up to 800's at a jet efficiency of at least 50%. With classical polymers like Delrin or POM these numbers cannot be obtained. The suggestion to use polymers with included metal powder for a better deposition of the laser energy per unit volume and thus the achievement of a higher jet velocity together with a lower ablation rate has been experimentally investigated. Samples of different polymers and different metal contents (Al and Mg in the range of 3% to 60% by weight) have been formulated and irradiated with CO(sub 2) laser pulses of about 12 microseconds in duration and energies of 40 J to 280 J (fluences of 20 to 150 J/sq cm). The samples were mounted to a pendulum for measuring the excerted impulse and the mass loss per pulse was determined by weighing. These experiments have been carried out in ambient atmosphere as well as at various pressure levels down to vacuum of less than 1 mbar in a vessel. In general the expansion of the ablated material (vapor) was forced to be one-dimensional by applying a guiding tube. But three-dimensional expansions were investigated as well. Furthermore the efficacy of certain selected formulations as a propellant have been tested in a bell shaped light concentrating structure. The samples have been inspected under an electron microscope before and after the laser interaction. Because a suspicion existed

from the beginning of the experiments that a certain amount of the incident laser energy might be absorbed in a decoupled plasma wave (breakdown) time resolved power measurements of the incident enemy of the reflected energy from the target and at a later stage of the energy transmitted through a hole in the target were made.
DTIC
Ablative Materials; Carbon Dioxide Lasers; Delrin (Trademark); Laser Ablation

20050051564 Department of the Navy, Washington, DC USA
Miniature Axisymmetric Streamline Tensile (MAST) Specimen
Cavallaro, Paul V., Inventor; Apr. 2004; 22 pp.; In English
Report No.(s): AD-D020177; No Copyright; Avail: CASI; A03, Hardcopy

The Navy has a need to test piezoelectric ceramic materials to determine their performance in sonar transducers. Piezoelectric ceramic materials are typically grown as a single crystal, which limits the size of the sample. These materials are very brittle and subject to cracking during use as a transducer. The Navy needs to know the useful life of these materials and the amount of stress that they can be subjected to while still being useful. It also is necessary to determine the electrical properties of the materials and how small flaws in the material affect these properties. No prior art test configuration properly gives this information for piezoelectric ceramics. Tensile testing of ceramic materials using a standard tensile testing machine is not commonly performed because the tensile strength of ceramic materials is typically very sensitive to small cracks. These cracks are almost always present in normally sized specimens. A bend test is more commonly used to determine the transverse rupture strength of a ceramic; however, this test does not give the true tensile strength of the material, and the ceramic is subject to failure at the points of load. This patent application discloses a miniature axisymmetric streamline tensile (MAST) specimen having improved axisymmetric surface profile design and surface stress concentration factor (SSCF) improvements (i.e., close to unity). The MAST specimen also has improved variable curvature transition fillets, miniaturized profile dimension, and shoulder region features used in conjunction with the collet loading method. An axisymmetric, rather than flat, design is preferred since no stress gradients exist in the hoop direction (i.e., circumferential direction) of the specimen. The MAST specimen is designed to permit various loading options. The MAST specimen may be used for testing any suitable material, including, but not limited to, metals, plastics and ceramics. (6 figures)
DTIC
Beams (Supports); Ceramics; Miniaturization; Patent Applications; Piezoelectricity; Shapes; Tensile Stress

20050051639 NASA Glenn Research Center, Cleveland, OH, USA
High-Solids Polyimide Precursor Solutions
Chuang, Chun-Hua, Inventor; August 31, 2004; 6 pp.; In English
Patent Info.: Filed 25 Jul. 2002; US-Patent-6,784,276; US-Patent-Appl-SN-202643; NASA-Case-LEW-17291-1; No Copyright; Avail: CASI; A02, Hardcopy

The invention is a highly concentrated stable solution of polymide precursors (monometers) having a solids content ranging from about 80 to 98 percent by weight in lower aliphatic alcohols i.e. methyl and/or ethylalcohol. the concentrated polyimide precursos solution comparisons effective amounts of at least one aromatic diamine, at least one aromatic dianhydride, and a monofunctional endcap including monoamines, monoanhydrides and lower alkyl esters of said monoanhydrides. These concentrated polyimide precursor solutions are particularly useful for the preparation of fibrous prepregs and composites for use in structural materials for military and civil applications.
Official Gazette of the U.S. Patent and Trademark Office
Polyimides; Solids; Methyl Compounds; Fiber Composites

20050052018 NASA Glenn Research Center, Cleveland, OH, USA
Nanotube/Quantum Dot-Polymer Solar Cells
Bailey, Sheila G.; Raffaelle, Ryne P.; Landi, Brian J.; Castro, Stephanie L.; January 2005; 4 pp.; In English; 19th European Photovoltaic Solar Energy Conference, 7-11 Jun. 2004, Paris, France
Contract(s)/Grant(s): WBS 22-319-20-C1; Copyright; Avail: CASI; A01, Hardcopy

Single wall carbon nanotubes used or this study were synthesized using the pulse laser vaporization technique. The as-produced SWNTs were collected from the condensed region on the quartz tube outside the furnace and purified by modification of the previously reported procedure. Preparation of the SWNT-P3OT composite solutions was performed using a series of mixing and sonication steps as previously demonstrated for other SWNT-polymer systems. Device fabrication involved the use of commercially-obtained, high quality (i.e., less than 10 W/sq.) ITO-coated polyethylene terapthalate (PET)

substrates. Initially, an intrinsic layer of pristine P3OT is spray deposited (approx. 1-2 mL of the 15 mg/mL solution) onto the masked, 1 sq in. active area of the substrate. This is followed with spray deposition of the SWNT-P3OT composite solutions at similar volumes. As seen completion of the solar cell occurs when aluminum contacts (typical thicknesses of l000A) are applied to the IT0 and SWNT-P3OT composite film layers. The homogeneous distribution of SWNTs in a polymer matrix is dependent upon the ability of the polymer chain to associate with the SWNT superstructure. Stable composite dispersions of 0.1 % and 1.0% w/w SWNTs in P3OT were produced and analyzed in this study. Optical spectroscopy was conducted to observe the SWNT doping level effects on the absorption properties and infer potential electronic interactions between dopant and polymer. Shown is an overlay of these spectra where the pristine P3OT shows strong optical absorption at energies less than 2 eV. As expected, variation in absorption properties for the SWNT-P3OT composites is observed as the doping level increases. Through modification of the SWNT doping level in the polymer, it is possible to alter the absorption pattern of these composite materials. In fact, at these relatively low doping levels, the P3OT shows a significant enhancement in absorption through the near-IR and visible regions. The gray curve for purified SWNTs is offset from the other three for clarity, but indicates the typical complex pattern observed for this spectral range.
Derived from text
Solar Cells; Quantum Dots; Polyethylenes; Carbon Nanotubes; Walls

20050060616 NASA Glenn Research Center, Cleveland, OH, USA
Optimization of Thin Film Ferroelectrics for Communication Applications
Miranda, Felix A.; [2004]; 39 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): 22-322-20-02
Report No.(s): E-14632; No Copyright; Avail: CASI; A03, Hardcopy

The application of thin film ferroelectrics for the development of tunable microwave components have been a very active field of investigation thraughout the last decade. This presentation will provide an overview of some of the activities in the aforementioned area by other research groups and the current status of the field. In particular, we will discuss the efforts currently underway at the NASA Glenn Research Center in the area of phase shifter development using Ba2Sr(1-x)TiO3 ferroelectric thin films. Emphasis will be given to the approaches that have been investigated in order to improve the performance (i.e., figure of merit) of these devices. Some of these approaches deal with the details of circuit design parameters, while others are related to Experimental results and discussions on the aforementioned topics will be presented the optimization of material properties through different deposition techniques.
Author
Thin Films; Ferroelectricity; Design Analysis

20050060620 NASA Glenn Research Center, Cleveland, OH, USA
Performance of Ceramics in Severe Environments
Jacobson, Nathan S.; Fox, Dennis S.; Smialek, James L.; Deliacorte, Christopher; Lee, Kang N.; [2005]; 37 pp.; In English
Contract(s)/Grant(s): 22-714-30-09
Report No.(s): E-14992; No Copyright; Avail: CASI; A03, Hardcopy

Ceramics are generally stable to higher temperatures than most metals and alloys. Thus the development of high temperature structural ceramics has been an area of active research for many years. While the dream of a ceramic heat engine still faces many challenges, niche markets are developing for these materials at high temperatures. In these applications, ceramics are exposed not only to high temperatures but also aggressive gases and deposits. In this chapter we review the response of ceramic materials to these environments. We discuss corrosion mechanisms, the relative importance of a particular corrodent, and, where available, corrosion rates. Most of the available corrosion information is on silicon carbide (SIC) and silicon nitride (Si3N4) monolithic ceramics. These materials form a stable film of silica (SO2) in an oxidizing environment. We begin with a discussion of oxidation of these materials and proceed to the effects of other corrodents such as water vapor and salt deposits. We also discuss oxidation and corrosion of other ceramics: precurser derived ceramics, ceramic matrix composites (CMCs), ceramics which form oxide scales other than silica, and oxide ceramics. Many of the corrosion issues discussed can be mitigated with refractory oxide coatings and we discuss the current status of this active area of research. Ultimately, the concern of corrosion is loss of load bearing capability. We discuss the effects of corrosive environments on the strength of ceramics, both monolithic and composite. We conclude with a discussion of high temperature wear of ceramics, another important form of degradation at high temperatures.
Derived from text
Ceramic Matrix Composites; High Temperature; Corrosion; Degradation; Heat Engines

20050060640 Argonne National Lab., IL, USA, Rocky Flats Environmental Technology Site, Golden, CO, USA, CH2M HILL, Greenwood Village, CO, USA

Investigations in Ceramicrete Stabilization of Hanford Tank Wastes

Wagh, A. S.; Maloney, M. D.; Thomson, G. H.; Antink, A.; Jan. 2003; 16 pp.; In English

Report No.(s): DE2004-827604; No Copyright; Avail: Department of Energy Information Bridge

This paper provides a summary of investigations done on feasibility of using Ceramicrete technology to stabilize high level salt waste streams typical of Hanford and other sites. We used two non-radioactive simulants that covered the range of properties from low activity to high level liquids and sludges. One represented tank supernate, containing Cr, Pb, and Ag as the major hazardous metals, and Cs as the fission products; the other, a waste sludge, contained Cd, Cr, Ag, Ni, and Ba as the major hazardous contaminants, and Cs, and Tc as the fission products.

NTIS

Waste Management; Hazardous Materials; Ceramics

20050061013 NASA Glenn Research Center, Cleveland, OH, USA

Crystallization Kinetics of a Solid Oxide Fuel Cell Seal Glass by Differential Thermal Analysis

Bansal, Narottam P.; Gamble, Eleanor A.; January 2005; 21 pp.; In English; Ninth International Symposium on Solid Oxide Fuel Cells, 15-20 May 2005, Quebec City, Canada

Contract(s)/Grant(s): WBS 22-066-20-06

Report No.(s): NASA/TM-2005-213436; E-14971; No Copyright; Avail: CASI; A03, Hardcopy

Crystallization kinetics of a barium calcium aluminosilicate glass (BCAS), a sealant material for planar solid oxide fuel cells, have been investigated by differential thermal analysis (DTA). From variation of DTA peak maximum temperature with heating rate, the activation energy for glass crystallization was calculated to be 259 kJ/mol. Development of crystalline phases on thermal treatments of the glass at various temperatures has been followed by powder x-ray diffraction. Microstructure and chemical composition of the crystalline phases were investigated by scanning electron microscopy and energy dispersive spectroscopic (EDS) analysis. BaSiO3 and hexacelsian (BaAl2Si2O8) were the primary crystalline phases whereas monoclinic celsian (BaAl2Si2O8) and (Ba(x), Ca(y))SiO4 were also detected as minor phases. Needle-shaped BaSiO3 crystals are formed first, followed by the formation of other phases at longer times of heat treatments. The glass does not fully crystallize even after long term heat treatments at 750 to 900 C.

Author

Solid Oxide Fuel Cells; Sealers; Crystallization; Barium; Calcium; Glass

20050061019 NASA Glenn Research Center, Cleveland, OH, USA

Solid Lubricants for Oil-Free Turbomachinery

DellaCorte, Christopher; January 2005; 1 pp.; In English; 2005 International Tribiology Conference, 29 May - 2 Jun. 2005, Kobe, Japan

Contract(s)/Grant(s): WBS 22-714-09-17; No Copyright; Avail: CASI; A01, Hardcopy

Recent breakthroughs in gas foil bearing solid lubricants and computer based modeling has enabled the development of revolulionary Oil-Free turbomachinery systems. These innovative new and solid lubricants at low speeds (start-up and shut down). Foil bearings are hydrodynamic, self acting fluid film bearings made from thin, flexible sheet metal foils. These thin foils trap a hydrodynamic lubricating air film between their surfaces and moving shaft surface. For low temperature applications, like ainrafl air cycle machines (ACM's), polymer coatings provide important solid lubrication during start-up and shut down prior to the development of the lubricating fluid film. The successful development of Oil-Free gas turbine engines requires bearings which can operate at much higher temperatures (greater than 300 C). To address this extreme solid lubrication need, NASA has invented a new family of compostie solid lubricant coatings, NASA PS300.

Derived from text

Solid Lubricants; Turbomachinery; Foil Bearings; Gas Turbine Engines

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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*.

20050051731 NASA Glenn Research Center, Cleveland, OH, USA

Quantitative Analysis of Spectral Interference of Spontaneous Raman Scattering in High-Pressure Fuel-Rich H2-Air Combustion

Kojima, Jun; Nguyen, Quang-Viet; April 21, 2004; 46 pp.; In English

Contract(s)/Grant(s): WBS 22-714-20-05; No Copyright; Avail: CASI; A03, Hardcopy

We present a theoretical study of the spectral interferences in the spontaneous Raman scattering spectra of major combustion products in 30-atm fuel-rich hydrogen-air flames. An effective methodology is introduced to choose an appropriate line-shape model for simulating Raman spectra in high-pressure combustion environments. The Voigt profile with the additive approximation assumption was found to provide a reasonable model of the spectral line shape for the present analysis. The rotational/vibrational Raman spectra of H2, N2, and H2O were calculated using an anharmonic-oscillator model using the latest collisional broadening coefficients. The calculated spectra were validated with data obtained in a 10-atm fuel-rich H2-air flame and showed excellent agreement. Our quantitative spectral analysis for equivalence ratios ranging from 1.5 to 5.0 revealed substantial amounts of spectral cross-talk between the rotational H2 lines and the N2 O-/Q-branch; and between the vibrational H2O(0,3) line and the vibrational H2O spectrum. We also address the temperature dependence of the spectral cross-talk and extend our analysis to include a cross-talk compensation technique that removes the nterference arising from the H2 Raman spectra onto the N2, or H2O spectra.

Author

High Pressure; Quantitative Analysis; Raman Spectra; Hydrogen; Fuel Combustion; Flames; Mathematical Models; Air

20050051986 NASA Ames Research Center, Moffett Field, CA, USA

Radiative Transfer Modeling of a Large Pool Fire by Discrete Ordinates, Discrete Transfer, Ray Tracing, Monte Carlo and Moment Methods

Jensen, K. A.; Ripoll, J.-F.; Wray, A. A.; Joseph, D.; ElHafi, M.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 353-366; In English; See also 20050051959

Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CASI; A03, Hardcopy

Five computational methods for solution of the radiative transfer equation in an absorbing-emitting and non-scattering gray medium were compared on a 2 m JP-8 pool fire. The temperature and absorption coefficient fields were taken from a synthetic fire due to the lack of a complete set of experimental data for fires of this size. These quantities were generated by a code that has been shown to agree well with the limited quantity of relevant data in the literature. Reference solutions to the governing equation were determined using the Monte Carlo method and a ray tracing scheme with high angular resolution. Solutions using the discrete transfer method, the discrete ordinate method (DOM) with both S(sub 4) and LC(sub 11) quadratures, and moment model using the M(sub 1) closure were compared to the reference solutions in both isotropic and anisotropic regions of the computational domain. DOM LC(sub 11) is shown to be the more accurate than the commonly used S(sub 4) quadrature technique, especially in anisotropic regions of the fire domain. This represents the first study where the M(sub 1) method was applied to a combustion problem occurring in a complex three-dimensional geometry. The M(sub 1) results agree well with other solution techniques, which is encouraging for future applications to similar problems since it is computationally the least expensive solution technique. Moreover, M(sub 1) results are comparable to DOM S(sub 4).

Author

JP-8 Jet Fuel; Fires; Radiative Transfer; Combustion Physics; Gray Gas

20050061020 NASA Glenn Research Center, Cleveland, OH, USA

Summary of Simplified Two Time Step Method for Calculating Combustion Rates and Nitrogen Oxide Emissions for Hydrogen/Air and Hydrogen/Oxygen

Marek, C. John; Molnar, Melissa; January 2005; 6 pp.; In English; 4th Joint Meeting of the U.S. Sections of the Combustion Inst., 20-23 Mar. 2005, Philadelphia, PA, USA

Contract(s)/Grant(s): WBS 22-066-10-12

Report No.(s): E-14975; No Copyright; Avail: CASI; A02, Hardcopy

A simplified single rate expression for hydrogen combustion and nitrogen oxide production was developed. Detailed

kinetics are predicted for the chemical kinetic times using the complete chemical mechanism over the entire operating space. These times are then correlated to the reactor conditions using an exponential fit. Simple first order reaction expressions are then used to find the conversion in the reactor. The method uses a two time step kinetic scheme. The first time averaged step is used at the initial times with smaller water concentrations. This gives the average chemical kinetic time as a function of initial overall fuel air ratio, temperature, and pressure. The second instantaneous step is used at higher water concentrations (greater than 1 x 10(exp -20)) moles per cc) in the mixture which gives the chemical kinetic time as a function of the instantaneous fuel and water mole concentrations, pressure and temperature (T(sub 4)). The simple correlations are then compared to the turbulent mixing times to determine the limiting properties of the reaction. The NASA Glenn GLSENS kinetics code calculates the reaction rates and rate constants for each species in a kinetic scheme for finite kinetic rates. These reaction rates are used to calculate the necessary chemical kinetic times. This time is regressed over the complete initial conditions using the Excel regression routine. Chemical kinetic time equations for H2 and NOx are obtained for H2/Air fuel and for H2/O2. A similar correlation is also developed using data from NASA's Chemical Equilibrium Applications (CEA) code to determine the equilibrium temperature (T(sub 4)) as a function of overall fuel/air ratio, pressure and initial temperature (T(sub 3)). High values of the regression coefficient R squared are obtained.
Author
Chemical Equilibrium; Combustion; Fuel-Air Ratio; Hydrogen; Nitrogen Oxides; Reaction Kinetics; Oxygen

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SPACE PROCESSING

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

20050051956 NASA Glenn Research Center, Cleveland, OH, USA
Coarsening in Solid-Liquid Mixtures-2: A Materials Science Experiment for the ISS
Hickman, J. Mark; Voorhees, Peter W.; Kwon, Yongwoo; Lorik, Tibor; November 29, 2004; 8 pp.; In English; 2005 IEEE Aerospace Conference, 5-12 Mar. 2005, Big Sky, MT, USA
Contract(s)/Grant(s): WBS 400-34-30-01
Report No.(s): IEEE Paper-1234; Copyright; Avail: CASI; A02, Hardcopy

A materials science experiment has been developed and readied for operation aboard the International Space Station (ISS). Components of this experiment are onboard ISS and area awaiting the flight of science samples. The goal of the experiment is to understand the dynamics of Ostwald ripening, also known as coarsening, a process that occurs in nearly any two-phase mixture found in nature. Attempts to obtain experimental data in ground-based laboratories are hindered due to the presence of gravity, which introduces material transport modes other than that of the coarsening phenomenon. This introduces adjustable parameters in the formulation of theory. The original Coarsening in Solid-Liquid Mixtures (CSLM) mission, which flew on the Space Shuttle in 1997, produced data from a coarsened eutectic alloy. Unfortunately, both the science matrix and the hardware, while nominally functional, did not account adequately for operations in microgravity. A significantly redesigned follow-on experiment, CSLM-2 has been developed to redress the inadequacies of the original experiment. This paper reviews the CSLM-2 project: its history, science goals, flight hardware implementation, and planned operations and analysis
Author
International Space Station; Liquid-Solid Interfaces; Mixtures; Spaceborne Experiments

20050051995 NASA Glenn Research Center, Cleveland, OH, USA
Motion of Air Bubbles in Water Subjected to Microgravity Accelerations
DeLombard, Richard; Kelly, Eric M.; Hrovar, Kenneth; Nelson, Emily S.; Pettit, Donald R.; November 23, 2004; 8 pp.; In English; 43rd AIAA Aerospace Sciences Meeting, 10-13 Jan. 2004, Reno, NV, USA
Report No.(s): AIAA Paper 2005-0722; No Copyright; Avail: CASI; A02, Hardcopy

The International Space Station (ISS) serves as a platform for microgravity research for the foreseeable future. A microgravity environment is one in which the effects of gravity are drastically reduced which then allows physical experiments to be conducted without the overpowering effects of gravity. During his six month stay on the ISS, astronaut Donald R Pettit performed many informal/impromptu science experiments with available equipment. One such experiment focused on the motion of air bubbles in a rectangular container nearly filled with de-ionized water. Bubbles were introduced by shaking and

the container was secured in place for several hours while motion of the bubbles were recorded using time-lapse photography. This paper shows correlation between bubble motion and quasi-steady acceleration levels during one such experiment operation. The quasi-steady acceleration vectors were measured by the Microgravity Acceleration Measurement System. Essentially linear motion was observed in the condition considered here. Dr. Pettit also created other conditions which produced linear and circulating motion, which are the subjects of further study. Initial observations of this bubble motion agree with calculations from many microgravity physical science experiments conducted on Shuttle microgravity science missions. Many crystal-growth furnaces involve heavy metals and high temperatures in which undesired acceleration-driven convection during solidification can adversely affect the crystal. Presented in this paper will be results showing correlation between bubble motion and the quasi-steady acceleration vector.
Author
Acceleration Measurement; Bubbles; Microgravity; Water; Motion; International Space Station

20050060621 NASA Glenn Research Center, Cleveland, OH, USA
Transitioning a Fundamental Research Program to Align with the NASA Exploration Initiative-Perspectives from Microgravity Combustion Science and Fluid Physics
Sutliff, Thomas J.; Kohl, Fred J.; June 10, 2004; 6 pp.; In English; 55th International Astronautical Congress, 4-9 Oct. 2004, Vancouver, British Columbia, Canada
Contract(s)/Grant(s): WBS 22-400-35-80-01
Report No.(s): IAC-04-Q.6/T.5.06; E-14913; No Copyright; Avail: CASI; A02, Hardcopy

A new Vision for Space Exploration was announced earlier this year by U.S. President George W. Bush. NASA has evaluated on-going programs for strategic alignment with this vision. The evaluation proceeded at a rapid pace and is resulting in changes to the scope and focus of experimental research that will be conducted in support of the new vision. The existing network of researchers in the physical sciences - a highly capable, independent, and loosely knitted community - typically have shared conclusions derived from their work within appropriate discipline-specific peer reviewed journals and publications. The initial result of introducing this Vision for Space Exploration has been to shift research focus from a broad coverage of numerous, widely varying topics into a research program focused on a nearly-singular set of supporting research objectives to enable advances in space exploration. Two of these traditional physical science research disciplines, Combustion Science and Fluid Physics, are implementing a course adjustment from a portfolio dominated by 'Fundamental Science Research' to one focused nearly exclusively on supporting the Exploration Vision. Underlying scientific and engineering competencies and infrastructure of the Microgravity Combustion Science and Fluid Physics disciplines do provide essential research capabilities to support the contemporary thrusts of human life support, radiation countermeasures, human health, low gravity research for propulsion and materials and, ultimately, research conducted on the Moon and Mars. A perspective on how these two research disciplines responded to the course change will be presented. The relevance to the new NASA direction is provided, while demonstrating through two examples how the prior investment in fundamental research is being brought to bear on solving the issues confronting the successful implementation of the exploration goals.
Author
Combustion; Fluid Dynamics; Microgravity; NASA Space Programs; Space Exploration; Research and Development

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*.

20050050979 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Precise Clock Solutions Using Carrier Phase from GPS Receivers in the International GPS Service
Zumberge, J. F.; Jefferson, D. C.; Stowers, D. A.; Tjoelker, R. L.; Young, L. E.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 227-223; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

As one of its activities as an Analysis Center in the International GPS Service (IGS), the Jet Propulsion Laboratory (JPL) uses data from a globally distributed network of geodetic-quality GPS receivers to estimate precise clock solutions, relative to a chosen reference, for both the GPS satellites and GPS receiver internal clocks, every day. The GPS constellation and ground network provide geometrical strength resulting in formal errors of about 100 p sec for these estimates. Some of the receivers in the global IGS network contain high quality frequency references, such as hydrogen masers. The clock solutions

for such receivers are smooth at the 20-p sec level on time scales of a few minutes. There are occasional (daily to weekly) shifts at the microsec level, symptomatic of receiver resets, and 200-p sec-level discontinuities at midnight due to 1-day processing boundaries. Relative clock solutions among 22 IGS sites proposed as 'fiducial' in the IGS/BIPM pilot project have been examined over a recent 4-week period. This allows a quantitative measure of receiver reset frequency as a function of site. For days and-sites without resets, the Allan deviation of the relative clock solutions is also computed for subdaily values of tau..
Author
Clocks; Errors; High Frequencies

20050051069 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
Validation Tools of Nonlinearities Associated With Aeroelastic Phenomena
Hajj, Muhammad R.; Nov. 2004; 4 pp.; In English
Contract(s)/Grant(s): F49620-03-1-02O6
Report No.(s): AD-A428596; AFRL-SR-AR-TR-04-0610; No Copyright; Avail: CASI; A01, Hardcopy

The work performed under Grant # F49620-03-l-0206 included the analysis of a unique database on the hard flutter of a Flexible Semispan Model of a High Speed Civil Transport model. The experiments were performed in the Langley Transonic Dynamic Tunnel. These experiments are unique in terms of the model scaling and characteristics, the range of Mach number and dynamic pressure and the observed phenomena. To date, the analysis of the data performed with the support of AFOSR yielded two journal articles and two conference papers. The abstracts of these articles and their reference numbers are listed in Appendix A Moreover, a new computer code has been developed to identify cubic nonlinearities of any system.
DTIC
Aeroelasticity; Nonlinear Systems

20050051091 Woods Hole Oceanographic Inst., MA USA
Completion and Field Demonstration of a Portable Coastal Observatory
Frye, Daniel E.; Butman, Bradford; Jan. 2005; 11 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0062
Report No.(s): AD-A428627; No Copyright; Avail: CASI; A03, Hardcopy

The goal of the NOPP funded project, Low Cost Modular Telemetry for Coastal Time Series Data 1, was to develop an affordable, easy to use technology for the real time collection and dissemination of data from instruments deployed in the coastal ocean. The observing system that was developed consists of four elements: 1) low cost acoustic modems that are deployed with each instrument, 2) small, easy to deploy surface buoys (and moorings) that carry the acoustic hydrophones and acoustic receiver and RF link, 3) a shore-based receive station that automatically forwards data received and logs it on a website, and (4) a back channel to the surface buoys from the laboratory so that acoustic receivers and RF links can be modified without requiring a site visit. An alternative to (2) was to deploy systems on existing Coast Guard buoys; if successful, this strategy might provide a large network of stations, especially in high-traffic areas where locating additional buoys are not feasible. The goal of the continuation project reported on here, Completion and Field Demonstration of a Portable Coastal Observatory, was to complete the development and testing of the low cost acoustic modem, which was not completed under the original project and to demonstrate its performance in the field. The larger goal was to demonstrate a technological approach for building coastal observatories with real time data distribution. Our vision is that acoustically linked coastal observatories will provide easy to use and easy to relocate systems that compliment fixed cabled observatories, which provide high bandwidth and power to offshore sensors, but are expensive, difficult to install and not relocatable.
DTIC
Coasts; Observatories; Telemetry

20050051248 Delaware Univ., Newark, DE USA
Vibration Nondestructive Inspection of Large-Scale Composite Structures
Yoon, M. Ken; Jul. 2003; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0811
Report No.(s): AD-A428896; No Copyright; Avail: Defense Technical Information Center (DTIC)

Conclusion: 1) Modified 2-D Gapped Smoothing Method; 2) Compared advanced sensors: MEMS & fiber optic strain sensors; 3) Applied to large-scale composite structures. Issues addressed: 1) Large vs. small size of damage; 2) Definition of damage index (square vs. absolute of curvature difference); 3) Compared MS and ODS data; 4) Effects of locations of sensors

and excitation; 5) Effects of frequency range; 6) Multi-excitation with single sensing vs. multi-sensing with single excitation. DTIC

Composite Structures; Inspection; Nondestructive Tests; Vibration

20050051642 Army Missile Command, Orlando, FL USA

Training Dismounted Combatants in Virtual Environments

Goldberg, Stephen L.; Knerr, Bruce W.; Grosse, James; Oct. 2003; 19 pp.; In English; Original contains color illustrations Report No.(s): AD-A428918; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available

Education; Military Operations; Terrain; Virtual Reality

20050051761 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan

NTT Technical Review, Volume 3, No. 1

Wada, Masato, Editor; Fukuda, Kenichi, Editor; Sibata, Tsugumichi, Editor; Tamechika, Emi, Editor; Sadakata, Toru, Editor; Ida, Minoru, Editor; Iwata, Hideyuki, Editor; Shibata, Hisaki, Editor; Hagiwara, Noboru, Editor; Okuda, Hidenori, Editor, et al.; January 2005; ISSN 1348-3447; 51 pp.; In English; See also 20050051762 - 20050051780; Copyright; Avail: Other Sources

This issue contains 9 articles and 10 abstracts. The articles include the following titles: 1) Planar Lightwave Circuit Technology: The Key to Constructing Large-capacity Optical Networks; 2) Resource Management Technologies for Home Network Services; 3) Home Network Service Management Technologies; 4) An Operation Service Composition Method for Home Network Operation Support; 5) Abstract Interface Technique for Home Network Management; 6) Technologies for Next-generation Wireless LANs; 7) Sensor-based Hardware Technology Supporting Daily Activities; 8) Activities of 1TU-T TSAG; 9) Scalable Video Software Codec Enabling Realtime Processing of Standard TV-Quality Video. The abstracts include the following titles: 1) Electron Cyclotron Resonance Plasma Sputtering Growth of Textured Films of C-axis-oriented LiNbO3 on Si(100) and Si(111) Surfaces; 2) A 43-Gb/s Clock and Data Recovery OEIC Integrating an InP-InGaAs HPT Oscillator with an HBT Decision Circuit; 3) A Quorum-based Extended Group Mutual Exclusion Algorithim without Unnecessary Blocking; 4) STM Observations of Three-dimensional Ge Islands on Si(111) Surfaces with Different Step Orientations and Step-bunching Conditions; 5) Structure Transition of Ge-Si(113) Surfaces during Ge Epitaxial Growth; 6) Inter-code Interference and Optimum Spreading Sequence in Frequency-selective Rayleigh Fading Channels on Uplink MC-CDMA; 7) Theoretical Design of a Semiconductor Ferromagnet Based on Quantum Dot Superlattices; 8) Importance of the sp(sup 2)-like Orbital Formation for Stabilizing Surface Local Structures; 9) Testing the Possibility of Average-color Perception from Multi-colored Patterns; 10) Aging Effect on Neural Basis of Controlled Attention in Working Memory.

CASI

Optical Communication; Communication Networks; Computer Networks; Communication Equipment; Psychological Tests; Atomic Structure; Energy Levels

20050051982 Pratt and Whitney Aircraft, USA

Liquid Film Modeling in High Shear Nozzles

Kim, W.-W.; Apte, S.; Herrmann, M.; Ham, F.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 305-314; In English; See also 20050051959; No Copyright; Avail: CASI; A02, Hardcopy

As part of ongoing development of predictive simulation capabilities for jet engine combustors, two approaches for modeling liquid film formation and evolution in the context of high shear nozzles are investigated. In the first approach, the dense spray region and liquid film formation is modeled by closely packed droplets moving in layers. It is shown that the displacement of gas-phase by droplet finite-size effect can capture the spreading of the liquid film on the injector walls. Collision dominates in the near wall region and is captured using an inter-particle stress model. In the second approach, a transport equation for film-height based on the lubrication theory is solved near the wall. The droplets are represented by the dense spray model until they hit the wall. After impingement, the Lagrangian droplet/parcel is removed and its mass and momentum are transferred to evolve the film-heght. We perform a preliminary assessment of these models for two configurations: a liquid jet impinging vertically on a flat plate and a simplified injector consisting of a turbulent channel flow with spray impinging onto one of the channel walls.

Author

Channel Flow; Displacement; Drop Size; Fluid Films; Lubrication; Nozzles

20050060634 NASA Glenn Research Center, Cleveland, OH, USA

Current Status of Joint AFRL/NASA Microgravity Spray Cooling Research Activities

Michalak, Travis; Yerkes,Kirk; McQuillen, John; Golliher, Eric; [2004]; 1 pp.; In English; SAE Power Systems Conference: Thermal Management for Aerospace Power systems and Applications, 2-4 Nov. 2004, Reno, NV, USA

Contract(s)/Grant(s): SAA3-307; 22R-101-53-00; No Copyright; Avail: Other Sources; Abstract Only

The Air Force Research Lab and the NASA Glenn Research Center are cooperatively examining spray cooling in a low and a variable gravity environment by conducting experiments principally aboard the NASA Reduced Gravity Aircraft. The objective of these research activities is to examine an effective high-heat flux, high-power thermal management technology using spray cooling for both aircraft and space-based platforms. Previous studies have demonstrated that two phase heat transfer and fluid management are issues that need to be examined. This effort has obtained preliminary results which confirm these concerns. More research is planned.

Author

Research and Development; Temperature Control; Microgravity; Cooling; Spraying

20050060736 Oklahoma Univ., Norman, OK, USA

High-Speed Rainbow Schlieren Visualization of an Oscillating Helium Jet Undergoing Gravitational Change

Leptuch, Peter A.; Agrawal, Ajay K.; January 2005; 9 pp.; In English

Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: CASI; A02, Hardcopy

Rainbow schlieren deflectometry combined with high-speed digital imaging was used to study buoyancy effects on flow structure of a helium jet discharged vertically into air. The experimental data were taken using the 2.2-sec drop tower facility at the NASA John H. Glenn Research Center in Cleveland, Ohio. The test conditions pertained to jet Reynolds number of 490 and jet Richardson number of 0.11, for which buoyancy is often considered unimportant. Experimental results show global oscillations at a frequency of 27 Hz in Earth gravity. In microgravity, the jet oscillations vanished and the jet width increased. Results provide a direct physical evidence of the importance of buoyancy on the flow structure of low-density gas jets at a Richardson number considered too small to account for gravity.

Author

High Speed; Rainbows; Gas Jets; Helium; Imaging Techniques; Flow Visualization

20050060923 Oklahoma Univ., Norman, OK, USA

Instability Analysis of a Low-Density Gas Jet Injected into a High-Density Gas

Lawson, Anthony Layiwola; 2001; In English

Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: Other Sources; Abstract Only

The objective of this study was to determine the effects of buoyancy on the absolute instability of low-density gas jets injected into high-density gas mediums. Most of the existing analyses of low-density gas jets injected into a high-density ambient have been carried out neglecting effects of gravity. In order to investigate the influence of gravity on the near-injector development of the flow, a linear temporal stability analysis and a spatio-temporal stability analysis of a low-density round jet injected into a high-density ambient gas were performed. The flow was assumed to be isothermal and locally parallel; viscous and diffusive effects were ignored. The variables were represented as the sum of the mean value and a normal-mode small disturbance. An ordinary differential equation governing the amplitude of the pressure disturbance was derived. The velocity and density profiles in the shear layer, and the Froude number (signifying the effects of gravity) were the three important parameters in this equation. Together with the boundary conditions, an eigenvalue problem was formulated. Assuming that the velocity and density profiles in the shear layer to be represented by hyperbolic tangent functions, the eigenvalue problem was solved for various values of Froude number. The temporal growth rates and the phase velocity of the disturbances were obtained. It was found that the presence of variable density within the shear layer resulted in an increase in the temporal amplification rate of the disturbances and an increase in the range of unstable frequencies, accompanied by a reduction in the phase velocities of the disturbances. Also, the temporal growth rates of the disturbances were increased as the Froude number was reduced (i.e. gravitational effects increased), indicating the destabilizing role played by gravity. The spatio-temporal stability analysis was performed to determine the nature of the absolute instability of the jet. The roles of the density ratio, Froude number, Schmidt number, and the lateral shift between the density and velocity profiles on the jet s absolute instability were determined. Comparisons of the results with previous experimental studies show good agreement when the effects of these variables are combined together. Thus, the combination of these variables determines how absolutely unstable the jet will be. Experiments were carried out to observe the qualitative differences between a round low-density gas jet injected into a high-density gas (helium jet injected into air) and a round constant density jet (air jet injected into air). Flow visualizations and velocity measurements in the near-injector region of the helium jet show more mixing and spreading of the

helium jet than the air jet. The vortex structures develop and contribute to the jet spreading causing the helium jet to oscillate. Author

Gas Jets; Stability Tests; Helium; Velocity Measurement; Viscous Flow

20050061039 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

Journal of The Chinese Institute of Engineers, Volume 27, No. 7

Chen, Shun-Tyan, Editor; Tsai, Hsien-Lung, Editor; Shiou, Fang-Jung, Editor; Lee, Liang-Sun, Editor; Young, Der-Liang, Editor; Pan, Ching-Tsai, Editor; Chen, Jean-Lien, Editor; Chung, Chung-Ping, Editor; Chao, Ching-Kong, Editor; Chang, Kai, Editor, et al.; November 2004; ISSN 0253-3839; 153 pp.; In English; See also 20050061040 - 20050061056; Copyright; Avail: Other Sources

The following reports from the Journal of The Chinese Institute of Engineers, Volume 27, No. 7, are presented: Time and Temperature Dependent Mechanical Characterization of Polymer-Based Materials in Electronic Packaging Applications; Analysis and Validation of Thermal and Packaging Effects of a Piezoresistive Pressure Sensor; Transverse Elasticity of Rabbit Sciatic Nerves Tested by in vitro Compression Analysis of SFIT SAW Filters Using Coupling of Modes Model; Flux-Difference Splitting Scheme with Modified Multidimensional Dissipation on Unstructured Meshes; Internal Symmetry Groups for Perfect Elastoplasticity Under Axial-Torsional Loadings; Kinematic Chain Study of the Adjustability of a Monolateral External Fixator; Modified Toughness Used to Evaluate the Effect of Polymer Modified Asphalt on SMA; Ground Movement and Tunnel Stability when Tunneling in Sandy Ground; Accurate Rotor Flux Orientation Technique for Indirect Rotor Flux Oriented Control of Induction Motor Drives; Calculation of Voltage Fluctuation Caused by Intermittent Loads; Genetic Robust Controller Design for Uncertain Systems with Time-Delays in Both State and Control Input via LMI Approach; Power Factor Definition in Single Phase System with Arbitrary Waveform According to Similarity; Robust H(exp infinity) Output Feedback Control for General Nonlinear Systems with Structured Uncertainty; Stress-Strain Characteristics of the Taipei Silty Clay at Small Strain; Stress Curves and Mechanical Properties of High Performance Concrete; and Dynamic Interpretation of Transmission Systems Using Advanced Time-Frequency.

Derived from text

Electronic Packaging; Measuring Instruments; Materials Tests

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*.

20050041952 NASA Glenn Research Center, Cleveland, OH, USA

Launch Vehicle Communications

Welch, Bryan; Greenfeld, Israel; January 2005; 10 pp.; In English

Contract(s)/Grant(s): WBS 041-40-99

Report No.(s): NASA/TM-2005-213418; E-14942; No Copyright; Avail: CASI; A02, Hardcopy

As the National Aeronautics and Space Administration's (NASA) planning for updated launch vehicle operations progresses, there is a need to consider improved methods. This study considers the use of phased array antennas mounted on launch vehicles and transmitting data to either NASA's Tracking and Data Relay Satellite System (TDRSS) satellites or to the commercial Iridium, Intelsat, or Inmarsat communications satellites. Different data rate requirements are analyzed to determine size and weight of resulting antennas.

Author

Launch Vehicles; NASA Programs; Communication Satellites; Satellite Antennas

20050050957 Naval Observatory, Washington, DC, USA

Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting

Breakiron, Lee A., Editor; 1999; 497 pp.; In English; 30th Annual Precise Time and Time Interval Systems and Applications Meeting, 1-3 Dec. 1998, Reston, VA, USA; See also 20050050958 - 20050051002; No Copyright; Avail: CASI; A21, Hardcopy

This document is a compilation of technical papers presented at the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting held 1-3 December 1998 at the Hyatt Regency Hotel at Reston Town Center, Reston,

Virginia. Papers are in the following categories: 1) Recent developments in rubidium, cesium, and hydrogen-based atomic frequency standards, and in trapped-ion and space clock technology; 2) National and international applications of PTTI technology with emphasis on GPS and GLONASS timing, atomic time scales, and telecommunications; 3) Applications of PTTI technology to evolving military navigation and communication systems; geodesy; aviation; and pulsars; and 4) Dissemination of precise time and frequency by means of GPS, geosynchronous communication satellites, computer networks, WAAS, and LORAN.
Author
Conferences; Frequency Standards; Time Measurement; Telecommunication; Computer Networks; Systems Engineering

20050050976 Naval Research Lab., Washington, DC, USA
Calibration Considerations for the IGS/BIPM Pilot Time Transfer Project Using Carrier Phase
Beard, R.; Brad, J.; White, J.; Oaks, O. J.; Landis, G. P.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 235-246; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

During the spring of 1998 a pilot project was begun between the Bureau International des Poids at Mesures (BIPM) and the International GPS Service (IGS) to investigate the accuracy of time and frequency comparisons using GPS phase and code measurements. The IGS has established a cooperative network of stations around the world which gather GPS data, analysis centers that provide analysis products from these GPS data and other contributed data. The precision of the data and products has made major contributions to geodynamics and earth sciences and presents the possibility of highly precise time and frequency comparisons. To compare time information between two sites by whatever means requires the time of propagation of the signal through the equipment, cables, and space to be precisely and accurately known. IGS differential measurements with GPS carrier phase data are highly precise and must be accurately calibrated in order to provide time comparisons. This paper will address the problems and possible techniques for calibration for time comparison. Specialized equipment and GPS system simulators will be described that calibrate from signal reception in the antenna through receiver output.
Author
Calibrating; Earth Sciences; Global Positioning System; Time Measurement; Modulation

20050050990 Belgian Royal Observatory, Brussels, Belgium
Frequency Transfer Using GPS: A Comparative Study of Code and Carrier Phase Analysis Results
Bruyninx, C.; Defaigne, P.; Sleewaegen, J.-M.; Paquet, P.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 307-314; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

This paper investigates the use of GPS codes and carrier phases for frequency transfer applications. Three types of baselines have been studied. First, the noise of the code and phase methods has been evaluated using a zero-baseline with two geodetic GPS receivers driven by the same H-Maser clock, or by a cesium and an H-Maser clock respectively. From the common frequency reference we were able to derive a frequency stability of 6 x 10(exp -16) for averaging times of one day. The different response of the hardware of the two receivers to small identical temperature variations is emphasized; the differential effect is about 30 ps/ C. The difference between the L1 and L2 carrier phase delays is shown too. Secondly, on-site tests over a 95-m baseline allowed checking the influence of combining two antennas/receivers in different environments. In this case, the effect of the varying temperature on the hardware delays of the receivers and cables is shown; this effect limits the frequency stability to 6 x 10(exp -15) for an averaging time of one day. The possibility to obtain frequency stabilities of a few parts in 10(exp 16) is shown; this can be reached if all the instruments are located in temperature.stabilized rooms. Finally, the frequency stability obtained with different code methods is compared on a longer baseline (640 km) between Brussels and Wettzell. In particular, the influence of using IGS satellite ephemerides instead of broadcast ephemerides is shown to be very small. The 'all-in-view' methods based on the code, as well as on the carrier phases, are compared to the classic frequency transfer by common view. Preliminary results, using carrier phases, lead to a frequency stability of a few parts in 10(exp 15) for averaging times of one day. Again, the main limitations are the hardware delay variations due to the changes in ambient conditions.
Author
Frequency Stability; Carrier Frequencies; Variations

20050050991 Naval Observatory, Washington, DC, USA
Two-way Satellite Time Transfer (TWSTT): USNO Operations and Calibration Services
DeYoung, James A.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 315-327; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Naval Observatory maintains a large number of dedicated antennas, modems, and related hardware worldwide in support of high precision DoD and non-DoD TWSTT time and frequency transfer users. This paper will present a small portion of our operations as an example. Recent TWSTT measured time and frequency comparison results, how we monitor the transmit and receive paths, some recent work done on evaluation of X-band high-power-amplifiers and effects on TWSTT, basics of calibration of high-precision time and frequency systems using TWSTT, and an estimate (approximately 1.1 ns) for a recent co-located Ku-band TWSTT calibration are given.
Author
Time Signals; Frequency Control; Transferring; Calibrating

20050050992 National Physical Lab., Teddington, UK
Improving the Delay Stability of a Two-way Satellite Time and Frequency Transfer Earth Station
Shemar, Setnam L.; Davis, John A.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 329-340; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

Two-Way Satellite Time and Frequency (TWSTFT) is increasingly used for the routine intercomparison of time scales at primary timing laboratories. The performance of a two-way time transfer link is, however, limited by delay instabilities in the earth station hardware. Several European laboratories have been operating near field satellite simulators to measure the delay instabilities of their TWSTFT earth stations. At the National Physical Laboratory (NPL) we have adopted a different characterization configuration, where two independent characterization loops are used to measure the TWSTFT earth station uplink and downlink delay instabilities separately. This allows an assessment of the performance of the difference loops in the measurement of the delay instabilities. The cables connecting the earth station hardware have also been investigated. Direct comparisons are made between PTFE coaxial cable propagating Ku-band and L-band signals. Furthermore, the performance of a higher chip rate code has been investigated. Finally, the results presented in this paper are used to discuss future improvements in TWSTFT at NPL.
Author
Time Signals; Synchronous Satellites; Stability; Time Lag; Ground Stations; Frequency Measurement

20050050997 Naval Research Lab., Washington, DC, USA
Performance of GPS On-Orbit NAVSTAR Frequency Standards and Monitor Station Time References
Oaks, Orville Jay; McCaskill, Thomas B.; Largay, Marie M.; Reid, Wilson G.; Buisson, James A.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 135-144; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

The U.S. Naval Research Laboratory OVRL) conducts comprehensive analyses of the Global Positioning System (GPS) atomic frequency standards under the sponsorship of the GPS Joint Program Office (JPO) and in cooperation with the 2nd Space Operations Squadron (2SOPS) at the Master Control Station (MCS) in Colorado Springs, Colorado. Included in the analysis are the on-orbit Navstar space vehicle clocks and the ground reference clocks at each of the frye Air Force and seven National Imagery and Mapping Agency (NIMA) GPS monitor stations. A presentation will be made of the performance of the Navstar clocks currently operating in the constellation, which are characterized through the use of phase, frequency, drift and stability histories in addition to frequency stability profiles based on the Allan and Hadamard variances. Clock performance is analyzed using a multi-year database comprised of pseudorange measurements collected by each of the 12 GPS monitor stations. Results of these analyses are routinely used by the MCS in optimizing the q's in the Kalman filter. Continuous 15-minute measurements of the phase offset of each monitor station time reference from the DoD Master Clock are obtained from Linked Common-View Time Transfer from DoD Master Clock, which is the reference clock at the NIMA Washington, D.C. monitor station. The method is extended to obtain continuous 15-minute measurements of the phase offset of each active Navstar space vehicle clock from the DoD Master Clock. Hence, the performance of all space and control segment clocks is referenced to the DoD Master Clock. Discontinuities in the phase and frequency of the clocks are removed to yield the unperturbed performance of the clocks. The corrections, together with the probable cause of the discontinuity, are summarized. Examples of the frequency history and the exhaustive calculation, for every multiple of the sample period of 15 minutes from 15 minutes to 18 days, of the frequency stability profile for several Navstar space vehicle clocks and for the time reference at two of the GPS monitor stations will be presented Analysis of the performance of the first on-orbit Block IIR operational rubidium clock will also be presented.
Author
Frequency Standards; Global Positioning System; Navstar Satellites; Time Signals; Onboard Equipment

20050051158 Abertay Univ., Dundee, UK

An Experimental Analysis of Narrative Technology for Enhanced C4I (computers, Communication, Command, Control and Intelligence)

Cook, Malcolm J.; Sep. 2004; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8655-03-1-3052

Report No.(s): AD-A428751; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report considers critical issues in supporting command-team functions using an analysis of those tasks identified in transcripts of command-team members discussing critical incidents and issues in command team performance. In previous research, a 12-category framework was developed from a historical analysis of command-team performance and this was applied to the transcripts from command-team members. The more recent analysis of the framework was developed without a priori knowledge of the original framework and this produced between seven and eight major categories that embraced almost all the text units identified in the transcripts. The major categories identified in the analysis overlap significantly with the categories identified via the earlier historical analysis, but the sub-nodes in each category differ, suggesting some qualified degree of validity. The current analysis would have been inadequate without prior knowledge of command team practice and opportunities to assess the validity of the conclusions using subject-matter experts. It is acknowledged that participatory design approaches are more appropriate to meet user-centered design criteria, but given the limited access to command staff, the adapted critical incident method used was a reasonable compromise. The seven most significant categories identified in the analysis included decision-making, technology, command-team issues, information-intelligence, general human factors issues, and communication. The most recent analysis strongly supports the view that command teams make extensive use of socio-cognitive processing to produce effective decision-making and planning. Empirical tests of critical issues in command-team function are considered briefly at the end of the report. (2 tables, 1 figure, 30 refs.)

DTIC

Cognition; Command and Control; Computers; Decision Making; Intelligence

20050051268 Defense Science Board, Washington, DC USA

Report of the Defense Science Board Task Force on Wideband Radio Frequency Modulation: Dynamic Access to Mobile Information Networks

Jul. 2003; 108 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428978; No Copyright; Avail: Defense Technical Information Center (DTIC)

Radio communications is in worldwide flux. There are pressures from the commercial sector for additional frequency spectrum to provide new services; there is significant demand from the Department of Defense (DoD) to increase communications capacity around the world and in multiple contexts/environments; and there are multiple proposals for innovative radio architectures that promise greatly enhanced radio frequency capacity. This report discusses these aspects and presents a set of recommendations aimed at moving in a comprehensive manner to a coherent communications system for the Department of Defense. Wideband radio frequency (RF) technology addressed many of these issues facing the Department of Defense regarding network-centric warfare. The technology offers high capacity communications links necessary to tie widespread sensors, to officers, and to weapons on target; it offers flexibility to meet mission goals, whether covert communications or networked task forces; it offers the means to interconnect terrestrial, airborne, space, and wired infrastructure into a comprehensive warfare network; and it offers the means to adapt to domestic and international spectrum management policies and recommendations.

DTIC

Broadband; Frequency Modulation; Radio Frequencies; Telecommunication

20050051591 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Real Time Calibration Method for Signal Conditioning Amplifiers

Medelius, Pedro J., Inventor; Mata, Carlos T., Inventor; Eckhoff, Anthony, Inventor; Perotti, Jose, Inventor; Lucena, Angel, Inventor; October 05, 2004; 5 pp.; In English

Patent Info.: Filed 15 Oct. 2002; US-Patent-6,801,868; US-Patent-Appl-SN-283353; NASA-Case-KSC-12374; No Copyright; Avail: CASI; A01, Hardcopy

A signal conditioning amplifier receives an input signal from an input such as a transducer. The signal is amplified and processed through an analog to digital converter and sent to a processor. The processor estimates the input signal provided by the transducer to the amplifier via a multiplexer. The estimated input signal is provided as a calibration voltage to the amplifier immediately following the receipt of the amplified input signal. The calibration voltage is amplified by the amplifier and provided to the processor as an amplified calibration voltage. The amplified calibration voltage is compared to the amplified

input signal, and if a significant error exists, the gain and/or offset of the amplifier may be adjusted as necessary.
Official Gazette of the U.S. Patent and Trademark Office
Real Time Operation; Signal Processing; Amplifiers; Calibrating

20050051595 NASA Pasadena Office, CA, USA
Digitally Synthesized Phased Antenna for Multibeam Global Positioning
Dunn, Charles E., Inventor; Young, Lawrence E., Inventor; December 07, 2004; 14 pp.; In English
Patent Info.: Filed 19 July 2002
Report No.(s): US-Patent-6,828,935; US-Patent-Appl-SN-176761; NASA-Case-NPO-200331-1CU; No Copyright; Avail: CASI; A03, Hardcopy

In a system according to the proposed technique, the signal received by each element of the array antenna would be subjected to downconversion, and spread-spectrum demodulation and correlation as necessary; this processing would be performed separately from, and simultaneously with, similar processing of signals received by the other antenna elements. For the GPS implementation, following downconversion to baseband, the signals would be digitized, and all subsequent processing would be digital. In In the digital process, residual carriers would be removed and each signal would be correlated with a locally generated model pseudo random-noise code, all following normal GPS procedure. As part of this procedure, accumulated values would be added in software and the resulting signals would be phase-shifted in software by the amounts necessary to synthesize the desired antenna directional gain pattern of peaks and nulls. The principal advantage of this technique over the conventional radio-frequency-combining technique is that the parallel digital baseband processing of the signals from the various antenna elements would be a relatively inexpensive and flexible means for exploiting the inherent multiple-peak/multiple-null aiming capability of a phased-array antenna. In the original intended GPS application, the peaks and nulls could be directed independently for each GPS signal being tracked by the GPS receiver. This will improve the SNR simultaneously for each GPS signal being tracked while steering multiple nulls toward sources of interference. The technique could also be applied to other code-division multiple-access communication systems.
Author
Digital Techniques; Antenna Arrays; Multibeam Antennas; Global Positioning System

20050051654 Office of the Under Secretary of Defense (Acquisitions and Technology), Washington, DC USA
Report of the Defense Science Board Task Force on Strategic Communication
Sep. 2004; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428770; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Defense Science Board Summer Study on the Transition to and from Hostilities was formed in early 2004 (the terms of reference are contained in Appendix A) and culminated in the production of a final report and summary briefing in August of 2004. The DSB Task Force on Strategic Communication conducted its deliberations within the overall Summer Study schedule and revisited a topic that was addressed in October 2001.1 Task Force members and Government advisors are identified in Appendix B. The current Strategic Communication Task Force re-examined the purposes of strategic communication and the salience of recommendations in the earlier study. It then considered the following questions: (1) What are the consequences of changes in the strategic communication environment? (2) What Presidential direction and strategic communication means are required? (3) What should be done about public diplomacy and open military information operations? The Task Force met with representatives from the National Security Council (NSC), White House Office of Global Communications, Department of State (DOS), Department of Defense (DOD), Broadcasting Board of Governors (BBG), and the private sector (the schedule of meetings, briefings and discussions is contained in Appendix C). Based on extensive interaction with a broad range of sectors in the government, commercial, and academic worlds, as well as a series of highly interactive internal debates, we have reached the following conclusions and recommendations.
DTIC
Security; Military Operations; Communication

20050051779 Nippon Telegraph and Telephone Public Corp., Japan
Inter-code Interference and Optimum Spreading Sequence in Frequency-selective Rayleigh Fading Channels on Uplink MC-CDMA
Shono, T.; Yamada, T.; Kobayashi, K.; Araki, K.; Sasase, I.; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 50; In English; See also 20050051761; Copyright; Avail: Other Sources

In uplink multicarrier code division multiple access (MC-CDMA), the inter-code interference (ICI) caused by the

independent and frequency-selective fading channel of each user and the inter-carrier interference caused by the asynchronous reception of each user's OFDM symbols result in multiple access interference (MAI). This paper evaluates the ICI in frequency-selective Rayleigh fading channels for uplink MC-CDMA. We derive theoretical expressions for the desired-to-undesired signal power ratio (DUR) as a quantitative representation of ICI, and validate them by comparison with computer simulations using a Walsh-Hadamard (WH) code. Based on the analytical results, we obtain the optimum spreading sequence that minimizes the ICI (in short, maximizes the multiplexing performance); this sequence appears to be orthogonal. Three equalization combining methods are examined; equal gain combining (EGC), orthogonality restoring combining (ORC), and maximum ratio combining (MRC).
Author
Rayleigh Fading; Multipath Transmission; Signal Processing; Channels (Data Transmission)

20050051846 Swedish Defence Research Establishment, Linkoeping, Sweden
A Proposal for an Integrated C2 and Protection Function for Preventive and Operative Crisis Management
Jungert, E.; Derefeldt, G.; Hallberg, J.; Hallberg, N.; Hunstad, A.; Mar. 2004; 74 pp.; In Swedish
Report No.(s): PB2005-100733; FOI-R-1183-SE; No Copyright; Avail: CASI; A04, Hardcopy

This work is the result of a study in which a command and control function for crisis management is proposed. This function will be based on a model that includes methods for data collection, discovery, identification, scrutiny and handling of various types of threats. Such threats should, with support from the command and control system, be connected to other existing threats so that chains of potential threats can be determined. Consequently, by starting from the command and control model it should be possible to describe and develop systems with the above capabilities. Hence, it should be possible to exploit different command and control applications to prevent or at least to delimit consequences of crises. To make this possible, method for cooperative work and communication between various agencies and organizations will be required. Important design aspects that must be considered are e.g. IT-security, human systems interaction, and decision support tools of various types.
NTIS
Command and Control; Data Acquisition; Management Methods

20050060962 Stanford Linear Accelerator Center, Stanford, CA, USA, Ecole Polytechnique Federale de Lausanne, Switzerland, Victoria Univ. of Manchester, UK
Evaluation of Advanced TCP Stacks on Fast Long-Distance Production Networks
Bullot, H.; Cottrell, R. L.; 2004; In English
Report No.(s): DE2004-826912; SLAC-PUB-10402; No Copyright; Avail: National Technical Information Service (NTIS)

With the growing needs of data intensive science, such as High Energy Physics, and the need to share data between multiple remote computer and data centers worldwide, the necessity for high network performance to replicate large volumes (TBytes) of data between remote sites in Europe, Japan and the U.S. is imperative. Currently, most production bulk-data replication on the network utilizes multiple parallel standard (Reno based) TCP streams. Optimizing the window sizes and number of parallel stream is time consuming, complex, and varies (in some cases hour by hour) depending on network configurations and loads. We therefore evaluated new advanced TCP stacks that do not require multiple parallel streams while giving good performances on high speed long-distance network paths.
NTIS
Computer Networks; Information Systems; Data Transmission

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*.

20050041862 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Opto-Electronic Oscillator Stabilized By A Hyperfine Atomic Transition
Strekalov, Dmitry; Aveline, David; Matsko, Andrey B.; Thompson, Robert; Yu, Nan; Sep. 2004; 11 pp.; In English; 35th Annual Precise Time and Time Interval Meeting; Original contains color illustrations
Report No.(s): AD-A427764; No Copyright; Avail: CASI; A03, Hardcopy

Opto-electronic oscillator (OEO) is a closed-loop system with part of the loop is implemented by an optical beam, and the rest by RF circuitry. The technological advantage of this approach over traditional all-RF loops in the gigahertz range comes from the that frequency filtering can be done far more efficiently in the optical range with compact, low power, and have superior stability. In this work, we report our preliminary results on using the phenomenon of coherent population trapping in (87) Rb vapor as an optical filter. Such a filter allows us to stabilize the OEO at the hyperfine splitting frequency of rubidium, thus implementing a novel type of frequency standard.
DTIC
Electron Transitions; Feedback Control; Hyperfine Structure; Oscillators

20050041871 Ljubljana Univ., Yugoslavia
Electrotechnical Review, Volume 71, No. 5
Zajc, Baldomir, Editor; Trost, Andrej, Editor; Bajd, Tadej, Editor; Babic, Hrvoje, Editor; Brglez, Franc, Editor; Divjak, Sasa, Editor; Drnovsek, Janko, Editor; Furlan, Joze, Editor; Groselj, Bojan, Editor; Gubina, Ferdo, Editor, et al.; 2004; ISSN 0013-5852; 78 pp.; In English; In Slovene; Copyright; Avail: Other Sources

Reports in this journal contain information pertaining to electrical engineering or electronics,mathematical modeling and computer techniques applied to a variety of topics such as optimization of images for MRI, the prediction of noise from overhead power lines; E-LOTOS;robot navigation. There are also reports on voltage sag mitigation in distribution utilities; and middle-voltage overhead lines with composite insulators.
Derived from text
Mathematical Models; Computer Programs; Robotics; Electrical Engineering

20050050967 Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin, Italy
The Range Covered by a Clock Error in the Case of White FM
Tavella, Patrizia; Meo, Daniela; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 49-60; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

The range covered by the time error of a clock affected by a white frequency noise is studied by means of the theory of the Wiener process and its probability distribution is inferred. The application to atomic clocks and the MTIE characterization used in the telecommunication standards is also examined.
Author
Atomic Clocks; Errors; Time Measurement; Frequencies

20050050968 Singapore Productivity and Standards Board, Singapore
Stability and Accuracy of the Realization of Time Scale in Singapore
Zhongning, Dai; Ann, Chua Hock; Hoon, Neo; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 109-115; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

Singapore Productivity and Standards Board (PSB) maintains the national time scale in Singapore. The time scale has been linked to Coordinated Universal Tune (UTC) since October 1997. This paper reports the analysis on the stability and accuracy of the time scale. Time dissemination through GPS is also discussed.
Author
Accuracy; Stability; Time Lag

20050050974 Naval Observatory, Washington, DC, USA
Postprocessed Timescales at the US Naval Observatory
Matsakis, Demetrios; Breakiron, Lee A.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 19-33; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

A set of free-running timescales is generated using 9 years of data from the USNO clock ensemble. Casium and master clock phases and frequencies are characterized by global fit to first-or-second order polynomials, and the timescales are generated from the clocks detrunded frequency using a variety of weighting functions. These timescales are compared to those generated by USNO's A.1, BIPM's ALGOS and TT98, and NIST's ATI algorithms from the perspective of algorithm choice and frequency stability.
Author
Algorithms; Clocks; Frequency Stability

20050050978 National Physical Lab., Teddington, UK

A Very Short Baseline Time Transfer Experiment Using Two Geodetic-Quality GPS Receivers and Carrier Phase Techniques

Clarke, Jon D.; Davis, John A.; Lowe, Andrew; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 257-269; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

For over 10 years primary timing laboratories have used signals from the Global Positioning System (GPS) to compare atomic timescales. The method used , the common-view of GPS satellites, does not use the GPS system to its full potential. Recently,there has been much interest in using geodetic-quality GPS receivers for time transfer. The result has been a substantial improvement in the precision of the resulting time and frequency transfer. In this paper, a detailed account is presented of common-clock comparisons made at NPL between a recently purchased Ashtech Z12-T receiver and an older Allen Osborne Associates (AOA) TTR-4P receiver. Data collected from these geodetic-quality GPS receivers were processed using analytical software developed at NPL. Direct comparisons are made between the two receivers using both P1 and P2 coded signals, and L1 and L2 phase measurements. Measured ionospheric delays were obtained from both receivers and compared. Multipath is one of the major causes of errors in the surveying applications of geodetic GPS receivers. Code-phase differences were used to estimate the magnitude of code multipath present in both receivers. The principal sources of error present in the common clock measurements are discussed and possible improvements are considered. The future direction of geodetic time transfer work at NPL is also outfined.

Author

Atoms; Clocks; Coding; Error Analysis

20050051000 Bell Telephone Labs., Inc., Holmdel, NJ, USA

Effect of Clock Noise on the Synchronization Performance of Constant Bit Rate (CBR) Traffic in an ATM Network

Jayawardena, T.; Olszewski, C.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 413-421; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

When Constant Bit Rate (CBR) traffic with an associated frequency is carried over an ATM network, the frequency needs to be reconstructed at the exit node of the ATM network. One method for reconstructing this frequency is the Synchronous Residual Time Stamp (SRTS) method. This method relies on two synchronized clocks, one at the entrance and the other at the exit of the ATM network. This paper quantifies the synchronization performance of the signal leaving the ATM network when different levels of noise are present in the signal source clock, the clock at the entrance to the ATM network, or the clock at the exit of the ATM network. Simulations were performed to study the effects of these noise sources separately and in combination. The SRTS scheme itself generates noise with a characteristic time deviation (TDEV) signature. The noise on the signal leaving the ATM network is determined by both the SRTS signature noise and the noise of clocks in the entrance and exit nodes of the ATM network. As the noise of the clocks rise above certain levels, the noise on the signal tends to be determined more by the clock noise than the inherent noise from the SRTS scheme.

Author

Asynchronous Transfer Mode; Clocks; Synchronism

20050051017 New Orleans Univ., LA USA

Synthesis and Spin Dynamics/Coherence Properties of Nanometer-Sized Diluted Magnetic Semiconductors (DMS)

O'Connor, Charles J.; Sep. 2004; 10 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0729; MDA972-02-1-0001

Report No.(s): AD-A428498; No Copyright; Avail: CASI; A02, Hardcopy

This report describes a research project which was directed at the synthesis and self-assembly of diluted magnetic semiconducting nanocrystals using high temperature organic solution techniques in an effort to advance the fundamental understanding of spin-related phenomena in nanometer-scale diluted magnetic semiconductors. This project was in support of a DARPA sponsored project entitled 'Spin Transport and Dynamics in Nano-Scaled Quantum Structures' (Grant No. MDA972-02-l-OOO1), which began January 1, 2002 and continued through June 30, 2004.

DTIC

Crystals; Dilution; Nanocrystals; Nanostructures (Devices); Particle Spin; Quantum Numbers; Semiconductors (Materials); Spin Dynamics

20050051033 California Univ., San Diego, La Jolla, CA USA

Advanced Fabrication and Characterization of Quantum and Nanophotonic Devices and Systems

Fainman, Y.; Jun. 2004; 23 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0369

Report No.(s): AD-A428546; AFRL-SR-AR-TR-04-0627; No Copyright; Avail: CASI; A03, Hardcopy

The program completed its acquisition of equipment for the Micro-Fabrication Facility. The facility is used for fabrication of Quantum and Nanophotonic devices and consists of a CAIBE system capable of sub- micron resolution anisotropic (i.e. high aspect-ratio) etching and a RIE refurbished by INTELVAC Inc. A major capability is a facility for near field complex amplitude characterization with nanoscale spatial and femtosecond scale time resolution for nanophotonics applications. This facility was designed and built in house. The necessary equipment and components to construct the sub-systems have been integrated into the system and are summarized below: (1)Femtosecond MIRA OPO, Coherent Inc. , and b) Near Field Scanning Optical Microscope (NSOM), TS2000 Nanonics Imaging Ltd. The total cost of the acquired equipment for fabrication and Characterization of Quantum and Nanophotonic Devices and Systems was $260, 000. The acquired equipment during the reporting period was used to support needs of nanofabrication and characterization of several projects at UCSD: (I) 'Quantum device technologies - applying 2-D photonic crystals,' (Y. Fainman, L. J. Sham, C. Tu) supported by AFOSR and DARPA's Quantum Information Science and Technology Programs; (2) ' Artificial Dielectrics and Photonic Crystals for STAB Elements: the Receiver' (Y. Fainman) supported by DARPA/STAB Program SPAWAR/ DARPA #N66001-00-C-80'75; and (3) 'Optical Nonlinearities Enhanced by Near-field Diffraction in Artificial Dielectric Nanostructures.'

DTIC

Crystals; Fabrication; Nanostructures (Devices); Quantum Theory

20050051068 Wisconsin Univ., Madison, WI USA

Solid State Quantum Computing Using Nanostructured Logic Gates

Van der Weide, D. W.; Eriksson, M. A.; Joynt, R.; Lagally, M. G.; Oct. 2004; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0515

Report No.(s): AD-A428594; ARO-42391.1-PH-QC; No Copyright; Avail: Defense Technical Information Center (DTIC)

The main goal of this work has been the development, measurement, and understanding of quantum dot qubits in silicon/silicon-germanium. Our team has approached this goal from both experimental and theoretical perspectives, covering materials, coherence, qubit fabrication, and measurement. Achievements include the measurement of stable, low noise Coulomb Blockade in a two dimensional electron gas-based Si/SiGe quantum dot, measurement of spin coherence in silicon quantum wells, development of new schemes for spin measurement and robust quantum gates, measurement of valley states and the low-energy spectrum in Si/SiGe quantum wells, and theoretical understanding of several decoherence mechanisms.

DTIC

Gates (Circuits); Nanostructures (Devices); Quantum Computation; Quantum Dots; Solid State

20050051100 Physics and Electronics Lab. TNO, The Hague, Netherlands

Future Trends for the Application of MEMS in Missiles and Gun Launched Munitions

VAN Heijster, Rob M.; Keizers, Huub L.; Apr. 2004; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428644; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available

Microelectromechanical Systems; Missiles; Trends

20050051159 York Univ., Ontario Canada

DEEPER: Discovery and Exploitation of Emergent Physics through Evolutionary Refinement

Miller, Julian F.; Harding, Simon; Feb. 2004; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F61775-02-WE036

Report No.(s): AD-A428752; No Copyright; Avail: Defense Technical Information Center (DTIC)

The DEEPER project aims to see if artificial evolution can create entirely new technologies, such as transistor-less circuits for sophisticated technological applications. The project is likely to have high impact in basic science. Using artificial evolution to explore 'bottom-up' may lead to devices with significant advantages in size/weight ratio, fault tolerance, radiation tolerance, and speed of response. The project objectives are as follows: (1) to build and test an intrinsic evolution platform (evolvable motherboard), (2) to investigate evolving circuits using radiation-damaged silicon, (3) to investigate evolving

circuits/information processors in liquid crystal, and (4) to investigate other novel materials that are field configurable and that may support artificial intrinsic evolution. The authors note that, with the success of the apparent evolution in liquid crystals and disruption of moving institutions, they have not had the time to investigate radiation-damaged components and their behavior under evolution. Following this status report is a paper entitled 'Evolution in materio: A Tone Discriminator in Liquid Crystal.' The abstract for this paper reads as follows: Intrinsic evolution is often limited to using standard electronic components as the media for problem solving. It has been argued that because such components are human designed and intentionally have predictable responses, they may not be the optimal medium to use when trying to get a naturally inspired search technique to solve a problem. Evolution has been demonstrated as capable of exploiting the physical properties of material to form solutions. However, by giving evolution only conventional components, researchers may be limiting themselves to solving certain problems. Using liquid crystal as the evolution substrate, the authors demonstrate that it is possible to evolve systems, including a tone discriminator, in materio. (20 figures, 16 refs.)
DTIC
Circuit Boards; Display Devices; Exploitation; Liquid Crystals; Printed Circuits; Problem Solving; Switching Circuits; Systems Engineering

20050051165 Mercury Computer Systems, Inc., Chelmsford, MA USA
Beamforming for Radar Systems on COTS Heterogeneous Computing Platforms
Rudin, Jeffrey A.; Aug. 2004; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428758; No Copyright; Avail: Defense Technical Information Center (DTIC)

The introduction of high-speed, analog-to-digital converters has resulted in many of the traditional front-end and sub-array combining functions of multi-function, phased-array radar systems being performed in the digital rather than in the analog domain. Due to the intense amount of processing that is required, many of these functions had to be realized in hardware. This was originally accomplished using VLSI ASICs. However, the advent of multi-million, gate field-programmable gate arrays (FPGA) has permitted these complex digital processing functions to be put in small packages with a degree of design flexibility that is normally associated only with software. This permits more of the radar functions to be realized in commercial off-the-shelf (COTS) hardware by obviating the need for full-custom VLSI in many cases. The incorporation of FPGA technology into COTS processing subsystems permits more complex designs to be created than could be achieved by general-purpose or digital signal processors alone. Simply incorporating FPGAs into single board computers could solve many signal processing problems. However, because of the complexity of the signal processing in a multifunction radar system, a distributed, parallel-processing architecture is usually required. In addition, the trend toward an increasing number of input channels and the formation of a greater number of simultaneous beams requires a high degree of interconnection among the processing elements. Therefore, the technology used to interconnect the computing elements must be flexible enough to accommodate different architectures and system requirements. Furthermore, the interconnection technology should be scalable enough to enable early design prototyping as well as system deployment over a wide range of mission platforms. Thirty briefing charts summarize the presentation.
DTIC
Architecture (Computers); Beamforming; Commercial Off-the-Shelf Products; Distributed Processing; Field-Programmable Gate Arrays; Heterogeneity; Parallel Processing (Computers); Signal Processing

20050051166 MPI Software Technology, Inc., Starkville, MS USA
VSIPL for Diverse Architectures (Pentium 4 to DSPs)
Chase, Brian; Wu, Wenhao; Skjellum, Anthony; Aug. 2004; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428759; No Copyright; Avail: Defense Technical Information Center (DTIC)

Many companies have described their experiences with using Motorola G4 processors to provide the VSIPL CoreLite standard for military and medical computing, and others have described their efforts with highly optimized Core and Core+ profiles. This poster paper uses the experience of MPI Software Technology's existing Core+ optimized VSIPL implementation for G4 as the springboard for supporting other platforms of emerging interest to COTS, defense, medical, and imaging customers. Three kinds of technologies are occurring in military computing that may unseat the preeminence of low-power, G4-style RISC processors: (1) the growing power of DSPs, including better development environments, as typified by TI TMS320C6x family (as opposed to SHARC 2106x, which was harder to program strictly from C and libraries); (2) the use of medium-power systems with Pentium 4-based blades; and (3) the growing perception that PowerPC is lagging Pentium in overall performance. Furthermore, the clock speed of the Intel Pentium line of processors is now reaching three or more GHz. Also, the vector processing registers (SSE) available on the Pentium III or later provide several orders of improved performance for single precision floating point operations. Additionally, the well-known Pentium family provides a

cost-effective COTS solution for embedded hardware designers as well as the end users. This means that although they have high power consumption, their Flops/Watt are becoming more attractive. MPI now has a fully optimized VSIPL (core and CoreLite) library, known as VSI/Pro, for a Pentium 4/SSE platform targeting Linux, Windows, and VxWorks operating systems. The FFT performance of VSI/Pro is consistently better than Intel's Math Kernel Library (MKL). VSI/Pro has a carefully designed API, i.e., VSIPL, which is well fitted to the needs of the signal and image processing community in the defense and medical industries. Twenty briefing charts summarize the presentation.
DTIC

Architecture (Computers); Central Processing Units; Commercial Off-the-Shelf Products; Image Processing; Parallel Processing (Computers); Signal Processing

20050051188 Air Force Research Lab., Rome, NY USA

VSIPL++/FPGA Design Methodology

Bergmann, Jules; Emeny, Susan; Bronowicz, Peter; Aug. 2004; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428797; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper describes a hardware/software codesign methodology for hybrid hardware and software systems. The methodology integrates VSIPL++ for software design and a portable, composable hardware design method based on streams. The hardware design is portable and scalable from design/test systems to the target system and to future technologies. The methodology increases productivity by providing a concise function description in both hardware and software and by providing a streamlined interface between hardware and software. The methodology supports a design methodology from algorithms to embedded systems with hardware/ software co-design, strong unit and system testing, and virtual breadboarding. It simplifies the integration of hardware and software to create high performance applications. It enables the use of predefined FPGA libraries for application acceleration. A standard high-level synthesis hardware design methodology, using a register Transfer Logic (RTL) description in a Hardware Design Language (HDL), achieves portability and scalability. The design can be synthesized onto a range of Field Programmable Gate Arrays (FPGAs) and Application-Specific Integrated Circuits (ASICs). Encapsulation of device specific optimizations into macro cells ensures high performance. Composable and highly reusable hardware units increase productivity. Hardware units use standardized interfaces for data exchange between them. The authors chose a stream interface with flow control, appropriate for signal and image processing. Their software design methodology builds applications using VSIPL++1. VSIPL++, a successor to the Vector Signal and Image Processing Library (VSIPL), addresses portability, performance, and productivity issues for embedded high-performance software design. The High Performance Embedded Computing Software Initiative (HPEC-SI)2 is standardizing VSIPL++. Thirty-five briefing charts summarize the presentation.
DTIC

Aerospace Engineering; Architecture (Computers); Computer Programming; Field-Programmable Gate Arrays; Image Processing; Integrated Circuits; Libraries; Signal Processing; Software Engineering; Vector Processing (Computers)

20050051190 Centar, Los Angeles, CA USA

High-Performance Scalable Base-4 Fast Fourier Transform Mapping

Nash, J. G.; Aug. 2004; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428800; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper describes a novel, scalable, parallel Fast Fourier Transform (FFT) architecture mapping that supports transform lengths that are not powers of two or four, that provides low latency as well as high throughput, that can do both 1-D and 2-D Discreet Fourier Transforms (DFTs), that is ideally suited to today's complex FPGA architectures, that possesses all the regularity and design simplicity of systolic arrays, and that is naturally suited to a parameterized HDL form. Its algorithmic underpinnings are based on an observation that with suitable permutations, the DFT coefficient matrix can be partitioned into regular blocks of smaller 'base-4' matrices (equivalent to a decimation in time and frequency). From this new base-4 matrix DFT description the authors have derived a new latency and throughput optimal base-4 FFT architecture. It combines the performance of traditional radix-4 'pipelined FFTs' with the design and implementation simplicity of systolic arrays, and yet is versatile. Twenty-six briefing charts summarize the presentation.
DTIC

Architecture (Computers); Discrete Functions; Fast Fourier Transformations; Field-Programmable Gate Arrays; Fourier Transformation; Signal Processing

20050051208 Air Force Research Lab., Wright-Patterson AFB, OH USA

The Growth and Characterization of Photonic Thin Films

Tullis, S.; Johnson, W. E.; Eyink, K.; Fleitz, P.; Bunning, T. J.; Nov. 2004; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428835; AFRL-ML-WP-TP-2004-402; No Copyright; Avail: Defense Technical Information Center (DTIC)

Photonic thin films have been grown on a variety of substrates using plasma enhanced chemical vapor deposition (PECVD) of organic monomers, namely benzene and ocafluorocyclobutane (OFCB). Films produced by both homo-polymerization and co-polymerization have been prepared and analyzed. In order to introduce significant contributions from OFCB into co-polymerization films, the OFCB was introduced directly into the plasma zone and the benzene flow was reduced to a low, stable level using a high-accuracy metering valve. The films have been characterized by x-ray photoelectron spectroscopy (XPS), Fourier transform infrared spectroscopy (FTIR) and variable-angle spectroscopic ellipsometry (VASE), with an emphasis on XPS. Apart from determining the atomic composition of the films with XPS, it was extremely valuable in determining the chemistry of the films. Studies of the mechanisms of the homo-and co- polymerization reactions have aided in the fabrication of photonic films. The effects of monomer feed-in rates were applied to manipulate the composition and chemistry of the deposited films to achieve the required optical properties. Applications of PECVD to fabricate a notch filter and an anti-reflective coating are also provided.

DTIC

Thin Films; Vapor Deposition

20050051210 Akron Univ., Akron, OH USA

Electromechanical Coupling In Free-Standing AlGaN/GaN Planar Structures

Jogai, B.; Albrecht, J. D.; Pan, E.; Nov. 2003; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-00-C-5402; Proj-M07R/4348

Report No.(s): AD-A428837; AFRL-ML-WP-TP-2004-403; No Copyright; Avail: Defense Technical Information Center (DTIC)

The strain and electric fields present in free-standing AlGaN/GaN slabs are examined theoretically within the framework of fully coupled continuum elastic and dielectric models. Simultaneous solutions for the electric field and strain components are obtained by minimizing the electric enthalpy. We apply constraints appropriate to pseudomorphic semiconductor epitaxial layers and obtain closed-form analytic expressions that take into account the wurtzite crystal anisotropy. It is shown that in the absence of free charges, the calculated strain and electric fields are substantially different from those obtained using the standard model without electromechanical coupling. It is also shown, however, that when a two-dimensional electron gas is present at the AlGaN/GaN interface, a condition that is the basis for heterojuction field-effect transistors, the electromechanical coupling is screened and the decoupled model is once again a good approximation. Specific causes of these calculations corresponding to transistor and superlattice structures are discussed.

DTIC

Aluminum Nitrides; Electromechanical Devices; Electromechanics; Gallium Nitrides; Planar Structures

20050051242 Delaware Univ., Newark, DE USA

Design and Fabrication of Sensors on Fibers

Sirdeshmukh, R.; Panchapakesan, B.; Abu-Obaid, A.; Heider, D.; Jul. 2003; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0811

Report No.(s): AD-A428890; No Copyright; Avail: Defense Technical Information Center (DTIC)

Summary: 1) Preliminary research on sensors/devices on fibers; 2) Key hurdles: Circular masks - Connection to the outside world; 3) Evaluated photo-resist materials and developed continuous application process; 4) Applied successful flat mask pattern on fiber; 5) Developed design concepts for sensors.

DTIC

Electromechanical Devices; Fabrication; Microinstrumentation; Sensors

20050051261 Air Force Research Lab., Wright-Patterson AFB, OH USA

Atomic Force Microscope Based Analysis of Bound and Bound + Mobile Phase Monolayer Behavior Under Mechanical and Electrical Stress

Nainaparampil, J. J.; Eapen, K. C.; Zabinski, J. S.; Oct. 2004; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-M06R

Report No.(s): AD-A428956; AFRL-ML-WP-TP-2004-404; No Copyright; Avail: Defense Technical Information Center (DTIC)

One of the major problems with microelectromechanical systems (MEMS) is the stiction caused by capillary, van der Waals, electrostatic, and chemical forces. Self-assembled monolayers are extensively used to resolve this problem and they have been effective to a certain extent. It has been noted that the molecular weight, entanglement of molecules with asperities, time dependent interactions between asperities and monolayers, and surface migration play major roles in the failure of these coatings. In addition, tribological stressing and diffusion at increased in the failure of these coatings. In addition, tribological stressing and diffusion at increased temperature can also cause monolayers to fail. In this study, atomic force microscopy (AFM) and related techniques are used to analyze the behavior of bound monolayer films of 1-decanol and bound 1-decanol combined with a mobile phase (a pentaerythritol ester). Molecular reorientation and surface detachment under electrostatic force increase with increasing electric field between the AFM tip and the film.

DTIC

Atoms; Electrostatics; Microelectromechanical Systems

20050051551 Naval Undersea Warfare Center, Newport, RI USA

Termination Clamp Assembly for a Hybrid Electrical/Fiber Optic Cable

Kassal, James J., Inventor; Dec. 2004; 23 pp.; In English

Report No.(s): AD-D020164; No Copyright; Avail: CASI; A03, Hardcopy

A device for terminating a hybrid electrical/fiber optic cable at a connector comprising a clamp assembly affecting a swage lock on a k-tube to prevent movement of the k-tube within the connector and resultant damage to the optical fibers. The clamp assembly comprises two clamp halves, at least one of which includes a k-tube groove, one or more optical fiber grooves, a fan out cavity, and means for joining the clamp halves. When the clamp halves are joined, the k-tube grooves form an enclosed k-tube channel that is slightly smaller than the outside diameter of the k-tube, thereby creating a swage lock to prevent movement of the k-tube. Similarly, the optical fiber grooves create a swage lock on protective plastic tubes that are placed over the optical fibers as they exit and fan out from the k-tube in the fan out cavity.

DTIC

Clamps; Fiber Optics; Power Lines; Transmission Lines

20050051554 Naval Undersea Warfare Center, Newport, RI USA

Multi-Layer Composite Transducer Array

Benjamin, Kim C., Inventor; Feb. 2004; 14 pp.; In English

Report No.(s): AD-D020167; No Copyright; Avail: CASI; A03, Hardcopy

A multi-layer composite transducer array includes at least one pair of composite transducers with an electrical and mechanical isolation layer disposed there between. Each composite transducer is defined by a composite panel having a common electrode coupled to a first surface and electrode segments electrically isolated from one another and coupled to a second surface. Each pair of composite transducers is configured such that the electrode segments associated with the pair's composite transducers oppose and are aligned with one another. The isolation layer has dielectric material segments that are sized, shaped and aligned in correspondence with opposing and aligned ones of the electrode segments associated with the pair's transducers. Spaces formed in the isolation layer between the dielectric material segments are filled with a viscoelastic material.

DTIC

Composite Structures; Electrical Insulation; Transducers; Vibration Isolators

20050051656 NASA Glenn Research Center, Cleveland, OH, USA

RF MEMS Based Reconfigurable Antennas

Simons, Rainee N.; [2004]; 33 pp.; In English; 10th International Symposium on Antenna Technology and Applied Electromagnetics, 20-23 Jul. 2004, Ottawa, Ontario, Canada

Contract(s)/Grant(s): WBS 322-70-00; No Copyright; Avail: CASI; A03, Hardcopy

The presentation will first of all address the advantages of RF MEMS circuit in antenna applications and also the need for electronically reconfigurable antennas. Next, discuss some of the recent examples of RF MEMS based reconfigurable microstrip antennas. Finally, conclude the talk with a summary of MEMS antenna performance.
Author
Microelectromechanical Systems; Radio Frequencies; Circuits

20050051769 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan
Planar Lightwave Circuit Technology: The Key to Constructing Large-capacity Optical Networks
Yamada, Yasufumi; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 6-11; In English; See also 20050051761; Copyright; Avail: Other Sources

As Fiber to the Home (FTTH) continues to expand, one promising approach to ensuring sufficient network transmission capacity is planar lightwave circuit (PLC) technology for fabricating optical integrated circuits. This technology is being developed by NTT Electronics Corporation (NEL), the major hardware manufacturer in the NTT Group. What features does NEL's PLC technology provide, and what strategy will NEL adopt to stay ahead of its competitors? We put these and other questions to Yasufumi Yamada, manager of the Planar Lightwave Circuits Group.
Author
Integrated Circuits; Optical Waveguides; Multiplexing; Switches

20050051775 Nippon Telegraph and Telephone Public Corp., Japan
A 43-Gb/s Clock and Data Recovery OEIC Integrating an InP-InGaAs HPT Oscillator with an HBT Decision Circuit
Kamitsuna, H.; Ishii, K.; Shibata, T.; Kurishima, K.; Ida, M.; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 49; In English; See also 20050051761; Copyright; Avail: Other Sources

This paper precents a 43-Gb/s clock and data recovery (CDR) optoelectronic integrated circuit (OEIC) that consists of a 43-GHz heterojunction phototransistor (HPT) oscillator as an optoelectronic clock recovery circuit and a 40-Gb/s-class heterojunction bipolar transistor (HBT) decision circuit. The layer and fabrication process of the HPT and HBT are fully compatible, and the HPT has a photo-coupling window in the emitter electrode for optical acceqs from the top. When the HPT is directly illuminated, the HPT oscillator successfully extracts a 43-GHz electrical clock signal from a 43-Gb/s optical data stream by itself. The OEIC regenerates the data signal input into the HBT decision circuit by using the electrical clock signal optoelectronically extracted by the HPT oscillator. The CDR OEIC achieves error-free operation for a 2(sup 31)-l PRBS data signal. The power dissipation of the OEIC is only 0.79 W. which is less than half that of a fully electrical 40-Gb/s-class CDR IC. This is the first successful demonstration of HPT-based OEICs integrated with HBT digital circuits operating at such a high bit rate.
Author
Heterojunction Devices; Indium Phosphides; Oscillators; Phototransistors; Integrated Circuits; Digital Electronics; Fabrication; Indium Gallium Arsenides

20050051927 NASA Glenn Research Center, Cleveland, OH, USA
Li-Ion Battery for ISS
Dalton, Penni; Cohen, Fred; April 2004; 12 pp.; In English; Space Power Workshop, 19-22 Apr. 2004, Manhattan Beach, CA, USA
Contract(s)/Grant(s): WBS 22-335-14-03-03; No Copyright; Avail: CASI; A03, Hardcopy

The ISS currently uses Ni-H2 batteries in the main power system. Although Ni-H2 is a robust and reliable system, recent advances in battery technology have paved the way for future replacement batteries to be constructed using Li-ion technology. This technology will provide lower launch weight as well as increase ISS electric power system (EPS) efficiency. The result of incorporating this technology in future re-support hardware will be greater power availability and reduced program cost. the presentations of incorporating the new technology.
Author
Lithium Batteries; Power Efficiency; Hydrogen

20050051943 National Renewable Energy Lab., Golden, CO, Evergreen Solar, Inc., Marlboro, MA, USA
Innovative Approaches to Low Cost Module Manufacturing of String Ribbon Si PV Modules
Hanoka, J. I.; May 2004; In English
Report No.(s): DE2004-15007609; NREL/SR-520-36194; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of the PV Manufacturing R&D subcontract, 'Innovative Approached to Low Cost Module Manufacturing of Sting Ribbon Si PV Modules,' over its three-phase duration is to continue the development of Evergreen's String Ribbon Si PV technology resulting in an advanced generation of crystalline silicon PV module manufacturing technology applied to a virtually continuous, fully integrated manufacturing line. The final goal of this line will be the production of frameless modules using wrap-around contacts on String Ribbon solar cells and made in a monolithic module configuration. Specific objectives include methods for improving surface and bulk quality of as-grown ribbon, improving techniques for wrap-around solar cell efficiencies, extensive reliability testing under accelerated conditions, developing low cost manufacturing to make frameless modules in general and monolithic modules in particular, and in-line diagnostics throughout the production line. During its first phase, the project involved five major areas of work: (1) Scale-up of a production worthy method for doping feedstock. (2) Development of a multiple ribbon growth system and pilot line introduction of same (Project Gemini) (3) Development of wrap-around contacts for making monolithic modules, including a method for forming a monolithic module with satisfactory long term reliability. (4) Accelerated testing of 25 W size and 50 W size monolithic modules (5) Development of a production machine to form solar cell contacts using Evergreen's unique contact printing technology.
NTIS
Photovoltaic Cells; Manufacturing; Research and Development; Solar Cells

20050051944 National Renewable Energy Lab., Golden, CO, Oregon Univ., Eugene, OR, USA
Novel Capacitance Measurements in Copper Indium Galium Diselenide Alloys. Final Subcontract Report, July 1, 1999-August 31, 2003
Johnson, D. C.; 2004; In English
Report No.(s): DE2004-15007675; NREL/SR-520-35614; No Copyright; Avail: National Technical Information Service (NTIS)

This subcontract report describes the University of Oregon's objectives to measure the electronic properties of the copper indium/gallium diselenide alloys using several well-developed capacitance techniques appropriate for probing materials with a continuous distribution of semiconducting gap electronic energy states. We applied a new synthetic method to the production of CIGS alloys, namely, the modulated elemental reactant method. To form CIGS by this method, alternating layers of Cu:In:Se and Cu:Ga: Se composites, each less than 100 thick, were evaporated in sequence and then annealed at low temperature. A second focus was to test and develop junction capacitance methods to better understand the electronic properties in CIGS material and establish a relationship of those properties to specific device performance parameters. The primary methods employed were transient photocapacitance (TPC) spectroscopy and drive-level capacitance profiling (DLCP). Finally, we extended our characterization studies to four CuIn1-xAlxSe2 (CIAS) samples, also supplied by IEC. Our photocapacitance and DLCP measurements on these CIAS samples indicated that for a sample with 13 at.% Al (having a bandgap of nearly 1.2 eV), the electronic properties were essentially identical to those in CIGS samples with 26 at.% Ga.
NTIS
Capacitance; Electrical Properties; Energy Gaps (Solid State); Measurement

20050051954 Lumileds Lighting, LLC, San Jose, CA, USA
New Technology Moves LEDs into Consumer Applications
Scott, Keith; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 80-81; In English; Original contains color illustrations; Copyright; Avail: Other Sources

Major advancements in LED technologies are making new lighting products and effects possible. Over the past few years, we've witnessed the advent of seven colors and a white LED in high-power packaging, along with silicon and plastic lenses that realize the promise of long-lifetime, high-lumen-maintenance LEDs. The market also has seen the emergence of a high-power 'warm white' LED with a remarkable color-rendering index. High-power LED packages already are finding a home in the everyday lighting world. Colored versions are rapidly displacing filtered incandescent sources in automotive and traffic signal applications. Building beacons, emergency and airfield lighting, architectural/entertainment highlighting, and other directional, saturated-color applications are viable candidates for high-power LED use. For example. LEDs are employed both indoors and outdoors at Holland Casino Breda in the Netherlands. LEDs are not only creating interesting lighting situations, but also saving energy and, as a result of their longevity, reducing maintenance costs. Consider a typical 12-in. red traffic signal that uses a 135-W incandescent lamp. Of the 2000 lm or more produced by the lamp, only about 200 lm are transmitted through the red filter. Twelve red Luxeon LEDs using 12 W produce the same amount of red light. Similar calculations can be made for amber and green. Large energy and financial savings are realized when colored high-power LEDs re-place colored filament and neon sources. White high-power LEDs replace colored filament and neon sources. White

high-power LEDs, with their long life, and high lumen maintenance, are excellent choices for today's lower-lumen applications.
Derived from text
Consumers; Light Emitting Diodes; Technology Utilization; Illuminating

20050060614 Osram Opto Semiconductors, Inc., San Jose, CA, USA, Osram Opto Semiconductors, Inc., San Jose, CA, USA
LEDs Continue to Advance
Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 60-62; In English; Original contains color illustrations; Copyright; Avail: Other Sources

LEDs have entered the mainstream in many applications as a result of the increases in their luminous flux, the availability of an extensive range of colors, and their inherent technological benefits compared with conventional filament-based light sources. Moreover, improvements in lifetime and the development of electronic and optical solutions have led to the rise of an extensive value chain of suppliers, solution providers and enablers that has aided in the proliferation of LED-based products in the absence of solid-state standards.
Author
Light Emitting Diodes; Light Sources

20050060658 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Power Electronics Components
Schwarze, Gene E.; October 27, 2004; 54 pp.; In English; SAE Power Systems Conference: Spacecraft Power Management and Distribution, 2-4 Nov. 2004, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-319-20-N1; No Copyright; Avail: CASI; A04, Hardcopy

This paper will give a description and status of the Advanced Power Electronics Materials and Components Technology program being conducted by the NASA Glenn Research Center for future aerospace power applications. The focus of this research program is on the following: 1) New and/or significantly improved dielectric materials for the development of power capacitors with increased volumetric efficiency, energy density, and operating temperature. Materials being investigated include nanocrystalline and composite ceramic dielectrics and diamond-like carbon films; 2) New and/or significantly improved high frequency, high temperature, low loss soft magnetic materials for the development of transformers/inductors with increased power/energy density, electrical efficiency, and operating temperature. Materials being investigated include nanocrystalline and nanocomposite soft magnetic materials; 3) Packaged high temperature, high power density, high voltage, and low loss SiC diodes and switches. Development of high quality 4H- and 6H- SiC atomically smooth substrates to significantly improve device performance is a major emphasis of the SiC materials program; 4) Demonstration of high temperature (\g 200 C) circuits using the components developed above.
Author (revised)
Spacecraft Electronic Equipment; Dielectrics; Capacitors; Magnetic Materials; Silicon Carbides

20050060668 NASA Glenn Research Center, Cleveland, OH, USA
The Electrical Engineering Profession at NASA
Emerson, Dawn; September 29, 2004; 17 pp.; In English; EU/US Cooperation Pragramme in Higher Education and Vocational Education and Training Conference, 4-8 Oct. 2004, Birmingham, England, UK; No Copyright; Avail: CASI; A03, Hardcopy

Presentation given at the opening ceremony of the Centre of Vocational Excellence in Birmingham, England on October 7, 2004. Presentation highlights examples of work performed by Electrical Engineers at the NASA Glenn Research Center and highlights the demographics of the NASA workforce. Presentation is intended to be inspirational in nature.
Author
Electrical Engineering; Engineers; Research Facilities

20050060728 Hamamatsu Corp., Bridgewater, NJ, USA
Smaller, Cheaper, Better: Photo ICs Come of Age
Asencios, Gustavo; Photonics Spectra; January 2005; Volume 39, No. 1, pp. 81-84; In English; Original contains color illustrations; Copyright; Avail: Other Sources

A current trend in the optical detector industry involves the need for photodetectors that feature added capabilities. It used

to be the case that the most efficient setup was a simple photodiode mounted on a PC board and a discrete amplifier, but times have changed. A new breed of photodetector is slowly making its way into applications once dominated by discrete components. There are many names for this type of device, which combines a photodetector and an integrated circuit. In this article, we will refer to such a device as a 'photo IC.'
Author
Computer Components; Photodiodes; Photometers

20050061042 Shanghai Jiao Tong Univ., China
Power Factor Definition in Single Phase System with Arbitrary Waveform According to Similarity
Ling, Zhi-Bin; Deng, Chao-Ping; Ye, Peng-Sheng; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1063-1068; In English; See also 20050061039; Copyright; Avail: Other Sources

A new definition of power factor, which is suitable for an arbitrary waveform of voltage and current in a single-phase system is presented according to similarity between voltage and current waveforms. The similarity is described in infinite dimensions real vector space, and the power factor is defined as the multiplication of root-mean-square (RMS) value factor lambda(sub RMS) and phase factor lambda(sub Phi). The new definition is compatible with IEEE Trial-Use Standard 1459-2000, and can be a useful reference for power factor measurement, power factor correction and power compensation.
Author
Waveforms; Root-Mean-Square Errors; Electric Potential; Mean Square Values

20050061044 National Tsing Hua Univ., Hsinchu, Taiwan, Province of China
Time and Temperature Dependent Mechanical Characterization of Polymer-Based Materials in Electronic Packaging Applications
Kuo, Chia-Tai; Yip, Ming-Chuen; Chiang, Kuo-Ning; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 949-954; In English; See also 20050061039
Contract(s)/Grant(s): NSC91-2212-E-007-036; Copyright; Avail: Other Sources

The thermo-mechanical testing of high performance polyimide films Type HPP-ST supplied by Dupont(Trademark) was conducted at different strain rates and in different temperature environments. The stress-strain behavior of materials was investigated and the dependence of Young's modulus on temperature and strain rate is reported. In view of the uncertainty of the Young's modulus determination, the specimens were tested with unloading-reloading to verify the test results. Constant strain rate uniaxial tensile tests and long-time creep tests at various temperatures were performed to characterize the time-temperature-dependent mechanical property precisely. Cyclic loading tests were also implemented on specimens to investigate cyclic stress-strain behaviors. This research is expected to enhance finite-element-modeling accuracy and characterize material properties precisely.
Author
Polyimides; Temperature Dependence; Mechanical Properties; Creep Properties; Creep Tests; Strain Rate; Stress-Strain Relationships

20050061045 National Tsing Hua Univ., Hsinchu, Taiwan, Province of China
Analysis and Validation of Thermal and Packaging Effects of a Piezoresistive Pressure Sensor
Peng, Chih-Tang; Lin, Ji-Cheng; Lin, Chun-Te; Chiang, Kuo-Ning; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 955-971; In English; See also 20050061039; Copyright; Avail: Other Sources

In this study, a packaged silicon base piezoresistive pressure sensor with thermal stress buffer is designed, fabricated and studied. A finite element method (FEM) is adopted for designing and optimizing the sensor performance. Thermal and pressure loading on the sensor is applied to make a comparison between experimental and simulation results. Furthermore, a method that transforms simulation stress data into output voltage is proposed in this study. and the results indicate that the experimental result coincides with the simulation data. In order to achieve better sensor performance. a parametric analysis is performed to evaluate the system sensitivity. as well as thermal and packaging effects of the pressure sensor. The design parameters of the pressure sensor include membrane size. sensor chip size. glass thickness. adhesive layer thickness. PCB thickeness/material, etc. The findings show that proper selection of the sensor structure and material not only enhances the sensor sensitivity but also reduces the thermal effects as well as the packaging influence.
Author
Piezoelectric Transducers; Pressure Sensors; Finite Element Method; Thermal Stresses; Design Analysis; Electric Potential

20050061046 National Taiwan Univ., Taipei, Taiwan, Province of China

Analysis of SFIT SAW Filters Using Coupling of Modes Model

Wu, Tsung-Tsong; Lin, Chih-Ming; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 973-979; In English; See also 20050061039; Copyright; Avail: Other Sources

This paper presents a study on using the coupling-of-model (COM) model to analyze wide-band SAW filters with slanted finger interdigital transducers (SFIT). In contrast to other design methods, the COM model is more convenient and more simple to use for designing different types of electrodes by just changing the elements of a P-matrix. In this paper, we give a complete description of how to use the COM approach to analyze SFIT SAW filters and show a comparison of simulated and experimental frequency responses of the SFIT SAW filter. Two SFIT SAW filters with 30% bandwidth, 60 MHz center frequency, and different numbers of SFIT pairs were designed. On the experimental side, SFIT SAW filters using YZ-LiNbO3 as the substrate material were fabricated and the on-wafer frequency responses were measured. Comparisons made between the simulated and measured frequency responses showed good agreement.

Author

Interdigital Transducers; Bandwidth; Frequencies; Broadband

20050061049 Chung Yuan Univ., Chung Li, Taiwan, Province of China

Calculation of Voltage Fluctuation Caused by Intermittent Loads

Hong, Ying-Yi; Wang, Jun-Jie; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1047-1054; In English; See also 20050061039; Copyright; Avail: Other Sources

Intermittent loads, such as grinders and welders are the main factors that degrade the power quality in the distribution system. Intermittent loads will result in voltage fluctuations with stochastic characteristics. which may lead to malfunction of other sensitive loads. This paper uses cumulant method to calculate the bus voltage fluctuation using the algebraic addition and multiplication. The probability density function of the voltage fluctuation can be further expressed by the Gram-Charlier series expansion. Compared with traditional methods. computation complexity can be simplified and computation time can be markedly reduced by the proposed method. The simulation results from an II-bus industrial distribution system with grinders show the applicability of the proposed method.

Author

Loads (Forces); Electric Potential; Stochastic Processes; Probability Theory; Series Expansion

20050061052 Yuang-Ta Institute of Technology and Commerce, Pingtung, Taiwan

Genetic Robust Controller Design for Uncertain Systems with Time-Delays in Both State and Control Input via LMI Approach

Chen, Jeng-Chen; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1055-1061; In English; See also 20050061039; Copyright; Avail: Other Sources

In this paper, the robust control for uncertain delay systems in state and control input is considered. The uncertainty is nonlinear time-varying perturbations and does not require a matching condition but is norm-bounded. Based on the constructive use of Lyapunov functional. delay-dependent stabilizability criteria are proposed to guarantee stability for the systems via linear control. Linear matrix inequality (LMI) and Genetic algorithms are used to design a memoryless state-feedback controller. Two numerical examples are given to illustrate that the proposed results are less conservative than some others. Key Words: genetic robust controller. uncertain time-delay systems. LMI approach.

Author

Controllers; Uncertain Systems; Perturbation; Matrices (Mathematics)

20050061056 National Tsing Hua Univ., Hsinchu, Taiwan, Province of China

Accurate Rotor Flux Orientation Technique for Indirect Rotor Flux Oriented Control of Induction Motor Drives

Guey, Zen-Jey; Pan, Ching-Tsai; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1033-1045; In English; See also 20050061039; Copyright; Avail: Other Sources

In this paper, a novel detuning index is first proposed for indicating the proper timing required to correct the rotor time constant of indirect rotor flux oriented controlled single-cage induction motor drives. This index can faithfully reflect the influence of rotor resistance changes as well as rotor flux changes. It also reduces greatly the number of rotor time constant estimations in practical applications. The theoretical basis of the index and the physical meaning are described in the paper in detail. Based on the proposed index. an on-line rotor time constant estimator is also proposed to make corrections. Only existing available quantities of the closed loop controller are used for calculating the estimated rotor time constant accurately.

Both simulation and experimental results verify the effectiveness of the proposed rotor flux orientation technique. It is seen that the proposed rotor flux orientation technique is suitable for practical applications.
Author
Rotors; Induction Motors; Time Constant; Rotor Dynamics

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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*.

20050041825 NASA Langley Research Center, Hampton, VA, USA
Navier-Stokes Computations of Longitudinal Forces and Moments for a Blended Wing Body
Pao, S. Paul; Biedron, Robert T.; Park, Michael A.; Fremaux, C. Michael; Vicroy, Dan D.; December 28, 2004; 11 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 23-762-45-AE
Report No.(s): AIAA Paper 2005-0045; No Copyright; Avail: CASI; A03, Hardcopy

The object of this paper is to investigate the feasibility of applying CFD methods to aerodynamic analyses for aircraft stability and control. The integrated aerodynamic parameters used in stability and control, however, are not necessarily those extensively validated in the state of the art CFD technology. Hence, an exploratory study of such applications and the comparison of the solutions to available experimental data will help to assess the validity of the current computation methods. In addition, this study will also examine issues related to wind tunnel measurements such as measurement uncertainty and support interference effects. Several sets of experimental data from the NASA Langley 14x22-Foot Subsonic Tunnel and the National Transonic Facility are presented. Two Navier-Stokes flow solvers, one using structured meshes and the other unstructured meshes, were used to compute longitudinal static stability derivatives for an advanced Blended Wing Body configuration over a wide range of angles of attack. The computations were performed for two different Reynolds numbers and the resulting forces and moments are compared with the above mentioned wind tunnel data.
Author
Blended-Wing-Body Configurations; Computational Fluid Dynamics; Longitudinal Stability; Navier-Stokes Equation; Subsonic Wind Tunnels; Wind Tunnel Tests; Pitching Moments

20050041939 NASA Langley Research Center, Hampton, VA, USA
Navier-Stokes Computations of Longitudinal Forces and Moments for a Blended Wing Body
Pao, S. Paul; Biedron, Robert T.; Park, Michael A.; Fremaux, C. Michael; Vicroy, Dan D.; January 2005; 11 pp.; In English
Report No.(s): AIAA Paper 2005-0045; No Copyright; Avail: CASI; A03, Hardcopy

The object of this paper is to investigate the feasibility of applying CFD methods to aerodynamic analyses for aircraft stability and control. The integrated aerodynamic parameters used in stability and control, however, are not necessarily those extensively validated in the state of the art CFD technology. Hence, an exploratory study of such applications and the comparison of the solutions to available experimental data will help to assess the validity of the current computation methods. In addition, this study will also examine issues related to wind tunnel measurements such as measurement uncertainty and support interference effects. Several sets of experimental data from the NASA Langley 14x22-Foot Subsonic Tunnel and the National Transonic Facility are presented. Two Navier-Stokes flow solvers, one using structured meshes and the other unstructured meshes, were used to compute longitudinal static stability derivatives for an advanced Blended Wing Body configuration over a wide range of angles of attack. The computations were performed for two different Reynolds numbers and the resulting forces and moments are compared with the above mentioned wind tunnel data.
Author
Blended-Wing-Body Configurations; Computational Fluid Dynamics; Navier-Stokes Equation; Static Stability; Longitudinal Stability; Wind Tunnel Tests; Subsonic Wind Tunnels

20050041941 NASA Langley Research Center, Hampton, VA, USA
On the Application of Contour Bumps for Transonic Drag Reduction(Invited)
Milholen, William E., II; Owens, Lewis R.; January 2005; 19 pp.; In English
Report No.(s): AIAA Paper 2005-0462; No Copyright; Avail: CASI; A03, Hardcopy

The effect of discrete contour bumps on reducing the transonic drag at off-design conditions on an airfoil have been

examined. The research focused on fully-turbulent flow conditions, at a realistic flight chord Reynolds number of 30 million. State-of-the-art computational fluid dynamics methods were used to design a new baseline airfoil, and a family of fixed contour bumps. The new configurations were experimentally evaluated in the 0.3-m Transonic Cryogenic Tunnel at the NASA Langley Research center, which utilizes an adaptive wall test section to minimize wall interference. The computational study showed that transonic drag reduction, on the order of 12% - 15%, was possible using a surface contour bump to spread a normal shock wave. The computational study also indicated that the divergence drag Mach number was increased for the contour bump applications. Preliminary analysis of the experimental data showed a similar contour bump effect, but this data needed to be further analyzed for residual wall interference corrections.
Author
Computational Fluid Dynamics; Contours; Drag Reduction; Transonic Wind Tunnels; Wind Tunnel Tests; Cryogenic Wind Tunnels; Airfoils

20050041948 NASA Glenn Research Center, Cleveland, OH, USA
Demonstration of Separation Delay with Glow-Discharge Plasma Actuators
Hultgren, Lennart S.; Ashpis, David E.; December 2004; 17 pp.; In English; 14 Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA
Contract(s)/Grant(s): WBS 22-708-28-13
Report No.(s): NASA/TM-2003-212204/REV1; AIAA Paper 2003-1025; E-13807-1/REV1; No Copyright; Avail: CASI; A03, Hardcopy

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

20050041977 Army Aviation and Missile Command, Hampton, VA, USA
Comprehensive Modeling of the Apache with CAMRAD II
Jones, Henry E.; Kunz, Donald L.; [2001]; 13 pp.; In English; American Helicopter Society Structural Specialists' Meeting, 30 Oct. - 1 Nov. 2001, Williamsburg, VA, USA; Copyright; Avail: CASI; A03, Hardcopy

This paper presents a report of a multi year study of the U.S. Army LONGBOW APACHE (AH-64D) aircraft. The goals of this study were to provide the Apache Project Managers Office (PMO) with a broad spectrum of calibrated comprehensive and CFD models of the AH-64D aircraft. The goal of this paper is to present an overview of the comprehensive model which has been developed. The CAMRAD II computer code was chosen to complete this task. The paper first discusses issues that must be addressed when modeling the Apache using CAMRAD. The work required the acquisition of a data base for the aircraft and the development and application of a multidisciplinary computer model. Sample results from various parts of the model are presented. Conclusions with regard to the strengths and weaknesses of simulations based on this model are discussed.
Author
Computational Fluid Dynamics; Apache Rocket Vehicle; AH-64 Helicopter; Rotor Aerodynamics; Aircraft Models; Computer Programs

20050041982 NASA Glenn Research Center, Cleveland, OH, USA
Review of Research into the Concept of the Microblowing Technique for Turbulent Skin Friction Reduction
January 2004; 61 pp.; In English; No Copyright; Avail: CASI; A04, Hardcopy

A new technology for reducing turbulent skin friction, called the Microblowing Technique (MBT), is presented. Results from proof-of-concept experiments show that this technology could potentially reduce turbulent skin friction by more than 50% of the skin friction of a solid flat plate for subsonic and supersonic flow conditions. The primary purpose of this review

paper is to provide readers with information on the turbulent skin friction reduction obtained from many experiments using the MBT. Although the MBT has a penalty for obtaining the microblowing air associated with it, some combinations of the MBT with suction boundary layer control methods are an attractive alternative for a real application. Several computational simulations to understand the flow physics of the MBT are also included. More experiments and computational fluid dynamics (CFD) computations are needed for the understanding of the unsteady flow nature of the MBT and the optimization of this new technology.
Author
Friction Reduction; Skin Friction; Computational Fluid Dynamics; Flow Distribution; Blowing; Turbulence

20050041986 NASA Langley Research Center, Hampton, VA, USA
A Modified Wall Matching Treatment to Account for Local Solid to Fluid Thermal Coupling
White, Jeffery A.; [2002]; 11 pp.; In English; JANNAF 2002 CS/APS/PSHS/MSS Joint Meeting, 8-12 Apr. 2002, Destin, FL, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The wall-matching methodology of Wilcox is modified to include a solid-wall, thermal-conduction model. This coupled fluid-thermal-structure model is derived assuming that the wall thermal-structure behavior is locally one-dimensional and that structural deformations, due to thermally induced stresses, are not significant. The one-dimensional coupled fluid-thermal-structure model is derived such that the wall temperature is removed as an independent boundary condition variable. The one-dimensional coupled fluid-thermal-structure model is also derived for the general case of an arbitrary mixture of thermally prefect gases and a wall of arbitrary thickness and conductivity by using a compressible, streamwise-pressure-gradient-corrected, wall-matching function and Fourier's law of heat conduction. The resulting model was implemented in the VULCAN CFD code as a new boundary condition type. VULCAN was then used to simulate a two-dimensional Mach 6 wind tunnel facility nozzle flow to demonstrate/validate the one-dimensional coupled fluid-thermal-structure model. The nozzle internal-wall surface temperature and heat transfer distributions computed using the one-dimensional coupled fluid-thermal-structure model are compared to wall temperature and heat transfer distributions from an iterative multi-dimensional analysis obtained by coupling the VULCAN CFD code and the MSC/NASTRAN-thermal code. The one-dimensional coupled fluid-thermal-structure model analysis is shown to be very robust and in excellent agreement with the multi-dimensional iteratively coupled analysis. It is also shown that the one-dimensional analysis can be used as an initial guess for the multi-dimensional iteratively coupled analysis.
Author
Computational Fluid Dynamics; Surface Temperature; Solid Surfaces; Rocket-Based Combined-Cycle Engines; Thermal Conductivity; Nozzle Walls; Mathematical Models

20050042032 NASA Langley Research Center, Hampton, VA, USA
Unified Model Deformation and Flow Transition Measurements
Burner, Alpheus W.; Liu, Tianshu; Garg, Sanjay; Bell, James H.; Morgan, Daniel G.; Journal of Aircraft; 1999; Volume 36, No. 5, pp. 898-90′; In English; Copyright; Avail: CASI; A02, Hardcopy

The number of optical techniques that may potentially be used during a given wind tunnel test is continually growing. These include parameter sensitive paints that are sensitive to temperature or pressure, several different types of off-body and on-body flow visualization techniques, optical angle-of-attack (AoA), optical measurement of model deformation, optical techniques for determining density or velocity, and spectroscopic techniques for determining various flow field parameters. Often in the past the various optical techniques were developed independently of each other, with little or no consideration for other techniques that might also be used during a given test. Recently two optical techniques have been increasingly requested for production measurements in NASA wind tunnels. These are the video photogrammetric (or videogrammetric) technique for measuring model deformation known as the video model deformation (VMD) technique, and the parameter sensitive paints for making global pressure and temperature measurements. Considerations for, and initial attempts at, simultaneous measurements with the pressure sensitive paint (PSP) and the videogrammetric techniques have been implemented. Temperature sensitive paint (TSP) has been found to be useful for boundary-layer transition detection since turbulent boundary layers convect heat at higher rates than laminar boundary layers of comparable thickness. Transition is marked by a characteristic surface temperature change wherever there is a difference between model and flow temperatures. Recently, additional capabilities have been implemented in the target-tracking videogrammetric measurement system. These capabilities have permitted practical simultaneous measurements using parameter sensitive paint and video model deformation measurements that led to the first successful unified test with TSP for transition detection in a large production wind tunnel.
Author (revised)
Flow Measurement; Flow Visualization; Optical Measurement; Wind Tunnel Tests; Deformation; Mathematical Models; Angle of Attack; Temperature Sensitive Paints

20050042044 NASA Langley Research Center, Hampton, VA, USA

Mimicking Natural Laminar to Turbulent Flow Transition: A Systematic CFD Study Using PAB3D

Pao, S. Paul; Abdol-Hamid, Khaled S.; [2005]; 14 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Report No.(s): AIAA Paper 2005-0286; Copyright; Avail: CASI; A03, Hardcopy

For applied aerodynamic computations using a general purpose Navier-Stokes code, the common practice of treating laminar to turbulent flow transition over a non-slip surface is somewhat arbitrary by either treating the entire flow as turbulent or forcing the flow to undergo transition at given trip locations in the computational domain. In this study, the possibility of using the PAB3D code, standard k-epsilon turbulence model, and the Girimaji explicit algebraic stresses model to mimic natural laminar to turbulent flow transition was explored. The sensitivity of flow transition with respect to two limiters in the standard k-epsilon turbulence model was examined using a flat plate and a 6:1 aspect ratio prolate spheroid for our computations. For the flat plate, a systematic dependence of transition Reynolds number on background turbulence intensity was found. For the prolate spheroid, the transition patterns in the three-dimensional boundary layer at different flow conditions were sensitive to the free stream turbulence viscosity limit, the reference Reynolds number and the angle of attack, but not to background turbulence intensity below a certain threshold value. The computed results showed encouraging agreements with the experimental measurements at the corresponding geometry and flow conditions.

Author

Computational Fluid Dynamics; K-Epsilon Turbulence Model; Laminar Flow; Turbulent Flow; Three Dimensional Boundary Layer

20050042074 NASA Langley Research Center, Hampton, VA, USA

Some Advanced Concepts in Discrete Aerodynamic Sensitivity Analysis

Taylor, Arthur C., III; Green, Lawrence L.; Newman, Perry A.; Putko, Michele M.; AIAA Journal; July 2003; Volume 41, No. 7, pp. 1224-1229; In English

Contract(s)/Grant(s): NCC1-01015; Copyright; Avail: CASI; A02, Hardcopy

An efficient incremental iterative approach for differentiating advanced flow codes is successfully demonstrated on a two-dimensional inviscid model problem. The method employs the reverse-mode capability of the automatic differentiation software tool ADIFOR 3.0 and is proven to yield accurate first-order aerodynamic sensitivity derivatives. A substantial reduction in CPU time and computer memory is demonstrated in comparison with results from a straightforward, black-box reverse-mode applicaiton of ADIFOR 3.0 to the same flow code. An ADIFOR-assisted procedure for accurate second-rder aerodynamic sensitivity derivatives is successfully verified on an inviscid transonic lifting airfoil example problem. The method requires that first-order derivatives are calculated first using both the forward (direct) and reverse (adjoinct) procedures; then, a very efficient noniterative calculation of all second-order derivatives can be accomplished. Accurate second derivatives (i.e., the complete Hesian matrices) of lift, wave drag, and pitching-moment coefficients are calculated with respect to geometric shape, angle of attack, and freestream Mach number.

Author

Sensitivity Analysis; Computational Fluid Dynamics; Aerodynamic Characteristics; Two Dimensional Models; Computer Programs; Discretization (Mathematics)

20050050898 NASA Langley Research Center, Hampton, VA, USA

Analysis of Transition-Sensitized Turbulent Transport Equations

Rumsey, Christopher L.; Thacker, William D.; Gatski, Thomas B.; Grosch, Chester E.; January 2005; 16 pp.; In English

Report No.(s): AIAA Paper 2005-0523; Copyright; Avail: CASI; A03, Hardcopy

The dynamics of an ensemble of linear disturbances in boundary-layer flows at various Reynolds numbers is studied through an analysis of the transport equations for the mean disturbance kinetic energy and energy dissipation rate. Effects of adverse and favorable pressure-gradients on the disturbance dynamics are also included in the analysis Unlike the fully turbulent regime where nonlinear phase scrambling of the fluctuations affects the flow field even in proximity to the wall, the early stage transition regime fluctuations studied here are influenced cross the boundary layer by the solid boundary. The dominating dynamics in the disturbance kinetic energy and dissipation rate equations are described. These results are then used to formulate transition-sensitized turbulent transport equations, which are solved in a two-step process and applied to zero-pressure-gradient flow over a flat plate. Computed results are in good agreement with experimental data.

Author

Transport Theory; Boundary Layer Flow; Mathematical Models; Transition Flow; Perturbation Theory; Linearity

20050050943 NASA Langley Research Center, Hampton, VA, USA

Approach for Input Uncertainty Propagation and Robust Design in CFD Using Sensitivity Derivatives

Putko, Michele M.; Taylor, Arthur C., III; Newman, Perry A.; Green, Lawrence L.; Journal of Fluids Engineering; March 2002; Volume 124, pp. 60-69; In English

Contract(s)/Grant(s): NCC1-01015; No Copyright; Avail: CASI; A03, Hardcopy

An implementation of the approximate statistical moment method for uncertainty propagation and robust optimization for quasi 3-D Euler CFD code is presented. Given uncertainties in statistically independent, random, normally distributed input variables, first- and second-order statistical moment procedures are performed to approximate the uncertainty in the CFD output. Efficient calculation of both first- and second-order sensitivity derivatives is required. In order to assess the validity of the approximations, these moments are compared with statistical moments generated through Monte Carlo simulations. The uncertainties in the CFD input variables are also incorporated into a robust optimization procedure. For this optimization, statistical moments involving first-order sensitivity derivatives appear in the objective function and system constraints. Second-order sensitivity derivatives are used in a gradient-based search to successfully execute a robust optimization. The approximate methods used throughout the analyses are found to be valid when considering robustness about input parameter mean values.

Author

Robustness (Mathematics); Computational Fluid Dynamics; Uncertain Systems; Sensitivity; Derivation; Method of Moments

20050050954 NASA Langley Research Center, Hampton, VA, USA

Source Term Model for Steady Micro Jets in a Navier-Stokes Computer Code

Waithe, Kenrick A.; January 2005; 10 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Report No.(s): AIAA Paper 2005-1401; No Copyright; Avail: CASI; A02, Hardcopy

A source term model for steady micro jets was implemented into a non-proprietary Navier-Stokes computer code, OVERFLOW. The source term models the mass flow and momentum created by a steady blowing micro jet. The model is obtained by adding the momentum and mass flow created by the jet to the Navier-Stokes equations. The model was tested by comparing with data from numerical simulations of a single, steady micro jet on a flat plate in two and three dimensions. The source term model predicted the velocity distribution well compared to the two-dimensional plate using a steady mass flow boundary condition, which was used to simulate a steady micro jet. The model was also compared to two three-dimensional flat plate cases using a steady mass flow boundary condition to simulate a steady micro jet. The three-dimensional comparison included a case with a grid generated to capture the circular shape of the jet and a case without a grid generated for the micro jet. The case without the jet grid mimics the application of the source term. The source term model compared well with both of the three-dimensional cases. Comparisons of velocity distribution were made before and after the jet and Mach and vorticity contours were examined. The source term model allows a researcher to quickly investigate different locations of individual or several steady micro jets. The researcher is able to conduct a preliminary investigation with minimal grid generation and computational time.

Author

Computational Fluid Dynamics; Computer Programs; Turbulence Models; Jet Flow; Steady Flow

20050051085 Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA

Effect of a Bore Evacuator on Projectile In-Bore Dynamics

Carlucci, Donald; Vega, Julio; Cordes, Jennifer; Nov. 2004; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428620; ARDEC-TR-04017; No Copyright; Avail: Defense Technical Information Center (DTIC)

Projectile base pressure measurements were taken in a 155-mm M284 gun tube using an Armament Research, Development and Engineering Center-designed instrumentation package incorporated into a modified XM982 artillery projectile. These measurements showed that the base pressure was affected as the projectile passed the bore evacuator ports. The perturbation in base pressure generated a high frequency response in the projectile. A simplified finite element model of the projectile was constructed and verified that the projectile dynamics were captured properly by the instrumentation. A dynamic response was also witnessed at abrupt changes in gun tub cross-section. This response has not been explained to date. DTIC

Base Pressure; Cavities; Gun Launchers; Projectiles

20050051138 National Observatory of Athens, Greece

Understanding Near-Surface and In-Cloud Turbulent Fluxes in the Coastal Stratocumulus-Topped Boundary Layers

Kalogiros, Ioannis; Oct. 2004; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N62558-03-M-0043

Report No.(s): AD-A428722; No Copyright; Avail: Defense Technical Information Center (DTIC)

Aircraft data collected in Monterey Bay area from forty flights in the framework of Autonomous Ocean Sampling Network (AOSN-II) project were used to study the spatial variability and bulk parameterization of turbulence surface fluxes in a coastal region. Flight maneuvers were used to calibrate the turbulence wind data obtained from a radome probe. The typical flight pattern consisted of dense near sea surface straight legs. A variety of near surface flow patterns with downcoast and upcoast strong or weak flow as well as offshore flow was observed. The wind field was quite complex due to intense topographical effects like flow channeling and thermal flows. In addition, coastal upwelling and stratocumulus cloud contribute significantly in the complexity of the atmospheric flow in the measurements area. Measured surface turbulent fluxes were found to be systematically lower than bulk estimations. Non-homogeneity of the flow, limited validity of surface similarity functions, low level clouds effects and poor roughness length parameterization especially under stable atmospheric conditions in the coastal area are probable reasons for this deviation.

DTIC

Air Water Interactions; Boundary Layers; Coasts; Stratocumulus Clouds; Turbulence; Turbulent Flow

20050051149 Glasgow Univ., UK

Prediction of Aeroelastic Stability Using Computational Fluid Dynamics

Badcock, K. J.; Woodgate, M. A.; Goura, G. S.; Moosa, A.; Barakos, G. N.; Jul. 2004; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428739; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available

Aeroelasticity; Computational Fluid Dynamics

20050051559 Department of the Navy, Washington, DC USA

Inlet Free Torpedo Launch System

Gieseke, Thomas J., Inventor; Apr. 2004; 27 pp.; In English

Report No.(s): AD-D020172; No Copyright; Avail: CASI; A03, Hardcopy

A launcher for torpedoes and underwater vehicles includes an inlet recess in fluid communication with a shutterway recess. A primary shutterway is provided both for ejection of the vehicle and for supplying fluid intake to the launcher. A pump circulates fluid from the inlet recess to the shutterway recess, and a launch tube houses a vehicle such as a weapon, within the launcher prior to launch thereof. A slide valve and impulse tank combination are positioned intermediate the pump and the launch tube, such that the slide valve controls a flow of fluid to the launch tube. A guide can is positioned at the shutterway recess for guiding the vehicle from the launch tube to an exterior of the launcher, and fluid within the launcher is continually moderated to enable selective launch of the vehicle with a fluid force. (10 figures)

DTIC

Ejection; Fluid Flow; Launchers; Launching; Patent Applications; Torpedoes

20050051576 NASA Langley Research Center, Hampton, VA, USA

Design of a Mach-15 Total-Enthalpy Nozzle with Non-Uniform Inflow Using Rotational MOC

Gaffney, Richard L., Jr.; [2005]; 22 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Report No.(s): AIAA Paper 2005-0691; Copyright; Avail: CASI; A03, Hardcopy

A new computer program to design nozzles with non-uniform idow has been developed using the rotational method of characteristics (MOC). This program has been used to design a nozzle for the NASA's HYPULSE shock-expansion tunnel for use in scramjet engine tests at a Mach-15 flight-enthalpy condition. The nozzle has an area ratio of 9.5:1 that expands the inflow from Mach 6 along the centerline to Mach 8.7. Although the density and Mach number vary radially at the exit due to the non-uniformities of the inflow, the MOC procedure produces exit flow that is parallel and has uniform static pressure. The design has been verified with CFD which compares favorably with the MOC solution.

Author

Mach Number; Method of Characteristics; Nozzle Design; Supersonic Combustion Ramjet Engines; Nonuniformity; Computational Fluid Dynamics; Shock Tunnels

20050051579 NASA Langley Research Center, Hampton, VA, USA

Static Aerodynamics of the Mars Exploration Rover Entry Capsule

Schoenenberger, Mark; Cheatwood, F. McNeil; Desai, Prasun; [2005]; 13 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Report No.(s): AIAA Paper 2005-0056; Copyright; Avail: CASI; A03, Hardcopy

The static aerodynamics for the Mars Exploration Rover (MER) aeroshell are presented. This aerodynamic database was an integral part of the end-to-end simulation used in pre- entry analysis for determining the MER entry design requirements for development of the MER entry system, as well as targeting the MER landing sites. The database was constructed using the same approach used for Mars Pathfinder (MPF). However, the MER aerodynamic database is of much higher fidelity and tailored to the MER entry trajectories. This set of data includes direct simulation Monte Carlo calculations covering the transitional regime of the entry trajectory and computational fluid dynamics calculations describing the aerodynamics in the hypersonic and supersonic continuum regimes. An overview of the methodology used to generate the data is given along with comparisons to important features in the MPF aerodynamics and related heritage data. The MER and MPF comparison indicates that trajectory specific data is required to properly model the flight characteristics of a.blunt entry capsule at Mars. Author

Mars Exploration; Mars Roving Vehicles; Space Capsules; Computational Fluid Dynamics; Aeroshells; Static Aerodynamic Characteristics

20050051581 NASA Langley Research Center, Hampton, VA, USA

Boundary-Layer Receptivity and Integrated Transition Prediction

Chang, Chau-Lyan; Choudhari, Meelan; [2005]; 19 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit

Report No.(s): AIAA Paper 2005-0526; Copyright; Avail: CASI; A03, Hardcopy

The adjoint parabold stability equations (PSE) formulation is used to calculate the boundary layer receptivity to localized surface roughness and suction for compressible boundary layers. Receptivity efficiency functions predicted by the adjoint PSE approach agree well with results based on other nonparallel methods including linearized Navier-Stokes equations for both Tollmien-Schlichting waves and crossflow instability in swept wing boundary layers. The receptivity efficiency function can be regarded as the Green's function to the disturbance amplitude evolution in a nonparallel (growing) boundary layer. Given the Fourier transformed geometry factor distribution along the chordwise direction, the linear disturbance amplitude evolution for a finite size, distributed nonuniformity can be computed by evaluating the integral effects of both disturbance generation and linear amplification. The synergistic approach via the linear adjoint PSE for receptivity and nonlinear PSE for disturbance evolution downstream of the leading edge forms the basis for an integrated transition prediction tool. Eventually, such physics-based, high fidelity prediction methods could simulate the transition process from the disturbance generation through the nonlinear breakdown in a holistic manner.

Author

Compressible Boundary Layer; Stability; Boundary Layer Transition; Numerical Analysis; Prediction Analysis Techniques

20050051730 NASA Glenn Research Center, Cleveland, OH, USA

Time and Space Resolved Wall Temperature Measurements during Nucleate Boiling with Constant Heat Flux Boundary Conditions

Myers, Jerry G.; Hussey, Sam W.; Yee, Glenda F.; Yerramilli, Vamsee K.; Kim, Jungho; January 2005; 8 pp.; In English; 2004 ASME Heat Transfer/Fluids Engineering Summer Conference, 11-15 Jul. 2004, Charlotte, NC, USA

Report No.(s): HT-FED2004-56169; No Copyright; Avail: CASI; A02, Hardcopy

The lack of temporally and spatially resolved measurements under nucleate bubbles has complicated efforts to fully explain pool-boiling phenomena. The objective of this current work is to acquire time and space resolved temperature distributions under nucleate bubbles on a constant heat flux surface. This was performed using a microheater array with 100 micron resolution that allowed effectively simultaneous measurements of surface temperature while supplying a constant dissipative heat flux. This data is then correlated with high speed (\g 1000Hz) visual recordings of the bubble growth and departure from the heater surface acquired from below and from the side of the heater. The data indicate that a significant source of energy during bubble nucleation and initial growth is the superheated layer around the bubble. Bubble coalescence was not observed to decrease surface temperature as significantly as bubble departure from the surface. Since bubble departure is typically followed by a sharp increase in the heater surface temperature, it is surmised that the departing bubble effectively removes the superheated layer, allowing a high local heat transfer rate with the bulk fluid through transient conduction/micro-convection during rewetting.

Author

Wall Temperature; Temperature Measurement; Nucleate Boiling

20050051745 NASA Glenn Research Center, Cleveland, OH, USA

Gas-Liquid Phase Distribution and Void Fraction Measurements using the MRI

Daidzic, N. E.; Schmidt, E.; Hasan, M. M.; Altobelli, S.; [2004]; 9 pp.; In English; 3rd International Symposium on Two-Phase Flow Modelling and Experimentation, 22-24 Sep. 2004, Pisa, Italy

Contract(s)/Grant(s): 22-101-58-09; No Copyright; Avail: CASI; A02, Hardcopy

We used a permanent-magnet MRI system to estimate the integral and spatially- and/or temporally-resolved void-fraction distributions and flow patterns in gas-liquid two-phase flows. Air was introduced at the bottom of the stagnant liquid column using an accurate and programmable syringe pump. Air flow rates were varied between 1 and 200 ml/min. The cylindrical non-conducting test tube in which two-phase flow was measured was placed in a 2.67 kGauss MRI with MRT spectrometer/imager. Roughly linear relationship has been obtained for the integral void-fraction, obtained by volume-averaging of the spatially-resolved signals, and the air flow rate in upward direction. The time-averaged spatially-resolved void fraction has also been obtained for the quasi-steady flow of air in a stagnant liquid column. No great accuracy is claimed as this was an exploratory proof-of-concept type of experiment. Preliminary results show that MRI a non-invasive and non-intrusive experimental technique can indeed provide a wealth of different qualitative and quantitative data and is especially well suited for averaged transport processes in adiabatic and diabatic multi-phase and/or multi-component flows. Author

Flow Distribution; Two Phase Flow; Magnetic Resonance Spectroscopy; Air Flow; Liquid-Gas Mixtures; Flow Measurement

20050051917 Minnesota Univ., Minneapolis, MN, USA, Cleveland State Univ., Cleveland, OH, USA, Cleveland State Univ., Cleveland, OH, USA

Direct Measurements of Eddy Transport and Thermal Dispersion in a High Porosity Matrix

Niu, Yi; Simon, David; Gedeon, David; October 29, 2004; 13 pp.; In English

Contract(s)/Grant(s): DE-FC36-00G0-10627; NNC04GA04G; 22-972-20-01; Copyright; Avail: CASI; A03, Hardcopy

Thermal losses from the hot end to the cold end of a Stirling cycle regenerator due to thermal dispersion through the regenerator matrix may significantly degrade the performance of the machine. Because of poor access to the void spaces within the porous medium, no direct measurements of thermal dispersion have been made and dispersion models have been derived indirectly. This is done by measuring the overall thermal performance of the regenerator and subtracting off the energy transfer caused by molecular conduction and advected enthalpy flows computed from volume-averaged fluid velocity and temperature. In the current program, a large-scale porous matrix consisting of stacked wire screens with a porosity of 90% is installed in a flow rig which is operated in a Reynolds number range that represents Stirling engine regenerator flow. Experiments are conducted to measure turbulent transport of momentum at the exit phase using hot-wires. The relationship of such turbulent transport terms to the thermal dispersion term in the volumetric-averaged energy equation for the regenerator matrix is developed and the measurements are used to determine cross-stream thermal dispersion. A dispersion model based upon the measurements is proposed and compared with models documented in the literature.

Author

Stirling Cycle; Turbulent Heat Transfer; Porous Materials; Regenerators

20050051955

Time-Averaged Velocity, Temperature and Density Surveys of Supersonic Free Jets

January 2005; 7 pp.; No Copyright; Avail: CASI; A03, Hardcopy

A spectrally resolved molecular Rayleigh scattering technique was used to simultaneously measure axial component of velocity U, static temperature T, and density p in unheated free jets at Mach numbers M = 0.6,0.95, 1.4 and 1.8. The latter two conditions were achieved using contoured convergent-divergent nozzles. A narrow line-width continuous wave laser was passed through the jet plumes and molecular scattered light from a small region on the beam was collected and analyzed using a Fabry-Perot interferometer. The optical spectrum analysis air density at the probe volume was determined by monitoring the intensity variation of the scattered light using photo-multiplier tubes. The Fabry-Perot interferometer was operated in the imaging mode, whereby the fringe formed at the image plane was captured by a cooled CCD camera. Special attention was given to remove dust particles from the plume and to provide adequate vibration isolation to the optical components. The velocity profiles from various operating conditions were compared with that measured by a Pitot tube. An excellent comparison within 5m's demonstrated the maturity of the technique. Temperature was measured least accurately, within 10K, while density was measured within 1% uncertainty. The survey data consisted of centerline variations and radial profiles of time-averaged U, T and p. The static temperature and density values were used to determine static pressure variations inside the jet. The data provided a comparative study of jet growth rates with increasing Mach number. The current work is part of a data-base development project for Computational Fluid Dynamics and Aeroacoustics codes that endeavor to predict noise

characteristics of high speed jets. A limited amount of far field noise spectra from the same jets are also presented. Finally, a direct experimental validation was obtained for the Crocco-Busemann equation which is commonly used to predict temperature and density profiles from known velocity profiles. Data presented in this paper are available in ASCII format upon request.
Author
Free Jets; Supersonic Jet Flow; Temperature Profiles; Velocity Distribution; Density; Computational Fluid Dynamics; Time Dependence

20050051959 Stanford Univ., Stanford, CA, USA
Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program
Moin, Parviz; Mansour, Nagi N.; December 2004; 400 pp.; In English; Studying Turbulence Using Numerical Simulation Databases, 21 Jun. - 16 Jul. 2004, Stanford, CA, USA; See also 20050051960 - 20050051991
Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A17, Hardcopy

This Proceedings volume contains 32 papers that span a wide range of topics that reflect the ubiquity of turbulence. The papers have been divided into six groups: 1) Solar Simulations; 2) Magnetohydrodynamics (MHD); 3) Large Eddy Simulation (LES) and Numerical Simulations; 4) Reynolds Averaged Navier Stokes (RANS) Modeling and Simulations; 5) Stability and Acoustics; 6) Combustion and Multi-Phase Flow.
Derived from text
Computerized Simulation; Turbulence Models; Magnetohydrodynamics; Large Eddy Simulation; Solar Physics

20050051960 Chungnam National Univ., Korea, Republic of
Magnetic turbulence in Compressible Fluids
Cho, J.; Lazarian, A.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 75-83; In English; See also 20050051959; No Copyright; Avail: CASI; A02, Hardcopy

We present high resolution numerical solutions of compressible magnetohydrodynamic (MHD) turbulence. We concentrate on studies of spectra and anisotropy of velocity and density. We describe a technique of separating different magnetohydrodynamic (MHD) modes (slow,fast and Alfven) and apply it to our simulations. For the mildly supersonic case, velocity and density show anisotropy. However, for the highly supersonic case, we observe steepening of the slow mode velocity spectrum and isotropization of density. Our present studies show that the spectrum of density gets substantially flatter than the Kolmogorov one.
Author
Compressible Fluids; Magnetohydrodynamic Turbulence; Numerical Analysis; Anisotropy; Magnetohydrodynamics

20050051961
LES/FDF/ISAT Computations of Turbulent Flames
Lu, L.; Ren, Z.; Raman, V.; Pope, S. B.; Pitsch, H.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 283-294; In English; See also 20050051959
Contract(s)/Grant(s): F-49620-00-1-0171; No Copyright; Avail: CASI; A03, Hardcopy

The in situ adaptive tabulation (ISAT) algorithm is incorporated in the Stanford structured large eddy simulation (LES) code for the large eddy simulation of turbulent combustion. The subgrid scale (SGS) closure implemented by Raman is based on the scalar filtered mass density function (FDF) methodology. The FDF represents the joint probability density function of the subgrid-scale scalar quantities and is obtained by solution of its modelled transport equation. In this equation, the effect of chemical reactions appears in closed form and the chemistry mechanism is implemented via ISAT; the influences of SGS mixing and convection are modelled. The modelled FDF transport equation is solved by Lagrangian Monte Carlo scheme which solves statistically equivalent stochastic differential equations (SDEs). The numerical simulation of a spatially developing mixing layer with a 9-species detailed hydrogen mechanism is performed to examine computational issues arising in the LES/FDF/ISAT methodology. It is shown that the filtered mixture fraction field obtained via the FDF agrees well with that obtained by the 'conventional' LES in which the finite difference solution of the transport equation of the filtered mixture fraction is obtained. The performance and load balancing of both the serial and parallel ISAT strategies are investigated. For the simulation in which cheap retrieves are dominated, a speed-up factor of about 300 is obtained for the combustion chemistry compared to using direct integration. And compared to the LES (without FDF), the relative cost of LES/FDF (without reaction) is about 2.8, and the relative cost of LES/FDF/ISAT is about 4.3. For the simulation in which there is a significant fraction

of direct integrations, the halving of the time in combustion chemistry is achieved by using the parallel ISAT strategy compare to serial ISAT.
Author
Algorithms; Chemical Reactions; Combustion Chemistry; Computerized Simulation; Large Eddy Simulation; Mixing Layers (Fluids)

20050051969 Bayreuth Univ., Germany
Thermal Convection in a Twisted Magnetic Field
Busse, F. H.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 5-9; In English; See also 20050051959; No Copyright; Avail: CASI; A01, Hardcopy

The onset of convection in a layer of na electrically conducting fluid heated from below is considered in the case when the layer is permeated by horizontal magnetic field of strength B(sub 0(the orientation of which varies sinusoidally with height.An approximate critical value of the Rayleigh number for the onset of convection is derived. The width delta of the convection rolls, delta approx, square root of h(sub t)/B(sub 0) (square root of (rho)mu(lambda)nu) is found to be independent of the height of the layer once the right hand side in this relationship is sufficiently small. Applications to the penumbral filaments of sunspots are briefly discussed.
Author
Conducting Fluids; Magnetic Field Configurations; Free Convection

20050051974 Free Univ., Brussels, Belgium
Hartmann effect on MHD turbulence in the limit Rm \h\h 1
Knaepen, B.; Dubief, Y.; Moreau, R.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 99-107; In English; See also 20050051959; No Copyright; Avail: CASI; A02, Hardcopy

This work is an attempt to model the actual MHD flows at the laboratory scale Rm \h\h 1. It essentially focuses on how to take into account the influence of the Hartmann layers on the turbulence present in the core flow, namely when the applied magnetic field is large enough to impose a quasi-2D regime. The model studied is obtained from the classical theory of Hartmann layers and consists in extra damping terms in the evolution equation of the fluid. Numerical results show that the model predicts the expected behavior of the core flow between Hartmann layers. A striking property is however that the component of the velocity field parallel to the magnetic field does not evolve to an anisotropic state as observed for the perpendicular components. This behavior is supported by an analytical analysis.
Author
Core Flow; Magnetohydrodynamic Flow; Magnetohydrodynamic Turbulence; Magnetic Fields; Damping; Hartmann Flow

20050051975 Colorado Univ., Boulder, CO, USA
Adaptive LES of 3D Decaying Isotropic Turbulence
Goldstein, D. E.; Vasilyev, O. V.; Kevlahan, N. K.-R.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 111-122; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

In this work SCALES simulations of decaying incompressible isotropic turbulence are compared to DNS and LES results. Current Large Eddy Simulation (LES) relies on, at best, a zonally adapted filter width to reduce the computational cost of simulating complex turbulent flows. While an improvement over a uniform filter width, this approach has two limitations. First, it does not capture the high wave number components of the coherent vortices that make up the organized part of turbulent flows, thus losing essential physical information. Secondly, the flow is over-resolved in the regions between the coherent vortices, thus wasting computational resources. The Stochastic Coherent Adaptive Large Eddy Simulation (SCALES) approach addresses these shortcomings of LES by using a dynamic grid adaptation strategy that is able to resolve and 'track' the most energetic coherent structures in a turbulent flow field. This corresponds to a dynamically adaptive local filter width. Unlike Coherent Vortex Simulation (CVS), which is able to recover low order statistics with no subgrid scale stress model, the higher compression used in SCALES necessitates that the effect of the unresolved subgrid scale (SGS) stresses must be modeled. These SGS stresses are approximated using a new dynamic eddy viscosity model based on Germano's classical dynamic procedure redefined in terms of two wavelet thresholding filters.
Author
Large Eddy Simulation; Three Dimensional Flow; Isotropic Turbulence; Stochastic Processes

20050051979 Harvard Univ., Cambridge, MA, USA

A Study of Turbulent Wake Dynamics Using a Novel Localized Stability Analysis

Liang, X. S.; Wa; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 211-222; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

This paper briefly presents a unified, localized treatment of hydrodynamic stability relating the stability theory to experimental and numerical results, which are in general highly nonlinear, intermittent, and involve multiple scales in space and time. The localization in time is achieved with the multiscale window transform, a mathematical machinery developed by Liang & Anderson (2004); while the spatial dimension is localized through 'transfer-transport separation', which is made precise with the introduction of the concept perfect transfer. The theory is applied to investigate the dynamics of cylinder wakes. A remarkable observation is that rapid amplification in perturbation energy does not necessarily correspond to instability. In a saturated laminar wake, an absolute instability is identified with two local transfer lobes attached to the cylinder surface. In the turbulent case, the instability is located far away downstream and has distinct patterns. The dynamics is structured on three scale windows, among which the meso-scale window hosts a regularly growing mode. This mode is maintained through a primary instability. Although its energy can be ultimately traced to the base flow, the turbulent or sub-mesoscale motion is sustained through two different mechanisms: The first is directly from the background, and is distributed rather symmetrically as two side lobes along the wake boundary; the second comes from a secondary instability of the regular meso-scale process, appearing mainly as a form of monopole in the center. On all the instability maps, there exist sporadic inverse transfer spots. This inverse transfer or self-laminarization has profound implications for vortex suppression, allowing us to propose a generic strategy to get turbulence under efficient control.
Author

Turbulent Wakes; Vortices; Flow Stability

20050051981 Fluent, Inc., Lebanon, NH, USA

A Constructed FDF Model for Fast CFD with Realistic Chemistry

Goldin, G. M.; Raman, V.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 295-304; In English; See also 20050051959; No Copyright; Avail: CASI; A02, Hardcopy

CFD predictions using a new model to include finite-rate chemistry effects in turbulent flames are presented. The Constructed Probability Density Function (PDF) model assumes that the scalar PDF in a general, complex geometry reacting flow is similar to the scalar PDF in a simple geometry reacting flow. Detailed chemistry simulations are performed in a model of the simple flow over all realizable conditions. The scalar PDF at discrete points in the realizable space is parameterized by a small set of its lower moments, and tabulated. Modeled transport equations for these lower moments are computed in the CFD solver and the PDF table is interpolated for unclosed terms. A priori calculation and tabulation of the chemistry and its interaction with the turbulence allow rapid, multi-physics CFD simulations on large meshes. The model is applied to the RANS prediction of turbulent, partially-premixed, piloted jet flames (Sandia flames D and F). Excellent agreement with the experimental data is obtained for temperature, major species and the fast chemistry radical OH. Good agreement is obtained for CO and the slow chemistry species NO.
Author

Computational Fluid Dynamics; Turbulent Flames; Reacting Flow; Probability Theory; Premixed Flames

20050051983 Technische Univ., Delft, Netherlands

Simulation of Dispersed Two-Phase Flow using a Coupled Volume-of-Fluid/Level-Set Method

Coyajee, E. R. A.; Herramnn, M.; Boersma, B. J.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 315-327; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, a coupled Volume-of-Fluid/Level-Set interface advection model is considered for the simulation of incompressible two-phase flow. With this method, mass conservation for both phases can be achieved up to specified tolerance in each computational cell. Representation of surface tension forces, however, is found unsatisfactory for the stationary droplet (Laplace) problem, as the procedure to couple the Volume-of-Fluid (VOF) and Level-Set (LS) functions gives rise to increased levels of VOF and LS interface descriptions is reported.
Author

Incompressible Flow; Interfacial Tension; Simulation; Two Phase Flow

20050051984 Polish Academy of Sciences, Gdansk, Poland

Filtered Particle Tracking for Dispersed Two-phase Turbulent Flows

Pozorski, J.; Apte, S. V.; Raman, V.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 329-340; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

Turbulent particulate flows are considered in the Eulerian-Langrangian approach where the large-eddy simulation of the carrier phase is coupled with the particle tracking. The issue addressed here is the impact of the subgrid scale turbulence on the statistics of particle motion, including preferential concentration. This is accomplished through a priori analysis of DNS data in the case of forced isotropic turbulence. A model for filtered particle tracking FPT is then proposed. The model aims to reconstruct the residual (subgrid scale) fluid velocity along particle trajectories. The computation results serve to appraise the model through comparisons with available DNS reference data on preferential concentrations for a selection of particle inertia parameters.

Author

Two Phase Flow; Turbulent Flow; Particle Motion; Particulates

20050051985

Toward the Development of a LES-SGS Closure Model for Buoyant Plumes

Tieszen, S. R.; Pitsch, H.; Blanquart, G.; Abarzhi, S.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 341-352; In English; See also 20050051959

Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CASI; A03, Hardcopy

LES simulations of a helium phase based on a dynamic Smagorinski closure model show very strong grid dependency. The authors interpret these results as the inability of diffusive, eddy-viscosity closure models to capture the growth of Rayleigh-Taylor (RT) instabilities, which develop at the plume-air interface, create thin finger-type structures, and lead eventually to strong mixing of air and helium. To capture the RT mixing and to achieve grid independent results, unreasonably high grid densities are required. Our motivation is therefore to develop subgrid models, which could reproduce the robust effect of the RT mixing on the plume dynamics, without having to capture the details of dynamics at small-scales. Preliminary results from a developed model highlight difficulties and suggest directions for future study.

Author

Turbulence Models; Large Eddy Simulation; Plumes; Buoyancy; Dynamic Models; Helium

20050051987 Manchester Coll. of Science and Technology, UK

Toward Improved Boundary Conditions for the DNS and LES of Turbulent Subsonic Flows

Prosser, R.; Schlueter, J.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 395-410; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

A procedure is outlined for the specification of time dependent boundary conditions, suitable for viscous, conducting flows. The method is based on a low Mach number asymptotic expansion of the governing equations and the characteristics derived from them. By consistent matching of the terms in the expansions, it is possible to develop inflow and outflow conditions that are transparent to acoustic waves, yet retain the flexibility to allow for complex flow structures such as turbulence to enter or leave the computational domain. The boundary conditions developed here represent a midway point in the evolution of this approach, which was originally developed for Euler flows, and which is evolving toward treatment of fully reacting viscous simulations.

Author

Boundary Conditions; Direct Numerical Simulation; Large Eddy Simulation; Subsonic Flow; Turbulence Models

20050051994 NASA Glenn Research Center, Cleveland, OH, USA

Time and Space Resolved Heat Flux Measurements During Nucleate Boiling with Constant Heat Flux Boundary Conditions

Yerramilli, Vamsee K.; Myers, Jerry G.; Hussey, Sam W.; Yee, Glenda F.; Kim, Jungho; January 2005; 11 pp.; In English; 5th International Conference on Multiphase Flow, ICMF'04, 30 May - 4 Jun. 2004, Yokohama, Japan

Report No.(s): Paper 258; No Copyright; Avail: CASI; A03, Hardcopy

The lack of temporally and spatially resolved measurements under nucleate bubbles has complicated efforts to fully explain pool-boiling phenomena. The objective of this current work was to acquire time and space resolved temperature distributions under nucleating bubbles on a constant heat flux surface using a microheater array with 100x 100 square microns

resolution, then numerically determine the wall to liquid heat flux. This data was then correlated with high speed (greater than l000Hz) visual recordings of The bubble growth and departure from the heater surface acquired from below and from the side of the heater. The data indicate that microlayer evaporation and contact line heat transfer are not major heat transfer mechanisms for bubble growth. The dominant heat transfer mechanism appears to be transient conduction into the liquid as the liquid rewets the wall during the bubble departure process.
Author
Boundary Conditions; Heat Flux; Nucleate Boiling; Time Dependence; Temperature Distribution

20050060619 NASA Glenn Research Center, Cleveland, OH, USA
An Isolated Circular Synthetic Jet in Cross-Flow at Low Momentum-Flux Ratio
Milanovic, Ivana M.; Zaman, Khairul B. M. Q.; Rumsey, Christopher L.; [2005]; 12 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 22-781-30-47
Report No.(s): AIAA Paper 2005-1110; E-14990; Copyright; Avail: CASI; A03, Hardcopy

A joint experimental and computational investigation was carried out for a round synthetic jet issuing normal to a turbulent boundary layer at a momentum-flux ratio of one. Distributions of velocity and turbulence intensity were measured by hot-wire anemometry. Numerical results were obtained using unsteady Reynolds-averaged Navier-Stokes (URANS) computations. Time and phase-averaged flow properties were compared on the cross sectional plane at x/D = 0.53, 5 and 10 as well as on the axial plane of symmetry. Overall, the numerical results agreed well with the experimental data. CFD predicted a somewhat larger velocity deficit in regions of low-momentum fluid pulled up from the boundary layer. Phase- averaged velocity contours at the plane of symmetry indicated good match between experiments and CFD regarding the size and the position of the periodic flow structure. However, some differences occurred in details such as the shape and inclination of the low-speed flow structure.
Author
Momentum; Turbulent Boundary Layer; Cross Flow; Navier-Stokes Equation; Reynolds Averaging; Velocity Measurement; Flow Characteristics

20050060648 NASA Langley Research Center, Hampton, VA, USA
Particle Image Velocimetry Measurements of a Two/Three-dimensional Separating/Reattaching Boundary Layer Downstream of an Axisymmetric Backward-facing Step
Hudy, Laura M.; Naguib, Ahmed M.; Humphreys, William M.; Bartram, Scott M.; January 10, 2005; 24 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): SAA1-562; NSF CTS-01-16907; 23-781-10-11
Report No.(s): AIAA Paper 2005-0114; No Copyright; Avail: CASI; A03, Hardcopy

Planar Particle Image Velocimetry measurements were obtained in the separating/reattaching flow region downstream of an axisymmetric backward-facing step. Data were acquired for a two-dimensional (2D) separating boundary layer at five different Reynolds numbers based on step height (Re(sub h)), spanning 5900-33000, and for a three-dimensional (3D) separating boundary layer at Re(sub h) = 5980 and 8081. Reynolds number effects were investigated in the 2D cases using mean-velocity field, streamwise and wall-normal turbulent velocity, and Reynolds stress statistics. Results show that both the reattachment length (x(sub r)) and the secondary separation point are Reynolds number dependent. The reattachment length increased with rising Re(sub h) while the secondary recirculation region decreased in size. These and other Re(sub h) effects were interpreted in terms of changes in the separating boundary layer thickness and wall-shear stress. On the other hand, in the 3D case, it was found that the imposed cross-flow component was relatively weak in comparison to the streamwise component. As a result, the primary influences of three dimensionality only affected the near-separation region rather than the entire separation bubble.
Author
Particle Image Velocimetry; Symmetry; Backward Facing Steps; Two Dimensional Boundary Layer; Flow Distribution; Three Dimensional Boundary Layer

20050060676 NASA Langley Research Center, Hampton, VA, USA
Design of a Mach-15 Total-Enthalpy Nozzle With Non-uniform Inflow Using Rotational MOC
Gaffney, Richard L., Jr.; December 28, 2004; 22 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 23-745-30-30
Report No.(s): AIAA Paper 2005-0691; No Copyright; Avail: CASI; A03, Hardcopy

A new computer program to design nozzles with non-uniform inflow has been developed using the rotational method of characteristics (MOC). This program has been used to design a nozzle for the NASA's HYPULSE shock-expansion tunnel for use in scramjet engine tests at a Mach-15 flight-enthalpy condition. The nozzle has an area ratio of 9.5:1 that expands the inflow from Mach 6 along the centerline to Mach 8.7. Although the density and Mach number vary radially at the exit due to the non-uniformities of the inflow, the MOC procedure produces exit flow that is parallel and has uniform static pressure. The design has been verified with CFD which compares favorably with the MOC solution.
Author
Enthalpy; Mach Number; Method of Characteristics; Nozzle Design; Nonuniformity; Computational Fluid Dynamics; Flow Distribution; Shock Tunnels

20050060677 NASA Langley Research Center, Hampton, VA, USA
Computations of Flow Over a Hump Model Using Higher Order Method With Turbulence Modeling
Balakumar, Ponnampalam; [2004]; 16 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 23-065-30-22
Report No.(s): AIAA Paper 2005-1270; Copyright; Avail: CASI; A03, Hardcopy

Turbulent separated flow over a two-dimensional hump is computed by solving the RANS equations with k-omega (SST) turbulence model for the baseline, steady suction and oscillatory blowing/suction flow control cases. The flow equations and the turbulent model equations are solved using a fifth-order accurate weighted essentially nonoscillatory (WENO) scheme for space discretization and a third order, total variation diminishing (TVD) Runge-Kutta scheme for time integration. Qualitatively the computed pressure distributions exhibit the same behavior as they are observed in the experiments. The computed separation regions are much longer than that are observed. However, the percentage reduction in the separation region in the steady suction case is closer to that was measured in the experiment. The computations did not predict the expected reduction in the separation length in the oscillatory case. The predicted turbulent quantities are two to three times smaller than that are measured and it points towards the deficiencies in the existing turbulent models when they are applied to strong steady/unsteady separated flows.
Author
Separated Flow; Computational Fluid Dynamics; Two Dimensional Models; Flow Distribution; Turbulence Models

20050060718 Oklahoma Univ., Norman, OK, USA
Full-Field Measurements of Self-Excited Oscillations in Momentum-Dominated Helium Jets
Yildirim, B. S.; Agrawal, A. K.; [2005]; 39 pp.; In English
Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: CASI; A03, Hardcopy

Flow structure of momentum-dominated helium jets discharged vertically into ambient air was investigated using a high-speed rainbow schlieren deflectometry (RSD) apparatus operated at up to 2000 Hz. The operating parameters, i.e., Reynolds number and Richardson number were varied independently to examine the self-excited, flow oscillatory behavior over a range of experimental conditions. Measurements revealed highly periodic oscillations in the laminar region at a unique frequency as well as high regularity in the flow transition and initial turbulent regions. The buoyancy was shown to affect the oscillation frequency and the distance from the jet exit to the flow transition plane. Instantaneous helium concentration contours across the field of view revealed changes in the jet flow structure and the evolution of the vortical structures during an oscillation cycle. A cross-correlation technique was applied to track the vortices and to find their convection velocity. Time-traces of helium concentration at different axial locations provided detailed information about the oscillating flow.
Author
Jet Flow; Helium; Gas Jets; Oscillating Flow; Dimensional Measurement

20050060723 NASA Glenn Research Center, Cleveland, OH, USA
Gravitational Effects on Near Field Flow Structure of Low Density Gas Jets
Griffin, D. W.; Yep, T. W.; Agrawal, A. K.; January 2005; 12 pp.; In English
Contract(s)/Grant(s): NAG3-2388
Report No.(s): AIAA Paper 2002-0761; Copyright; Avail: CASI; A03, Hardcopy

Experiments were conducted in Earth gravity and microgravity to acquire quantitative data on near field flow structure of helium jets injected into air. Microgravity conditions were simulated in the 2.2- second drop tower at NASA Glenn Research Center. The jet flow was observed by quantitative rainbow schlieren deflectometry, a non-intrusive line of site measurement

technique for the whole field. The flow structure was characterized by distributions of angular deflection and helium mole percentage obtained from color schlieren images taken at 60 Hz. Results show that the jet in microgravity was up to 70 percent wider than that in Earth gravity. The global jet flow oscillations observed in Earth gravity were absent in microgravity, providing direct experimental evidence that the flow instability in the low density jet was buoyancy induced. The paper provides quantitative details of temporal flow evolution as the experiment undergoes change in gravity in the drop tower.
Author
Gas Jets; Gravitational Effects; Near Fields; Earth Gravitation; Rarefied Gases; Jet Flow

20050060739 Oklahoma Univ., Norman, OK, USA
Linear Stability Analysis of Gravitational Effects on a Low-Density Gas Jet Injected into a High-Density Medium
Lawson, Anthony L.; Parthasarathy, Ramkumar N.; January 2005; 42 pp.; In English
Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this study was to determine the effects of buoyancy on the absolute instability of low-density gas jets injected into high-density gas mediums. Most of the existing analyses of low-density gas jets injected into a high-density ambient have been carried out neglecting effects of gravity. In order to investigate the influence of gravity on the near-injector development of the flow, a spatio-temporal stability analysis of a low-density round jet injected into a high-density ambient gas was performed. The flow was assumed to be isothermal and locally parallel; viscous and diffusive effects were ignored. The variables were represented as the sum of the mean value and a normal-mode small disturbance. An ordinary differential equation governing the amplitude of the pressure disturbance was derived. The velocity and density profiles in the shear layer, and the Froude number (signifying the effects of gravity) were the three important parameters in this equation. Together with the boundary conditions, an eigenvalue problem was formulated. Assuming that the velocity and density profiles in the shear layer to be represented by hyperbolic tangent functions, the eigenvalue problem was solved for various values of Froude number. The Briggs-Bers criterion was combined with the spatio-temporal stability analysis to determine the nature of the absolute instability of the jet whether absolutely or convectively unstable. The roles of the density ratio, Froude number, Schmidt number, and the lateral shift between the density and velocity profiles on the absolute instability of the jet were determined. Comparisons of the results with previous experimental studies show good agreement when the effects of these variables are combined together. Thus, the combination of these variables determines how absolutely unstable the jet will be.
Author
Gas Jets; Stability Tests; Gas Density; Media; Buoyancy; Velocity Distribution; Gravitational Effects

20050060753 Oklahoma Univ., Norman, OK, USA
Computational Analysis of Gravitational Effects in Low-Density Gas Jets
Satti, Rajani P.; Agrawal, Ajay K.; [2004]; 32 pp.; In English
Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: CASI; A03, Hardcopy

This study deals with the computational analysis of buoyancy-induced instability in the nearfield of an isothermal helium jet injected into quiescent ambient air environment. Laminar, axisymmetric, unsteady flow conditions were considered for the analysis. The transport equations of helium mass fraction coupled with the conservation equations of mixture mass and momentum were solved using a staggered grid finite volume method. The jet Richardson numbers of 1.5 and 0.018 were considered to encompass both buoyant and inertial jet flow regimes. Buoyancy effects were isolated by initiating computations in Earth gravity and subsequently, reducing gravity to simulate the microgravity conditions. Computed results concur with experimental observations that the periodic flow oscillations observed in Earth gravity subside in microgravity.
Author
Analysis (Mathematics); Buoyancy; Gravitational Effects; Finite Volume Method; Computational Fluid Dynamics

20050060809 Oklahoma Univ., Norman, OK, USA
Buoyancy Effects on Flow Structure and Instability of Low-Density Gas Jets
Pasumarthi, Kasyap Sriramachandra; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: CASI; A01, Hardcopy

A low-density gas jet injected into a high-density ambient gas is known to exhibit self-excited global oscillations accompanied by large vortical structures interacting with the flow field. The primary objective of the proposed research is to study buoyancy effects on the origin and nature of the flow instability and structure in the near-field of low-density gas jets. Quantitative rainbow schlieren deflectometry, Computational fluid dynamics (CFD) and Linear stability analysis were the techniques employed to scale the buoyancy effects. The formation and evolution of vortices and scalar structure of the flow

field are investigated in buoyant helium jets discharged from a vertical tube into quiescent air. Oscillations at identical frequency were observed throughout the flow field. The evolving flow structure is described by helium mole percentage contours during an oscillation cycle. Instantaneous, mean, and RMS concentration profiles are presented to describe interactions of the vortex with the jet flow. Oscillations in a narrow wake region near the jet exit are shown to spread through the jet core near the downstream location of the vortex formation. The effects of jet Richardson number on characteristics of vortex and flow field are investigated and discussed. The laminar, axisymmetric, unsteady jet flow of helium injected into air was simulated using CFD. Global oscillations were observed in the flow field. The computed oscillation frequency agreed qualitatively with the experimentally measured frequency. Contours of helium concentration, vorticity and velocity provided information about the evolution and propagation of vortices in the oscillating flow field. Buoyancy effects on the instability mode were evaluated by rainbow schlieren flow visualization and concentration measurements in the near-field of self-excited helium jets undergoing gravitational change in the microgravity environment of 2.2s drop tower at NASA John H. Glenn Research Center. The jet Reynolds number was varied from 200 to 1500 and jet Richardson number was varied from 0.72 to 0.002. Power spectra plots generated from Fast Fourier Transform (FFT) analysis of angular deflection data acquired at a temporal resolution of 1000Hz reveal substantial damping of the oscillation amplitude in microgravity at low Richardson numbers (~0.002). Quantitative concentration data in the form of spatial and temporal evolutions of the instability data in Earth gravity and microgravity reveal significant variations in the jet flow structure upon removal of buoyancy forces. Radial variation of the frequency spectra and time traces of helium concentration revealed the importance of gravitational effects in the jet shear layer region. Linear temporal and spatio-temporal stability analyses of a low-density round gas jet injected into a high-density ambient gas were performed by assuming hyper-tan mean velocity and density profiles. The flow was assumed to be non parallel. Viscous and diffusive effects were ignored. The mean flow parameters were represented as the sum of the mean value and a small normal-mode fluctuation. A second order differential equation governing the pressure disturbance amplitude was derived from the basic conservation equations. The effects of the inhomogeneous shear layer and the Froude number (signifying the effects of gravity) on the temporal and spatio-temporal results were delineated. A decrease in the density ratio (ratio of the density of the jet to the density of the ambient gas) resulted in an increase in the temporal amplification rate of the disturbances. The temporal growth rate of the disturbances increased as the Froude number was reduced. The spatio-temporal analysis performed to determine the absolute instability characteristics of the jet yield positive absolute temporal growth rates at all Fr and different axial locations. As buoyancy was removed (Fr . 8), the previously existing absolute instability disappeared at all locations establhing buoyancy as the primary instability mechanism in self-excited low-density jets.

Author

Computational Fluid Dynamics; Buoyancy; Flow Characteristics; Flow Stability; Gas Density; Gas Jets; Gravitational Effects; Microgravity; Jet Flow; Stability; Velocity Distribution; Helium

20050060848 Oklahoma Univ., Norman, OK, USA

Schlieren Measurements of Buoyancy Effects on Flow Transition in Low-Density Gas Jets

Pasumarthi, Kasyap S.; Agrawal, Ajay K.; January 2005; 7 pp.; In English; 2004 ASME Heat Transfer/Fluids Engineering Summer Conference, 11-15 Jul. 2004, Charlotte, NC, USA

Contract(s)/Grant(s): NAG3-2388

Report No.(s): HT-FED2004-56810; Copyright; Avail: Other Sources

The transition from laminar to turbulent flow in helium jets discharged into air was studied using Rainbow Schlieren Deflectometry technique. In particular, the effects of buoyancy on jet oscillations and flow transition length were considered. Experiments to simulate microgravity were conducted in the 2.2s drop tower at NASA Glenn Research Center. The jet Reynolds numbers varied from 800 to1200 and the jet Richardson numbers ranged between 0.01 and 0.004. Schlieren images revealed substantial variations in the flow structure during the drop. Fast Fourier Transform (FFT) analysis of the data obtained in Earth gravity experiments revealed the existence of a discrete oscillating frequency in the transition region, which matched the frequency in the upstream laminar regime. In microgravity, the transition occurred farther downstream indicating laminarization of the jet in the absence of buoyancy. The amplitude of jet oscillations was reduced by up to an order of magnitude in microgravity. Results suggest that jet oscillations were buoyancy induced and that the brief microgravity period may not be sufficient for the oscillations to completely subside.

Author

Gas Jets; Schlieren Photography; Turbulent Flow; Buoyancy; Rarefied Gases

20050060866 Oklahoma Univ., Norman, OK, USA

Numerical Analysis of Flow Evolution in a Helium Jet Injected into Ambient Air

Satti, Rajani P.; Agrawal, Ajay K.; January 2005; In English; 2004 ASME Heat Transfer/Fluids Engineering Summer Conference, 11-15 Jul. 2004, Charlotte, NC, USA

Contract(s)/Grant(s): NAG3-2388

Report No.(s): HT-FED-2004-56811; Copyright; Avail: Other Sources

A computational model to study the stability characteristics of an evolving buoyant helium gas jet in ambient air environment is presented. Numerical formulation incorporates a segregated approach to solve for the transport equations of helium mass fraction coupled with the conservation equations of mixture mass and momentum using a staggered grid method. The operating parameters correspond to the Reynolds number varying from 30 to 300 to demarcate the flow dynamics in oscillating and non-oscillating regimes. Computed velocity and concentration fields were used to analyze the flow structure in the evolving jet. For Re=300 case, results showed that an instability mode that sets in during the evolution process in Earth gravity is absent in zero gravity, signifying the importance of buoyancy. Though buoyancy initiates the instability, below a certain jet exit velocity, diffusion dominates the entrainment process to make the jet non-oscillatory as observed for the Re=30 case. Initiation of the instability was found to be dependent on the interaction of buoyancy and momentum forces along the jet shear layer.

Author

Gas Jets; Helium; Numerical Analysis; Air; Flow Distribution

20050060910 Oklahoma Univ., Norman, OK, USA

Effects of Mean Flow Profiles on Instability of a Low-Density Gas Jet Injected into a High-Density Gas

Vedantam, Nanda Kishore; 2003; 3 pp.; In English

Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this study was to investigate the effects of the mean flow profiles on the instability characteristics in the near-injector region of low-density gas jets injected into high-density ambient gas mediums. To achieve this, a linear temporal stability analysis and a spatio-temporal stability analysis of a low-density round gas jet injected vertically upwards into a high-density ambient gas were performed by assuming three different sets of mean velocity and density profiles. The flow was assumed to be isothermal and locally parallel. Viscous and diffusive effects were ignored. The mean flow parameters were represented as the sum of the mean value and a small normal-mode fluctuation. A second order differential equation governing the pressure disturbance amplitude was derived from the basic conservation equations. The first set of mean velocity and density profiles assumed were those used by Monkewitz and Sohn for investigating absolute instability in hot jets. The second set of velocity and density profiles assumed for this study were the ones used by Lawson. And the third set of mean profiles included a parabolic velocity profile and a hyperbolic tangent density profile. The effects of the inhomogeneous shear layer and the Froude number (signifying the effects of gravity) on the temporal and spatio-temporal results for each set of mean profiles were delineated. Additional information is included in the original extended abstract.

Author (revised)

Jet Flow; Gas Jets; Unsteady Flow; Flow Stability; Rarefied Gases; Gas Density

20050060911 Oklahoma Univ., Norman, OK, USA

Effects of Mean Flow Profiles on the Instability of a Low-Density Gas Jet Injected into a High-Density Gas

Vedantam, NandaKishore; Parthasarathy, Ramkumar N.; [2004]; In English; 2004 ASME Heat Transfer/Fluids Engineering Summer Conference, 11-15 Jul. 2004, Charlotte, NC, USA

Contract(s)/Grant(s): NAG3-2388

Report No.(s): HT-FED04-56794; Copyright; Avail: Other Sources

The effects of the mean velocity profiles on the instability characteristics in the near-injector region of axisymmetric low density gas jets injected vertically upwards into a high-density gas medium were investigated using linear inviscid stability analysis. The flow was assumed to be isothermal and locally parallel. Three velocity profiles, signifying different changes in the mean velocity in the shear layer, were used in the analysis. The effects of the inhomogeneous shear layer and the Froude number (signifying the effects of gravity) on the instability for each set of mean profiles were delineated. At a large Froude number (negligible gravity), a critical density ratio was found for the three profiles at which the jet became absolutely unstable. The critical density ratio for each velocity profile was increased as the Froude number was reduced. A critical Froude number was found for the three sets of profiles, below which the jet was absolutely unstable for all the density ratios less than unity,

which demarcated the jet flow into the momentum-driven regime and the buoyancy-driven regime.
Author
Gas Jets; Shear Layers; Velocity Distribution; Stability Tests

20050060916 Oklahoma Univ., Norman, OK, USA
Gravitational Effects on Flow Instability and Transition in Low Density Jets
Agrawal, Ajay K.; Parthasarathy, Ramkumar; November 2004; 239 pp.; In English
Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: CASI; C01, CD-ROM; A11, Hardcopy

Experiments were conducted in Earth gravity and microgravity to acquire quantitative data on near field flow structure of helium jets injected into air. Microgravity conditions were simulated in the 2.2-second drop tower at NASA Glenn Research Center. The jet flow was observed by quantitative rainbow schlieren deflectometry, a non-intrusive line of sight measurement technique suited for the microgravity environment. The flow structure was characterized by distributions of helium mole fraction obtained from color schlieren images taken at 60 Hz. Results show that the jet in microgravity was up to 70 percent wider than that in Earth gravity. Experiments reveal that the global flow oscillations observed in Earth gravity are absent in microgravity. The report provides quantitative details of flow evolution as the experiment undergoes change in gravity in the drop tower.
Author (revised)
Jet Flow; Gravitational Effects; Microgravity; Helium; Gas Jets; Air

20050060928 Oklahoma Univ., Norman, OK, USA
Scalar Measurements and Analysis of Helium Jets in Earth Gravity and Microgravity using Rainbow Schlieren Deflectometry
Yep, Tze Wing; 2001; In English
Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: Other Sources; Abstract Only

Recent experiments have shown that low-density gas jets injected into a high-density gas undergo an instability mode leading to highly periodic oscillations in the flow field. The transition from laminar to turbulent flow in these jets is abrupt, without a gradual change in scales. Although this type of instability at high Richardson numbers has been attributed to buoyancy, direct physical evidence was not acquired through experiments. In this study, several experiments were conducted in Earth gravity and microgravity to acquire qualitative data on near field flow structure of helium jets injected into air. Microgravity conditions were simulated in the 2.2-second drop tower at NASA Glenn Research Center. The operating parameters of this study included the tube inside diameter, the jet Reynolds number, and the jet Richardson number. Tubes with inside diameters of 19.05 mm and 31.75 mm were used in the experiments conducted in the drop tower. The jet flow was analyzed using quantitative rainbow schlieren deflectometry, a non-intrusive line of sight measurement technique for the whole field. The flow structure was characterized by distributions of angular deflection and the resulting helium mole fraction obtained from color schlieren images taken at 60 Hz. Three sets of experimental data with respect to three schlieren fields of view were acquired for each tube. Results show that the jet in microgravity was up to 70 percent wider than that in Earth gravity. The global jet flow oscillations observed in Earth gravity were absent in microgravity, providing direct experimental evidence that the flow instability in the low-density jet was buoyancy-induced. This study provides quantitative details of temporal flow evolution as the experiments undergo change in gravity in the drop tower.
Author
Gas Dynamics; Gas Density; Helium; Air; Gravitational Effects; Microgravity; Gas Jets; Flow Stability; Flow Distribution

20050060932 Oklahoma Univ., Norman, OK, USA
Concentration Measurements in Self-Excited Momentum Dominated Low-Density Gas Jets
Yildirim, B. S.; Pasumarthi, K. S.; Agrawal, A. K.; [2004]; 7 pp.; In English
Contract(s)/Grant(s): NAG3-2388; Copyright; Avail: CASI; A02, Hardcopy

Flow structure of self-excited, laminar, axisymmetric, momentum-dominated helium jets discharged vertically into ambient air was investigated using high-speed rainbow schlieren deflectometry technique. Measurements were obtained at temporal resolution of 1 ms and spatial resolution of 0.19 mm for two test cases with Richardson number of 0.034 and 0.018. Power spectra revealed that the oscillation frequency was independent of spatial coordinates, suggesting global oscillations in the flow. Abel inversion algorithm was used to reconstruct the concentration field of helium. Instantaneous concentration contours revealed changes in the flow field and evolution of vortical structures during an oscillation cycle. Temporal evolution

plots of helium concentration at different axial locations provided detailed information about the instability in the flow field. Author

Gas Jets; Helium; Flow Distribution; Gas Density; Concentration (Composition); Rarefied Gases

20050060942 Oklahoma Univ., Norman, OK, USA

Linear Temporal Stability Analysis of a Low-Density Round Gas Jet Injected into a High-Density Gas

Lawson, Anthony L.; Parthasarathy, Ramkumar N.; [2002]; 10 pp.; In English; Proceedings of ETCE 2002: ASME Engineering Technology Conference on Energy, 4-6 Feb. 2002, Houston, TX, USA

Contract(s)/Grant(s): NAG3-2388

Report No.(s): ETCE2002/CAE-29010; Copyright; Avail: CASI; A02, Hardcopy

It has been observed in previous experimental studies that round helium jets injected into air display a repetitive structure for a long distance, somewhat similar to the buoyancy-induced flickering observed in diffusion flames. In order to investigate the influence of gravity on the near-injector development of the flow, a linear temporal stability analysis of a round helium jet injected into air was performed. The flow was assumed to be isothermal and locally parallel; viscous and diffusive effects were ignored. The variables were represented as the sum of the mean value and a normal-mode small disturbance. An ordinary differential equation governing the amplitude of the pressure disturbance was derived. The velocity and density profiles in the shear layer, and the Froude number (signifying the effects of gravity) were the three important parameters in this equation. Together with the boundary conditions, an eigenvalue problem was formulated. Assuming that the velocity and density profiles in the shear layer to be represented by hyperbolic tangent functions, the eigenvalue problem was solved for various values of Froude number. The temporal growth rates and the phase velocity of the disturbances were obtained. The temporal growth rates of the disturbances increased as the Froude number was reduced (i.e. gravitational effects increased), indicating the destabilizing role played by gravity.

Author

Gas Density; Stability Tests; Viscous Flow; Gravitational Effects; Flow Stability

20050060985 Oklahoma Univ., Norman, OK, USA

Full Field Scalar Measurements in a Pulsating Helium Jet using Rainbow Schlieren Deflectometry

Pasumarthi, Kasyap S.; July 2000; 2 pp.; In English

Contract(s)/Grant(s): NAG3-2388; No Copyright; Avail: Other Sources; Abstract Only

The flow structure of a pulsating helium jet was investigated using quantitative rainbow schlieren deflectometry. The operating parameters included the tube inside diameter, the jet Reynolds number and the jet Richardson number. The jet structure was characterized by the frequency spectrum, temporal evolution of the oscillations and mean and root-mean-square profiles of the species mole fraction, which in this case, was helium. Experiments were conducted using a variable nozzle facility. Angular deflection data were obtained using rainbow schlieren deflectometry across full field of color images taken at a temporal resolution of 60Hz. The flicker cycle was analyzed by instantaneous rainbow schlieren images, contour plots of deflection angle and helium mole fraction placed sequentially in time. Two observe the flow downstream, the tube was lowered with respect to the optical setup and images were taken at different axial planes. In this way, the laminar, transition and turbulent regions of the jet flow were observed. Abel inversion algorithm was utilized to reconstruct the refractive index field from the measurements of the beam deflection angle. The concentration field was then generated from the refractive index field. The phenomenon of vortex initiation and propagation in the flicker cycle was described by correlating the ray deflection angle and concentration contour plots. Experiments in the flickering jet reveal global oscillation in the flow field. The effect of jet exit Reynolds number and jet Richardson number on the flickering frequency was analyzed. The effect of jet Richardson number was more pronounced than that of the jet exit Reynolds number. The flow field was studies quantitatively in terms of temporal evolution and statistical description of helium mole fraction.

Author

Gas Jets; Helium; Jet Flow; Dimensional Measurement; Deflection; Rainbows; Refractivity

20050061070 Stanford Univ., Stanford, CA, USA

Annual Research Briefs, 2004: Center for Turbulence Research

Moin, Parviz; Mansour, Nagi N.; [2004]; 366 pp.; In English; See also 20050061071 - 20050061104

Contract(s)/Grant(s): NCC2-1371; No Copyright; Avail: CASI; A16, Hardcopy

This report contains the 2004 annual progress reports of the Research Fellows and students of the Center for Turbulence Research in its eighteenth year of operation. Since its inception in 1987, the objective of the CTR has been to advance the

physical understanding of turbulent flows and development of physics based predictive tools for engineering analysis and turbulence control. Turbulence is ubiquitous in nature and in engineering devices. The studies at CTR have been motivated by applications where turbulence effects are significant; these include a broad range of technical areas such as planetary boundary layers, formation of planets, solar convection, magnetohydrodynamics, environmental and eco systems, aerodynamic noise, propulsion systems and high speed transportation. Numerical simulation has been the predominant research tool at CTR which has required a critical mass of researchers in numerical analysis and computer science in addition to core disciplines such as applied mathematics, chemical kinetics and fluid mechanics. Maintaining and promoting this interdisciplinary culture has been a hallmark of CTR and has been responsible for the realization of the results of its basic research in applications. The first group of reports in this volume are directed towards development, analysis and application of novel numerical methods for ow simulations. Development of methods for large eddy simulation of complex flows has been a central theme in this group. The second group is concerned with turbulent combustion, scalar transport and multi-phase ows. The nal group is devoted to geophysical turbulence where the problem of solar convection has been a new focus of considerable attention recently at CTR.

Author

Turbulence; Large Eddy Simulation; Geophysics; Aerodynamic Noise; Boundary Layers

20050061072 Stanford Univ., Stanford, CA, USA

On LES Outflow Conditions for Integrated LES-RNS Computations

Schluter, J. U.; Wu, X.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 107-116; In English; See also 20050061070; No Copyright; Avail: CASI; A02, Hardcopy

For the numerical prediction of turbulent flow of industrial relevance two approaches are currently in use. One is based on the Reynolds-Average Navier Stokes (RANS) approach, which computes essentially an ensemble-average of the flow and uses a turbulence model to approximate all scales of turbulence. The other approach is that of Large-Eddy Simulations (LES), where the large scales of motion are resolved in time and space and only the smallest scale are modeled. Although, LES is prohibited by the increased computational costs.

Derived from text

Large Eddy Simulation; Computation; Turbulent Flow

20050061075 Stanford Univ., Stanford, CA, USA

High Degree Oscillations in 3D Numerical Simulations of Solar Convection

Georgobiani, D.; Mansour, N. N.; Stein, R. F.; Nordlund, A.; Kosovichev, A. G.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 361-367; In English; See also 20050061070; No Copyright; Avail: CASI; A02, Hardcopy

High-degree acoustic modes probe shallow solar layers, where convection drives oscillations. we study these oscillations by means of the three-dimensional hydrodynamic code of Nordlund & Stein (1990). The code simulates a small part of the solar convection zone, and is therefore suitable for studies of high degree modes. In our previous work Georgobiani et al. (2000), we looked at the modes with angular degree l = 740. However, these modes in the Sun are reflected at 9-10 Mm beneath the surface, but the simulated domain was too shallow to include their lower turning points. As a result, the mode frequencies did not match the observed ones, although the velocity amplitudes were quite similar. In this work, we study modes of higher degree, l = 140.

Derived from text

Convection; Oscillations; Three Dimensional Models; Numerical Analysis; Simulation

20050061078 Stanford Univ., Stanford, CA, USA

Numerical Issues and Freestream Behavior of the v(exp 2)-f Model

Kalitzin, G.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 55-62; In English; See also 20050061070; No Copyright; Avail: CASI; A02, Hardcopy

The numerical method used to solve the equations of a turbulence model is of comparable importance to the concerns about the representation of the flow physics, as its efficiency and robustness determines the overall performance of the flow solver. The upsilon(sup 2)-f model by Durbin has shown to reproduce mean flow and turbulence quantities accurately for a large number of turbulent flow. However, the stiffness of the equations and, in particular, of the wall boundary condition that

results from the strong near-wall coupling of the bar-upsilon(sup 2) transport equation and the elliptic relaxation equation for f, hindered its application to large scale industrial flow applications.
Derived from text
Numerical Analysis; Free Flow; Fluid Dynamics; Turbulence Models

20050061080 Stanford Univ., Stanford, CA, USA
Conditional Filtering Method for Large Eddy Simulation of Turbulent Nonpremixed Combustion
Kim, S. H.; Pitsch, H.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 243-255; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this study is to develop a subgrid combustion model for turbulent nonpremixed flames with local extinction and reignition, based on the concept of conditional moment closure (CMC). In what follows, the conditionally filtered equations for reactive scalars are derived and closure assumptions are discussed. The integrated conditional filtering for a reacting shear layer is introduced. The closure assumptions and the performance of the model are tested with direct numerical simulation (DNS) data of reacting mixing layers.
Author
Combustion Physics; Large Eddy Simulation; Reactivity; Scalars; Turbulent Combustion; Turbulent Flames

20050061084 Stanford Univ., Stanford, CA, USA
Consistent Hybrid LES-FDF Formulation for the Simulation of Turbulent Combustion
Raman, V.; Pitsch, H.; Fox, R. O.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 1-11; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

The numerical simulation of turbulent reactive flows is a complex and challenging problem with widespread practical use. Recent breakthroughs in algorithmic techniques and the drastic increase in computing power have provided us with the tools to understand the complex interaction between turbulence and chemical reactions. In the past decade, the use of the large-eddy simulation (LES) technique has made it possible to make accurate predictions of turbulent flows even for complex configurations. On the other hand, the treatment of combustion is mainly through models similar to that uses in the Reynolds-Averaged NS methods (RANS) like flamelet models or conditional moment closure type approximations. Although these models work well for systems that exhibit little or no extinction, a higher-dimensional multi-scalar model is required to describe slow and extinction chemistry. The transported-filtered density function (FDF) method provides a natural starting point for such detailed description. The FDF technique has the key advantage that the reaction source term of the scalars appears closed and requires no modeling. Though a joint velocity-composition FDF transport equation can be formulated, numerical implementations of this high-dimensional system pose stability and feasibility issues. To overcome this problem, a hybrid approach is used where the velocity and turbulence fields are solved using an Eulerian scheme (like RANS or LES), while the scalar transport is handled using the FDF approach. Although the FDF technique has been widely used in the RANS context, almost all the applications involve steady-state flows. Since LES is inherently transient, the coupled LES-FDF method needs to maintain temporal accuracy. Due to the statistical nature of the FDF scheme, such a coupled scheme poses numerical accuracy issues. Hence, in order to establish the accuracy of a LES-FDF implementation, a robust consistency criterion is formulated. Based on redundant density fields carried by the Eulerian as well as the Lagrangian part of the solver, it is required that the evolution of all such density fields should be equivalent. The theoretical development guarantees such an equivalence. The current implementation of the LES-FDF scheme is then used to verify this equivalence in the context of a numerical simulation of a variable density complex flow problem.
Author
Flames; Large Eddy Simulation; Reynolds Averaging; Turbulent Combustion; Turbulent Flow

20050061085 NASA Ames Research Center, Moffett Field, CA, USA
Direct Numerical Simulation of Turbulent Condensation in Clouds
Shariff, K.; Paoli, R.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 305-316; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

In this brief, we investigate the turbulent condensation of a population of droplets by means of a direct numerical simulation. To that end, a coupled Navier-Stokes/Lagrangian solver is used where each particle is tracked and its growth by water vapor condensation is monitored exactly. The main goals of the study are to find out whether turbulence broadens the droplet size distribution, as observed in in situ measurements. The second issue is to understand if and for how long a correlation between the droplet radius and the local supersaturation exists for the purpose of modeling sub-grid scale

microphysics in cloud-resolving codes. This brief is organized as follows. In Section 2 the governing equations are presented, including the droplet condensation model. The implementation of the forcing procedure is described in Section 3. The simulation results are presented in Section 4 together with a sketch of a simple stochastic model for turbulent condensation. Conclusions and the main outcomes of the study are given in Section 5.
Author (revised)
Direct Numerical Simulation; Condensing; Turbulence Models; Drops (Liquids)

20050061086 Stanford Univ., Stanford, CA, USA
A Multilevel Formulation to Simulate Particulate Flows
Apte, S. V.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 201-208; In English; See also 20050061070; No Copyright; Avail: CASI; A02, Hardcopy

A formulation for simulating resolved particles is developed based on the work by Kajishima & Takagi, 2002. Regions where particles are subgrid can be captured by using the formulation developed in CTR-ARBO3. thus, different regimes encountered in particle-laden flows in the same simulation can be handled. The resolved particle domain is replaced by material points which do not move relative to each other. Forces acting at the material points are interpolated to the Eulerian grid using a Gaussian interpolation operator. It was observed that the present formulation predicts the drag on a fixed sphere correctly and captures unsteady wake effects with grid resolution of the order of 10.
Derived from text
Particulates; Interpolation; Two Phase Flow

20050061088 Stanford Univ., Stanford, CA, USA
Variational Multiscale Large Eddy Simulation of Turbulent Flows Using a Finite Volume Method
Gravemeier, V.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 131-144; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

Variational multiscale method represents a general approach for problems in computational mechanics which give rise to broad ranges of scales, see Hughes et al. (1998). The basic concept differentiates a predefined number of scale groups. This theoretical framework has also been applied to the problem of the incompressible Navier-Stokes equations in Hughes et al (2000) in order to facilitate large eddy simulation (LES) of turbulent flows. In Collis (2001) and Gravemeier (2003), the variational multiscale method for LES has recently been broadened by raising the number of separated scale groups to three. Such a three-scale separation accounts specifically for large resolved scales, small resolved scales, and unresolved scales. Apart from the initial separation and potentially different treatment of the respective scale ranges, two important aspects characterize the variational multiscale LES. Firstly, a variational projection separates scale ranges within the variational multiscale method rather than a spatial filter as in traditional LES. Secondly, the (direct) influence of the subgrid-scale model is confined to the small resolved scales. Thus, the large resolved scales are solved as a direct numerical simulation (DNS), i.e. without any (direct) influence of the modeling term. Of course, the large resolved scales are still influences indirectly by the subgrid-scale model due to the inherent coupling of all scales. At this stage, it should be pointed out that the variational multiscale method is essentially a theoretical framework for the separation of scales. Corresponding practical implementations within the variational multiscale framework are still rare. For such practical methods, it is crucial that a clear separation of the different scale ranges is actually achieved. The scale-separating approach developed in this work is implemented into the CDP-alpha code. Underlying this code is a finite volume method particularly suited for applications on unstructured grids. Please consult e.g. Ham et al. (2003) for further information concerning CDP-alpha. Within this computational environment, the separation of scales is developed in this work.
Derived from text
Finite Volume Method; Large Eddy Simulation; Turbulent Flow; Variational Principles

20050061090 Stanford Univ., Stanford, CA, USA
Identification of an Internal Layer in a Diffuser
Wu, X.; Schluter, J.; Moin, P.; Pitsch, H.; Iaccarino, G.; Ham, Frank; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 169-182; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

Identifying regions of self-preservation in representative non-equilibrium flows is useful for basic fluid mechanics as well as engineering computation. Townsend (1976) discussed the process that sudden changes in external conditions in boundary layers may result in an internal boundary layer that spreads from the section of change, and the layer outside the internal layer develops in almost the same way as in the original flow. Experimental evidence in support of this observation includes the

boundary layer over a curved hill (Baskaran et al. 1987), and the boundary layer over a bump (Webster et al. 1996). In Baskaran et al., streamwise pressure gradient changes rapidly from adverse to favorable at the leading edge, and separation occurs downstream of the summit. Internal layer was found downstream of the leading edge. The flow of Webster et al. remains attached, its streamwise pressure gradient changes suddenly from adverse to favorable at both the leading and trailing edges and internal layers were identified downstream of these two locations. They considered signatures of internal layer as knee points in the wall normal profiles of streamwise turbulence intensity. In these two studies knee points emerge when the outer peak of streamwise turbulence intensity associated with upstream adverse pressure gradient decays rapidly under favorable pressure gradient and an inner peak establishes as a result of the internal layer. Obviously this process of knee point formation is specific to the gill or bump type of flows in which upstream strong adverse pressure gradient changes suddenly to favorable at the leading/trailing edges. This paper describes an internal layer identified from an incompressible turbulent diffuser flow, as opposed to the internal layers previously identified in external boundary layer flows.
Derived from text
Diffusers; Boundary Layer Flow; Identifying; Fluid Flow; Nonequilibrium Flow

20050061092 Stanford Univ., Stanford, CA, USA
A Space-Time Correlation Theory for Turbulent Shear Flows
He, G. W.; Wang, M.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 195-199; In English; See also 20050061070; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this research is to investigate the large eddy simulation (LES) prediction of velocity space-time correlations in turbulent shear flows. In the application of LES methodology to aeroacoustics, Lighthill's acoustic analogy is often used to compute the far-field noise. According to Lighthill's theory, the acoustic intensity radiated by a turbulent flow depends on the space-time correlations of the Lighthill stresses, which are related to the space-time correlations of velocity fluctuations based on Proudman's (1952) analysis. In this study, we investigate the space-time correlations in turbulent shear flows. An elliptic hypothesis is proposed to model the space-time correlations in the streamwise direction. It is shown that Taylor's hypothesis is a linear approximation to the correlation contours, whereas the elliptic hypothesis is a second order approximation to the contours. An analytical expression for space-time correlations is formulated from the elliptic hypothesis, which relates the space-time correlations to two-point spatial correlations and propagation velocities. The propagation velocities are neither the sweeping velocity nor the mean velocity in general. The results will be used to guide a subsequent computation aimed at elucidating the SGS modeling effect on space-time correlations in turbulent shear flows.
Author
Aeroacoustics; Large Eddy Simulation; Space-Time Functions; Turbulent Flow; Shear Flow; Correlation

20050061093 Stanford Univ., Stanford, CA, USA
A Presumed PDF Model for Droplet Evaportation/Condensation in Complex Flows
Apte, S.; Ghosal, S.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 209-221; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

In many multiphase flow problems, the condensed phase (liquid or solid) exists in the form of a cloud of droplets of heterogeneous size in an amibent gas undergoing time dependent (often turbulent motion). One example is the problem of the formation and growth of ice crystals in the 'contrails' of aircraft. Other examples include atmospheric aerosols, rain drops in clouds, and the fuel vapor from evaporating drops of hydrocarbon fuel in spray combustion engines. In order to be specific, we shall assume here that the condensed phase is a liquid that undergoes evaporation. The need for modeling the spray arises in both LES and DNS. In DNS, the size of a computational grid is typically within an order of magnitude of the Kolmogorov scale. However, if particle sizes and the average distance between the particles is much smaller than this, then clearly some kind of a statistical description of the particles need to be adopted so as not to increase the computational effort by many orders of magnitude. In LES the size of the computational grid is somewhere intermediate between the integral scale and the Kolmogorov scale. Here once again some statistical modeling is needed if particle sizes and the distance between them are much smaller than the LES grid. In this report the statistical description based on a 'presumed PDF' (henceforth PPDF) outlined in CTR-SP02 is worked out in detail for a specific evaporation model and for a lognormal form of the presumed PDF. The predictions are checked against a full numerical simulation that does not involve any statistical modeling.
Author (revised)
Drops (Liquids); Evaporation; Condensing; Multiphase Flow; Spray Characteristics

20050061094 Stanford Univ., Stanford, CA, USA

Flux Corrected Finite-Volume Scheme for Preserving Scalar Boundedness in Large-Eddy Simulations

Herrmann, M.; Blanquart, G.; Raman, V.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 75-85; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

Large-Eddy Simulation (LES) has emerged as the next generation simulation tool for handling industrially relevant turbulent reacting flows. Of particular interest is the use of LES for modeling complex combustors used both in power-production and aircraft engines. Similarly, the chemical processing industry deals with a variety of turbulent flows that involve interaction of mixing and reaction with the final aim of controlling product selectivity and optimizing yield. As LES technique moves from being an academic tool to a practical simulation strategy, robustness of the LES solvers is a key issue to be answered. In low-mach number combustion, the staggered representation of the primary variables combined with an energy conserving scheme for the momentum equations, the scalar transport equations that represent the species distribution inside the geometry and is thus key to predicting combustor performance, have not been studied in detail. Numerical schemes for scalar transport equations are challenging from the viewpoint of stability. The advection equation solved using central difference based schemes can lead to oscillations and instabilities. To counter this problem, all known explicit schemes use an upwind bias that reduces numerical oscillations. As can be expected, this upwind bias reduces the numerical accuracy of the scheme and leads to artificial diffusion. In spite of this drawback, such schemes are widely used to their robust numerical stability. Many of these schemes suffer from one another drawback in that the species values are not bounded. In principle, a scalar transport equation solved using bounded initial and boundary conditions should preserve the boundedness. In the present study, we consider the simulation of a conserved scalar, namely mixture fraction.

Derived from text

Boundary Conditions; Finite Volume Method; Large Eddy Simulation; Scalars; Flux (Rate)

20050061097 Stanford Univ., Stanford, CA, USA

A Turbulence Model for Polymer Flows

Dubief, Y.; Iaccarino, G.; Lele, S. K.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 63-73; In English; See also 20050061070

Contract(s)/Grant(s): MDA972-01-C-0041; ARPA Order K042/31; ARPA Order K042/13; ARPA Order N115/00; No Copyright; Avail: CASI; A03, Hardcopy

Recent advancements in the modeling of polymer drag reduction in the context of RANS simulation are discussed. The present model is derived from the current understanding of the mechanism of near-wall turbulence in drag reduced polymer flows described in Dubief et al. (2004) and adapted the V(sup 2)-f turbulence model introduced by Durbin (1995) for Newtonian flows. Results for channel flows with homogeneous polymer concentrations prove to be very satisfactory. The modele captures accurately the behavior of the mean velocity profiles for the two main engines called LDR and HDR, Low and High Drag Reduction, respectively.

Author

Drag Reduction; Channel Flow; Simulation; Turbulence; Velocity Distribution

20050061099 Stanford Univ., Stanford, CA, USA

Large-Eddy Simulation of Passive-Scalar Mixing Using Multifractal Subgrid-Scale Modeling

Burton, G. C.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 145-156; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

Turbulent mixing of a passive scalar is important to a number of processes of interest to industry and science, including multiphase flows and dispersion of pollutants in atmospheric flows. Turbulent mixing also is of particular interest to the modeling of reacting flows, since turbulence is known to mix reactants in an extremely rapid manner, which may greatly influence the rate and efficiency of the reactive processes. While experimental and/or field work may continue to provide certain insights into the characteristics of these flows, their analysis may be difficult, time consuming or expensive to conduct. As a result, the practicing engineer and scientist has turned in the past decade to numerical simulation to develop a more detailed understanding of turbulent flows. In this context, large eddy simulation has been shown to be a promising approach to numerically simulate many turbulent flows. However, most current subgrid-scale models use for LES fail to recover the detailed spatial structure of the stress and energy transfer fields of such flows. These factors, however, may be of particular importance for modeling processes that occur principally in the subgrid scales, such as energy-dissipation, scalar-dissipation and chemical reactions.

Author

Large Eddy Simulation; Multiphase Flow; Scale Models; Turbulent Mixing; Turbulent Flow; Pollution Transport; Reacting Flow

20050061100 Stanford Univ., Stanford, CA, USA

Large-Eddy Simulation of a Free Round Jet Using Multifractal Subgrid-Scale Modeling

Burton, G. C.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 157-167; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

A multifractal subgrid model has been recently proposed that does not rely on an eddy-viscosity assumption, but instead is derived from the multifractal structure of the vorticity field in high Reynolds-number turbulence. From this, a new, highly accurate model for the subgrid velocity field has been proposed that permits explicit calculation of the nonlinear term thus closing the filtered Navier-Stokes equations.This work involves refining and evaluating the accuracy of the multifractal model in the significantly more complex configuration of a free round turbulent jet.

Derived from text

Turbulent Jets; Mathematical Models

20050061101 Universidad Politecnica de Madrid, Madrid, Spain

Spreading Laws for Diffusion in a Low-Reynolds-Number Channel

Jimenez, J.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 223-230; In English; See also 20050061070

Contract(s)/Grant(s): CICyT-BPI2003-03434; No Copyright; Avail: CASI; A02, Hardcopy

It was shown that the spectral energy densities of the streamwise velocity fluctuations in turbulent channels contain relatively-narrow ridges at long wavelengths, scaling as lambda(sub z) is approximately lambda(sub z)(exp 1/3) in the viscous and buffer sublayers, and as lambda(sub z)(exp 1/2) in the logarithmic region. The wavelengths lambda(sub z) and lambda(sub z) in those expressions can be interpreted as characteristic streamwise and spanwise dimensions of individual velocity structures, and it was argued by those authors that those two laws could be explained by the spreading of wakes left in the mean velocity profile by compact wall-normal-velocity structures.

Author

Spreading; Low Reynolds Number; Turbulence; Channel Flow; Velocity Distribution

20050061102 Stanford Univ., Stanford, CA, USA

DNS of Lean Premixed Turbulent Spherical Flames with a Flamelet Generated Manifold

Bastiaans, R. J. M.; Pitsch, H.; vanOijen; Martin, S. M.; deGoey, L. P. H.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 257-268; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

He present research is concerned with the direct numerical simulation (DNS) and analysis of turbulent propagation of premixed flame kernels. The simulations are a direct in the sense that the smallest scales of motion are fully resolved, while the chemical kinetics are solved in advance and parameterized in a table by the method of the flamelet generated manifolds (FGM). The state of the reactions are assumed to be directly linked to a single progress variable. The conservation equation for this progress variable is solved using DNS, with the unclosed terms coming from the table. This allows the use of detailed chemical kinetics without having to solve the individual species conservation equations. Turbulent premixed combustion of gaseous fuels is one of the most important energy conversion processes today, but its physics are not fully understood. On the one hand a detailed knowledge is required to understand the behavior of the conversion process and the efficiency and formation of pollutants. On the other hand this insight is needed to obtain the parameterizations that are essential in developing accurate models for large scale simulations. One of the most important processes to understand is the physics of turbulent flame wrinkling. Flame wrinkling is very important because it determines both the total flame surface area as well as the local modulation of the mass burning rate.

Author

Turbulent Flames; Flames; Flame Propagation; Turbulent Combustion; Burning Rate; Direct Numerical Simulation

20050061103 Stanford Univ., Stanford, CA, USA

Numerical Simulations of Spray Flames

Kurose, R.; Desjardins, O.; Nakamura, M.; Akamatsu, F.; Pitsch, H.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 269-280; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

Spray combustion is utilized in a number of engineering applications such as energy conversion and propulsion devices. It is, therefore, necessary to precisely predict the spray combustion behavior in designing and operating the equipment. However, since spray combustion is a complex phenomenon in which dispersion of the liquid fuel droplets , evaporation, and

chemical reaction of the fuel vapor with oxidizer take place interactively at the same time, the underlying physics governing these processes has not been well understood. Direct numerical Simulations (DNS) directly solve conservation equations for the carrier gases phase and Lagrangian equations for dispersed droplet dynamics and can be used for discussing the detailed spray combustion mechanism. However, few of such studies have been done even for low Reynolds numbers and simple geometries, because such simulations can be quite expensive.
Author
Combustion; Direct Numerical Simulation; Chemical Reactions; Flames; Sprayers; Energy Conversion

20050061104 Stanford Univ., Stanford, CA, USA
Macroscopic Modeling and Computation of Radiation for a 2m Diameter Pool Fire
Ripoll, J. F.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 293-304; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

In this paper, the M1 radiation model, sometimes referred to as Maximum Entropy Closure, is chosen to model the radiation field generated by a synthetic fire. The first goal is to show the ability of the M1 model to solve a real fire case occuring in a complex geometry. The fire considered here occurs in the FLAME facility of Sandia Albuquerque, and the particular and complex geometry of this facility will be taken into account. A discussion of the radiative characteristics of the fire will be given to show the coherence of the modeling.Average opacities, also called effective mean absorption coefficients, are of outstanding importance to radiation modeling. For fires, this spectral coefficient is mainly derived from the soot volume fraction and is linear in frequency. As a results, mean absorption coefficients are different from Planck mean absorption coefficient. In this paper, new, effective mean coefficients are derived and used to model the opacity field.
Derived from text
Fires; Heat Transfer; Mathematical Models

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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*.

20050041921 Ball Aerospace and Technologies Corp., Boulder, CO, USA
Final Report for the Advanced Camera for Surveys (ACS)
January 08, 2004; 239 pp.; In English
Contract(s)/Grant(s): NAS5-32864
Report No.(s): NASA/CR-2004-212755; No Copyright; Avail: CASI; A11, Hardcopy

ACS was launched aboard the Space Shuttle Columbia just before dawn on March 1, 2002. At the time of liftoff, the Hubble Space Telescope (HST) was reflecting the early morning sun as it moved across the sky. After successfully docking with HST, several components were replaced. One of the components was the Advanced Camera for Surveys built by Ball Aerospace & Technologies Corp. (BATC) in Boulder, Colorado. Over the life of the HST contract at BATC, hundreds of employees had the pleasure of working on the concept, design, fabrication, assembly, and test of ACS. Those employees thank NASA - Goddard Space Flight Center and the science team at Johns Hopkins University (JHU) for the opportunity to participate in building a great science instrument for HST.
Author
Hubble Space Telescope; CCD Cameras; Ultraviolet Detectors; Fabrication

20050041981 NASA Langley Research Center, Hampton, VA, USA
Holographic Flow Visualization at NASA Langley
Burner, A. W.; Goad, W. K.; January 2005; 8 pp.; In English; 25th International Instrumentation in the Aerospace Industry, 7-10 May 1979, Anahein, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

Holographic flow visualization systems at two NASA Langley facilities, a hypersonic blow-down tunnel using CF4 gas and an expansion tube with very short test time, are described. A pulsed ruby laser is used at a CF4 tunnel for single pulse holography, double pulse with several minutes between exposures, and dual plate holographic interferometry. Shadow-graph, schlieren, and interferograms are reconstructed from the holograms in a separate reconstruction lab. At the expansion tube the short run time of 200 microseconds requires precise triggering of its double pulsed ruby laser. With pulse separation, one pulse

can occur before and one after flow is established to obtain fringe free background interferograms (perfect infinite fringe) or both pulses can occur during flow in order to study flow instabilities. Holograms are reconstructed at the expansion tube with an in-place setup which makes use of a high power CW Argon laser and common optics for both recording and reconstructing the holograms. The holographic systems at the CF4 tunnel and expansion tube are operated routinely for flow visualization by tunnel technicians. Typical flow visualization photographs from both facilities are presented.
Author
Carbon Tetrafluoride; Flow Visualization; Holographic Interferometry; Hypersonic Wind Tunnels; NASA Programs

20050042005 NASA Langley Research Center, Hampton, VA, USA
A Portable Surface Contamination Monitor Based on the Principle of Optically Stimulated Electron Emission (OSEE)
Perey, D. F.; [1996]; 8 pp.; In English; 1996 JANNAF Propulsion and Joint Subcommittee Meetings, 9-13 Dec. 1996, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy

Many industrial and aerospace processes involving the joining of materials, require sufficient surface cleanliness to insure proper bonding. Processes as diverse as painting, welding, or the soldering of electronic circuits will be compromised if prior inspection and removal of surface contaminants is inadequate. As process requirements become more stringent and the number of different materials and identified contaminants increases, various instruments and techniques have been developed for improved inspection. One such technique, based on the principle of Optically Stimulated Electron Emission (OSEE), has been explored for a number of years as a tool for surface contamination monitoring. Some of the benefits of OSEE are: it is non-contacting; requires little operator training; and has very high contamination sensitivity. This paper describes the development of a portable OSEE based surface contamination monitor. The instrument is suitable for both hand-held and robotic inspections with either manual or automated control of instrument operation. In addition, instrument output data is visually displayed to the operator and may be sent to an external computer for archiving or analysis.
Author
Contamination; Electron Emission; Portable Equipment; Monitors; Optical Measuring Instruments; Stimulated Emission Devices

20050050958 Coast Guard, Alexandria, VA, USA
Validation of a Time of Transmission Monitor Suite for Measurement of the Offset Between LORAN-C Transmissions and UTC
Putnam, Lee S.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 483-491; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

The U.S. Loran-C system is an integral part of the national infrastructure for the dissemination of precise time and time interval. In 1997 the U.S. Coast Guard Loran Support Unit located in Wildwood, New Jersey,developed a Time of Transmission Monitor (TOTM) suite. The TOTM suite will be used to measure the average daily offset between UTC and the time of transmission of a Loran-C signal with respect to UTC will allow the Coast Guard to more tightly couply the Lora-C system to UTC. This paper will discuss the effort, jointly undertaken by the U.S. Coast Guard and the U.S.Naval Observatory, to implement and validate the TOTM equipment suite.
Author
Observatories; Time Measurement; Time Signals

20050050959 Naval Observatory, Washington, DC, USA
Hardware Delay Measurements and Sensitivities in Carrier Phase Time Transfer
Powers, Edward; Wheeler, Paul; Judge, David; Matsakis, Demetrios; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 293-30; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

Precise time and frequency transfer experiments using GPS carrier phase with time stability less than one hundred picoseconds are now being reported. Strong daily variations in some of the data reported indicate temperature sensitivity in the measurement hardware. The environmental dependence of the instrumental delays of a commonly used carrier phase GPS receiver, its antenna, and several types of antenna cable are reported in this paper.
Author
Global Positioning System; Sensitivity; Antennas; Time

20050050966 Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin, Italy

Statistical Problems in the Analysis of Unequally Spaced Data

Tavella, Patrizia; Leonardi, Mauro; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 35-48; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

The statistical analysis of irregularly spaced data or the handling of series with missing data asks for particular care because results may be biased. In particular, in PTTI applications, two points seems to be addressed: 1) the noise analysis in terms of Allan or related variances; 2) the estimation of a missing datum on a particular date. Both these issues are examined in the particular case of the current TWSTT measurement,by means of an analytical and theoretical approach that can be of more general interest. Some numerical estimates based on the TWSTT measures are eventually reported.

Author

Statistical Analysis; Time; Time Measurement; Frequency Measurement; Electromagnetic Noise

20050050972 Quartzlock (UK) Ltd., Devon, UK

IEM Kvarz and Quartzlock's GPS-Disciplined Rubidium Frequency and Time Standard

Green, Clive; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 219-225; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

IEM Kvarz and Quartzlock have devised a GPS-disciplined rubidium frequency and time standard to 10(exp -14) level accuracy. As a result of employing unique carrier phase tracking techniques with algorithmic weighting of 'all-in-view' software clock techniques with an excellent OCXO or rubidium oscillator built in, both short-term stability (STS) at 10(exp -13) level and long-term stability (LTS) to 10(exp -14) is realized. Now IEM Kvarz and Quartzlock have reduced the overall size and most importantly introduced temperature control for both the antenna and the downconverter, receiver, and processor. The original quad helix antenna eliminates multipath errors and the need for a choke plate, while the downconverter at the antenna means that the coax carries only 90 MHz, so it can be very long and thin (not short and fat for 1.5 GHz). Time output accuracy meets GPS time transfer atomic clock comparisons at \h 5 ns, while LTS can be little improved, and STS has wander, noise floor, and holdover built to the 10(exp -14) level. IEM Kvarz and Quartzlock have now exceeded even high performance commercial cesium stability at only 20% of its cost and the need to employ a hydrogen maser test to maintain 10:1 integrity margin above GPS (and cesium) performance.

Author

Frequency Standards; Global Positioning System; Time Measurement; Atomic Clocks; Rubidium

20050050973 Bureau International des Poids et Mesures, Sevres, France

A Test of the Use of GLONASS Precise Code for High-Precision Time Transfer

Azoubib, J.; Lewandowski, W.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 201-210; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

In a first attempt to evaluate performance of the GLONASS P-code time transfer, one-site measurements are used to show that single-channel GLONASS precise code, combined with temperature-controlled antennas, reduces the noise experienced by time receiving equipment to a few hundred of picoseconds for a one-day averaging times, thus allowing frequency comparison at a level of a few parts in 10(exp 15).

Author

GLONASS; Satellite Antennas; Frequency Measurement; Time Signals

20050050977 Colorado Univ., Boulder, CO, USA

A Long-Term Comparison Between GPS Carrier-Phase and Two-way Satellite Time Transfer

Larson, Kristine; Nelson, Lisa; Levine, Judah; Parker, Tom; Powers, Edward D.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 247-256; In English; See also 20050050957

Contract(s)/Grant(s): NAG5-6147; No Copyright; Avail: CASI; A02, Hardcopy

We have conducted GPS carrier-phase time-transfer experiment between the Master Clock at USNO in Washington DC and the Alternate Master Clock at Schriever Air Force Base near Colorado Springs, Colorado. These clocks are also monitored on an hourly basis with two-way satellite time-transfer (TWSTT) measurements. We compare the performance of the GPS carrier-phase and TWSTT systems over a 167-day period. Apart from an overall constant time offset (due to unknown delays in the GPS hardware at both ends), we find that the systems agree within +/- 1ns, with a drift of 1.9 +/- 0.1 ps/d. For averaging

times of a day, the carrier-phase and TWSTT systems have a frequency uncertainty of 2.5 and 5.5 parts in 10(exp 15), respectively.
Author
Clocks; Time Measurement

20050050980 National Inst. of Standards and Technology, Boulder, CO, USA
GPS Week Roll-over and Y2K Compliance for NBS-type Receivers, and Absolute Calibration of the NIST Primary Receiver
Weiss, M.; Zhang, V.; Powers, E.; Loiler, R.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 11-18; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

The Nbs-type receiver software was modified to account for both the GPS end-of-week crossover and for the Y2K event. Receivers using this software were tested by personnel from the National Institute of Standards and Technology and the U.S. Naval Observatory using a simulator at the Naval Research Laboratory. An independent test was performed by a private company. The software now appears to be full compliant with requirements for both the GPS week roll over and the Y2K events. Since the NBS-type receivers are still the predominant receiver for time transfer among laboratories which generate International Atomic Time this receiver was given significant attention. In the process, an absolute calibration of the delay through the primary NIST GPS common-view receiver was completed. This calibration agrees within its 2.8 ns uncertainty both with the value from an estimate in June 1986, which has been used continuously since then, and with an absolute calibration in April of 1987.
Author
Calibrating; Time Measurement; Time Measuring Instruments; Time Synchronization

20050050981 Swiss Federal Office of Metrology, Bern-Wabern, Switzerland
First Results on a Transatlantic Time and Frequency Transfer by GPS Carrier Phase
Dudle, G.; Overney, F.; Prost, L.; Schildknecht, T.; Hetzel, P.; Powers, E.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 271-280; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

Time and frequency transfer by GPS carrier phase, also referred to as Geodetic Time Transfer (GeTT), has been studied intensively in the frame of a collaboration between the Swiss Federal Office of Metrology (OFMET) and the Astronomical Institute of the University of Berne (AIUB). Two terminals equipped with geodetic GPS receivers have been built and were successfully deployed over European baselines. The study has demonstrated the low instrumental noise of GETT (sigma(sub y)(tau) = 10(exp 13) at tau = 100 s), which makes this method an ideal tool for frequency comparisons between high performance clocks since much shorter averaging times are required than with GPS common view. This new time and frequency transfer method is now to be tested over longer baselines. In this paper we report on a transatlantic campaign between the Physikalisch-Technische Bundesanstalt in Germany (PTB) and the US Naval Observatory, Washington (USNO). Besides the longer baseline the choice of these two sites offers also the possibility to compare frequently GeTT and TWSTFT. The paper outlines the main parts of a GeTT campaign and summarizes the first results of time and frequency transfer by GPS carrier phase between PTB and USNO.
Author
Frequencies; Measuring Instruments; Time; Time Measuring Instruments; Time Measurement

20050050987 Bern Univ., Bern, Switzerland
High Precision Time and Frequency Transfer Using GPS Phase Measurements
Schildknecht, T.; Springer, T.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 281-292; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

The use of GPS C/A Code measurements for time transfer by means of the so-called common view method is a widely accepted technique. The full potential of he GPS system for time and frequency transfer is, however, only exploited by using all phase and code observables from all satellites in view. Geodetic processing techniques, adapted to the specific requirements to process data from specially modified geodetic receivers, will be presented. We will also discuss the requirements for the receivers and the control as well as the calibration of instrumental delays. The potential of the technique will be illustrated by laboratory experiments and measurement campaigns on continental and intercontinental baselines.
Author
Calibrating; Data Processing; Receivers; Geodetic Accuracy; Time; Timing Devices

20050050994 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Unequal-Arms Michelson Interferometers

Tinto, Massimo; Armstrong, J. W.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 117-123; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

Michelson interferometers allow phase measurements many orders of magnitude below the phase stability of the laser light injected into their two almost equal-length arms. If, however, the two arms are unequal, the laser fluctuations can not be removed by simply recombining the two beams. This is because the laser jitters experience different time delays in the two arms, and therefore can not cancel at the photo detector. We present here a method for achieving exact laser noise cancellation, even in an unequal-arm interferometer. The method presented in this paper requires a separate readout of the relative phase in each arm, made by interfering the returning beam in each arm with a fraction of the outgoing beam. By linearly combining the two data sets with themselves, after they have been properly time-shifted, we show that it is possible to construct a new data set that is free of laser fluctuations. An application of this technique to future planned space-based laser interferometer detectors of gravitational radiation is discussed.

Author

Laser Outputs; Michelson Interferometers; Radiation Detectors; Stability

20050050996 National Standard Time and Frequency Lab., Taoyuan, Taiwan

Automatic Frequency Calibration using Fuzzy Logic Controller

Chang, Ching-Haur; Liao, Chia-Shu; Tu, Kung-Yuan; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 83-88; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

A way of frequency calibration using fuzzy logic controller (FLC) is presented in this paper. Generally, atomic clocks tend to drift due to temperature, aging, or some environmental effects. It is sure that one cannot compensate for the drift with a fixed amount of control quantity. As a controller, it has the task to adaptively catch up with the variation. Our approach takes advantage of FLC to determine the control quantity. Three procedures are employed in our approach Firstly the performance of the device being calibrated is observed continuously. Then the FLC uses the performance data to generate the control quantity. Finally the FLC calibrates the device using the computed control quantity. The FLC can calibrate the device at any time since the performance of the device is continuously being monitored. In the experiment, we use FMAS (Frequency Measurement and Analysis System) as the performance evaluation equipment and the FLC is realized by a PC. In the experiment, a cesium-beam oscillator is chosen as the target. The result validates the effectiveness of our approach. An oscillator with frequency offset of -1.4 x 10(exp -13) can be improved to approximately -1.0 x 10(exp -14) after one week of calibration.

Author

Fuzzy Systems; Frequency Measurement; Atomic Clocks; Controllers

20050050999

GPS Block IIR Rubidium Atomic Frequency Standard Life Test

Beard, R.; White, J.; Brad, J.; Stebbins, S.; Smathers, J.; Myers, T.; Danzy, F.; Frank, A.; Reid, W.; Buisson, J.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 145-159; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

The rubidium clocks in the GPS Block IIR spacecraft have no previous flight experience, and will be the only atomic clocks used on the Block IIR satellites. The U.S. Naval Research Laboratory (NRL), in cooperation with the Global Positioning System Joint Program Office (GPS-JPO), the GPS Control Segment, Lockheed Martin, ITT, and EG&G, is conducting a three year life-test of two flight qualified EG&G Rubidium Atomic Frequency Standards (RAFS) selected from the operational spacecraft inventory. The two RAFS, serial numbers 28 and 30, were selected as representative of the flight configuration build for Block IIR by ITT and provided by the JPO to NRL for this test. The test is intended to build confidence in these units as operational spacecraft clocks and establish a database of fundamental performance characteristics. The two units are being operated in independent thermal vacuum chambers with high resolution monitoring of the clock's frequency compared to the NRL hydrogen maser references. The units' internal monitors that would normally be sent as telemetry and environmental test conditions are monitored and recorded with high resolution. Output from one of the two units has been used as input to the NRL Time Keeping System Simulator (TKSS). The TKSS was originally built to evaluate the implementation and algorithms used in the Block IIR on-board Time Keeping System (TKS), which determines the satellite's clock signal to the transmitter. Data from the TKSS have been used to evaluate TKS on-orbit performance and serve as an analysis reference. RAFS data from the beginning of the test on 31 March 1997 to August 1998 and representative TKSS data will be presented.

Frequency stability results of the RAFS have routinely shown Allan deviation performance in parts in 10(exp -14) at one day, much better than initially expected. In addition to the data from the two test units, on-orbit data from the Block HR clocks is being added to the database for life data analysis as satellites are put into service.
Author
Atomic Clocks; Rubidium; Artificial Satellites; Global Positioning System; Time Measurement; Simulators

20050051012 Defence Science and Technology Organisation, Salisbury, Australia
Implementation of the Hierarchical Discrete Radon Transform with Application to Image Registration
Jones, Ronald; Redding, Nicholas J.; Payne, Timothy M.; Sep. 2004; 35 pp.; In English
Report No.(s): AD-A428461; DSTO-TR-1599; DODA-AR-013-146; No Copyright; Avail: CASI; A03, Hardcopy

This report discusses the background theory and implementation details of two new modules in the Analyst's Detection Support System (ADSS) environment. The first is the Hierarchical Discrete Radon Transform (HDRT), which provides a hierarchy of Radon transforms, from the Radon transform of single pixels in the image, right up to the Radon transform of the entire image. The second new module is an application of the HDRT to image registration. A coarse-to-fine strategy is implemented in order to handle local variations caused by terrain elevations and errors in global parameters. The use of the HDRT is fundamental to this multiresolution strategy.
DTIC
Image Processing; Pattern Registration; Radon; Synthetic Aperture Radar

20050051150 Princeton Univ., NJ USA
Distributed Real-Time Embedded Video Processing
Lv, Tiehan; Wolf, Wayne; Ozer, Burak; Aug. 2004; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428740; No Copyright; Avail: Defense Technical Information Center (DTIC)

The embedded systems group at Princeton University is building a distributed system for real-time analysis of video from multiple cameras. Most work in multiple-camera video systems relies on centralized processing. However, performing video computations at a central server has several disadvantages: it introduces latency that reduces the response time of the video system; it increases the amount of buffer memory required; and it consumes network bandwidth. These problems cause centralized video processing systems to not only provide lower performance but to use excess power as well. A deployable multi-camera video system must perform distributed computation, including computation near the camera as well as remote computations, in order to meet performance and power requirements. Smart cameras combine sensing and computation to perform real-time image and video analysis. A smart camera can be used for many applications, including face recognition and tracking. We have developed a smart camera system Wo102 that performs real-time gesture recognition. This system, which currently runs on a Trimedia TM-100 VLIW processor, classifies gestures such as walking, standing, waving arms. It currently runs at 25 frames/sec on the Trimedia processor. The application uses a number of standard vision algorithms as well as some improvements of our own; the details of the algorithms are not critical to the distributed system research we propose here.
DTIC
Cameras; Distributed Processing; Embedding; Real Time Operation; Video Signals

20050051184 Honeywell, Inc., Minneapolis, MN USA
LDART: A Large Scale Network of Embedded Systems for Laser Detection and Reciprocal Targeting
Manley, Jathan; DeMers, Robert; Jelinek, Jan; Rhodes, Michael; Schwichtenberg, Jay; Sep. 2003; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-02-C-1175
Report No.(s): AD-A428793; No Copyright; Avail: Defense Technical Information Center (DTIC)

LDART (Laser Detection And Reciprocal Targeting) is a novel military application developed by Honeywell under the DARPA NEST program. LDART provides battlefield situational awareness by detecting if a soldier or vehicle has been painted by a battlefield laser (target designator, range finder, etc.) and determines a precise position of the source (within +or- 0.06 degrees). It can also be configured to reciprocally designate an enemy laser source or communicate a combat ID to a friendly laser system. LDART, in addition to providing situational aware capabilities, allows the asset to take evasive action and possibly take offensive action against the enemy.
DTIC
Detection; Helmet Mounted Displays; Lasers; Optical Tracking; Situational Awareness

20050051589 NASA Langley Research Center, Hampton, VA, USA

Method of Improving a Digital Image as a Function of its Dynamic Range

Woodell, Glenn, Inventor; Jobson, Daniel J., Inventor; Rahman, Zia-ur, Inventor; December 21, 2004; 12 pp.; In English Patent Info.: Filed 25 Jun. 2001; US-Patent-6,834,125; US-Patent-Appl-SN-888701; NASA-Case-LAR-16012-1-CU; No Copyright; Avail: CASI; A03, Hardcopy

The present invention is a method of processing a digital image that is initially represented by digital data indexed to represent position on a display. The digital data is indicative of an intensity value I(sub i)(x,y) for each position (x,y) in each i-th spectral band. A classification of the image based on its dynamic range is then defined in each of the image's S spectral bands. The intensity value for each position in each i-th spectral band is adjusted to generate an adjusted intensity value for each position in each i-th spectral band in accordance with SIGMA (sup n)(sub n=1) W(sub n)(log I (sub i)(x,y) - log[I(sub i)(x,y)*F(sub n)(x,y)]), i=1,...,S where W(sub n) is a weighting factor, "*' is the convolution operator and S is the total number of unique spectral bands. For each n, the function F(sub n)(x,y) is a unique surround function applied to each position (x,y) and N is the total number of unique surround functions. Each unique surround function is scaled to improve some aspect of the digital image, e.g., dynamic range compression, color constancy, and lightness rendition. The adjusted intensity value to each position in each i-th spectral band of the image is then filtered with a filter function that is based on the dynamic range classification of the image.

Official Gazette of the U.S. Patent and Trademark Office

Digital Data; Dynamic Range; Image Classification

20050051590 NASA Glenn Research Center, Cleveland, OH, USA

Method of Assembling a Silicon Carbide High Temperature Anemometer

Okojie, Robert S., Inventor; Fralick, Gustave C., Inventor; Saad, George J., Inventor; September 21, 2004; 10 pp.; In English Patent Info.: Filed 5 Aug. 2003; US-Patent-6,794,213; US-Patent-Appl-SN-637083; NASA-Case-LEW-17222-2; No Copyright; Avail: CASI; A02, Hardcopy

A high temperature anemometer includes a pair of substrates. One of the substrates has a plurality of electrodes on a facing surface, while the other of the substrates has a sensor cavity on a facing surface. A sensor is received in the sensor cavity, wherein the sensor has a plurality of bondpads, and wherein the bondpads contact the plurality of electrodes when the facing surfaces are mated with one another. The anemometer further includes a plurality of plug-in pins, wherein the substrate with the cavity has a plurality of trenches with each one receiving a plurality of plug-in pins. The plurality of plug-in pins contact the plurality of electrodes when the substrates are mated with one another. The sensor cavity is at an end of one of the substrates such that the sensor partially extends from the substrate. The sensor and the substrates are preferably made of silicon carbide.

Official Gazette of the U.S. Patent and Trademark Office

Anemometers; Assembling; Silicon Carbides; High Temperature; Engine Monitoring Instruments

20050060907 JAI Pulnix, Inc., Sunnyvale, CA, USA

Developing Standards for the Automated Imaging Industry

Hori, Toshi; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, No. 1, pp. 72 and 74; In English; Original contains color illustrations; Copyright; Avail: Other Sources

One of the greatest challenges to automated imaging manufacturers is to build equipment to widely accepted standards, thereby assuring compatibility, reduced costs and increased market acceptance. Several standards are in place, some developed by groups of companies and others by industry groups such as the Automated Imaging Association (AIA). The AIA's standards committees are instrumental in developing new and emerging standards for the industry, and they often endorse those developed by company consortiums. The advantage of working with the AIA is that the committees are formed of many experienced engineers, offering far more than any single company could on its own. The automated imaging industry has been guided by several standards in the past, and a variety are under development. Several take the common standards many steps further.

Author

Cameras; Standards; Industries; Manufacturing; Computer Vision

20050061011 NASA Glenn Research Center, Cleveland, OH, USA

Preparation and Analysis of Platinum Thin Films for High Temperature Sensor Applications

Wrbanek, John D.; Laster, Kimala L. H.; January 2005; 26 pp.; In English

Contract(s)/Grant(s): WBS 22-794-20-5E

Report No.(s): NASA/TM-2005-213433; E-14967; No Copyright; Avail: CASI; A03, Hardcopy

A study has been made of platinum thin films for application as high temperature resistive sensors. To support NASA Glenn Research Center s high temperature thin film sensor effort, a magnetron sputtering system was installed recently in the GRC Microsystems Fabrication Clean Room Facility. Several samples of platinum films were prepared using various system parameters to establish run conditions. These films were characterized with the intended application of being used as resistive sensing elements, either for temperature or strain measurement. The resistances of several patterned sensors were monitored to document the effect of changes in parameters of deposition and annealing. The parameters were optimized for uniformity and intrinsic strain. The evaporation of platinum via oxidation during annealing over 900 C was documented, and a model for the process developed. The film adhesion was explored on films annealed to 1000 C with various bondcoats on fused quartz and alumina. From this compiled data, a list of optimal parameters and characteristics determined for patterned platinum thin films is given.
Author
Thin Films; High Temperature; Detection; Magnetron Sputtering; Platinum; Annealing

20050061012 NASA Glenn Research Center, Cleveland, OH, USA
Narrow Angle Wide Spectral Range Radiometer Design FEANICS/REEFS Radiometer Design Report
Camperchioli, William; January 2005; 54 pp.; In English
Contract(s)/Grant(s): WBS 22-400-31-30-03
Report No.(s): NASA/TM-2005-213421; E-14947; No Copyright; Avail: CASI; A04, Hardcopy

A critical measurement for the Radiative Enhancement Effects on Flame Spread (REEFS) microgravity combustion experiment is the net radiative flux emitted from the gases and from the solid fuel bed. These quantities are measured using a set of narrow angle, wide spectral range radiometers. The radiometers are required to have an angular field of view of 1.2 degrees and measure over the spectral range of 0.6 to 30 microns, which presents a challenging design effort. This report details the design of this radiometer system including field of view, radiometer response, radiometric calculations, temperature effects, error sources, baffling and amplifiers. This report presents some radiometer specific data but does not present any REEFS experiment data.
Author
Radiometers; Radiance; Temperature Effects; Radiative Heat Transfer; Gravitational Effects; Flame Propagation

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*.

20050041890 Laurin Publishing Co., Inc., Pittsfield, MA, USA
Electrically Pumped 1.5 muons MEMS VCSEL Tunes over 40 nm
Hitz, Breck; Photonics Spectra; December 2004; ISSN 0731-1230; Volume 38, Issue 12, pp. 2212-2214; In English; Reprinted from IEEE Photonics Technology Letters, Oct. 2004, pp. 2212-2214; Copyright; Avail: Other Sources

A collaboration of scientists at Two-Chip Photonics AG and Technische Universitat Darmstadt, both in Darmstadt. Germany. and at Technische Universitat Munchen in Munich. Germany, has resulted in an electrically pumped vertical-cavity surface-emitting laser (VCSEL) with a 40-nm tuning range, the widest yet reported for such a device. Lasing in a single mode from approx. 1553 to approx. 1595 nm. the laser could find important applications not only in telecommunications, but also in trace-gas sensing. metrology. process control and medical diagnostics.
Author
Surface Emitting Lasers; Microelectromechanical Systems; Laser Pumping; Tunable Lasers

20050051142 Army Research Lab., Adelphi, MD USA
Processing Interband Cascade Laser for High Temperature CW Operation
Tober, Richard L.; Monroy, Carlos; Olver, Kimberly; Bruno, John D.; Nov. 2004; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428728; ARL-TN-233; No Copyright; Avail: Defense Technical Information Center (DTIC)

A narrow ridge-waveguide mid-IR interband cascade laser based on Type-II inAs/GaInSh heterostructures processed with a thick gold heat spreading layer operated CW at temperatures ranging from 80 K to 214.4 K. Its differential quantum

efficiency was 547% at 80 K dropped slowly to 239% at 200 K, commensurate with a T(1) of 160.2. The device had a characteristic temperature, T(0), of 40.2 K and showed signs of significant heating at temperatures above 200 K.
DTIC
Chemical Warfare; Continuous Radiation; High Temperature; Infrared Lasers; Lasers; Optical Countermeasures

20050051909 nLight, Vancouver, WA, USA
Addressing Inefficiency in Laser Diodes
Farmer, Jason; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 94, 96, 102; In English; Original contains color illustrations; Copyright; Avail: Other Sources

At the time the Super High Efficiency Diode Sources (SHEDS) program started in September 2003, nLight's highest performing 940-nm semiconductor lasers operated near 50 percent overall efficiency. In little more than a year, the improvements described here and others have enabled the company to demonstrate high-power semiconductor lasers with efficiencies of more than 70 percent. With the focus on efficiency provided by SHEDS, a clear experimental path that will enable 75 percent efficiency in the near future has been identified. The goal is 80 percent by September 2006. This is clearly achievable, and it will set the path for a revolutionary class of high-power semiconductor lasers. NLight is taking a direct approach to the design and fabrication of laser diodes that can meet the goals of the SHEDS program. It is targeting three key sources that limit the overall efficiency of today's commercially available laser diodes to 50 percent: voltage drop, the energy expended in getting charge carriers (holes and electrons) from the electrodes across the semiconductor and into the quantum well: lost electron-hole pairs, the energy lost when holes and electrons recombine without producing a laser photon: and lost laser photons, the energy lost when photons are absorbed or scattered before leaving the resonator. In this paper the voltage drop, lost photons, and lost electron-hole pairs is further discussed.
Derived from text
Semiconductor Lasers; Fabrication; Efficiency; High Power Lasers

20050051913 University of Central Florida, Orlando, FL, USA
Optimizing and Stabilizing Diode Laser Spectral Parameters
Glebov, Leonid B.; January 2005; 4 pp.; In English; Original contains color illustrations; Copyright; Avail: Other Sources

The stated goal of the Super High Efficiency Diode Sources (SHEDS) program is to develop super-efficient diode lasers, which, in turn, will lead to efficient, high-power solid-state lasers. The missing link between these two goals is the spectral match between the diode laser pump and the solid state laser, and it is on realizing that match that we are focusing our efforts.
Derived from text
Semiconductor Lasers; Optimization; Spectrum Analysis; Stability

20050051914 NP Photonic Technologies, LLC, Tucson, AZ, USA
Single-Frequency Fiber Lasers
Edsell, Patrick L.; January 2005; 3 pp.; In English; Original contains color illustrations; Copyright; Avail: Other Sources

Optoelectronics and fiber optics technology experienced significant advances in the 1990s, driven largely by well-funded innovation in the telecommunications, semiconductor and consumer electronics sectors. Although some of these sectors have since lost momentum, the trickle-down effect for other photonic applications markets has continued and, in some cases, accelerated. Fiber optic sensors, for example, have achieved enhanced performance by integrating improvements in fiber, laser and photodetector technology. At the same time, the relative cost of such devices has come down as a result of advances in optoelectronics manufacturing methods. In recent years, factors such as escalating demand for increased security, the need for higher-performance military systems and the difficulty in finding new oil reserves have resulted in a demand for better sensing systems. One response to this has been the development of optical fiber sensing technology. In comparison with conventional sensing technologies, fiber-based sensors are lightweight, compact and easily multiplexed; are resistant to hazardous environments, electromagnetic interference and chemical corrosion; require no electrical power at the sensing point; can distribute sensing over very long distances; and are producible at relatively low cost because of the use of readily available telecommunications components. The result is large, fast-growing opportunities in the security, military, oil and gas, utilities, and research and development markets.
Author
Fiber Lasers; Technology Utilization; Laser Applications

20050060695

Measuring High-Power Diode Laser Efficiency

Cromer, Christopher L.; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 118-120; In English; Original contains color illustrations; Copyright; Avail: Other Sources

The National Institute of Standards and Technology (NIST) has been tasked by the Defense Advanced Research Projects Agency with providing a wall-plug efficiency and spectral measurements of high-power, high-efficiency laser diodes and arrays as part of its Super High Efficiency Diode Sources (SHEDS) program. These optical sources present a significant measurement challenge. Edge emitters have a high divergence on the fast axis, which makes it difficult to capture the entire beam. Moreover, the high power levels and the relatively large size of the arrays can challenge the best commercially available optical radiometers.

Author

High Power Lasers; Semiconductor Lasers; Efficiency; Arrays; Diodes

20050060784 University of Central Florida, Orlando, FL, USA

Modeling High-Power Solid-State Lasers

Bass, Michael; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 110-112; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

Unlike other contributors to the Super High Efficiency Diode Sources (SHEDS) program, we are not addressing the efficiency of semiconductor lasers in our laboratory at the University of Central Florida. Instead, we are mathematically modeling diode-pumped high-power solid-state lasers. Our work has two immediate goals. First, we hope to provide guidance to diode laser manufacturers regarding which characteristics are advantageous for the pumping of high-power solid-state lasers. Second, we hope to provide insights into the optimal design of the lasers themselves.

Author

High Power Lasers; Semiconductor Lasers; Mathematical Models

20050060789 JDS Uniphase Corp., San Jose, CA, USA

Radically Asymmetric Wavelength-Stabilized Lasers Reduce Loss

Peters, Matthew; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 106-108; In English; Original contains color illustrations; Copyright; Avail: Other Sources

As part of our ongoing involvement in the development of potentially industry-changing advanced technology, we at JDS Uniphase Corp. have been working since January 2004 on the Defense Advanced Research Projects Agency's Super High Efficiency Diode Sources (SHEDS) program. We believe that the goal of combining single-emitter lasers into a 360-W bar with 80 percent electrical efficiency at 50 C in a tight wavelength band around 939 nm is possible using a radically asymmetric wavelength-stabilized design. Currently, lasers using this technology achieve efficiency as high as 67 percent at 25 C.

Author

Wavelengths; Semiconductor Lasers; Infrared Lasers; Energy Conversion Efficiency; Bandwidth

20050060906 California Inst. of Tech., Pasadena, CA, USA

Transverse Bragg Resonance Lasers: A New Approach to Mode Control in Semiconductor Lasers

Choi, John M.; Yariv, Amnon; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, No. 1, pp. 102 and 104; In English; Original contains color and black and white illustrations; Copyright; Avail: Other Sources

In the pursuit of a large-area, high power diode laser that maintains efficient single-mode operation, we have proposed a device that lases in a fundamentally different manner, the transverse Bragg resonance mode. To date, our work has focused on developing an accurate model of the device, and an experimental investigation is in progress.

Author

Semiconductor Lasers; Optical Resonance; Bragg Reflectors

20050061060 Alfalight, Inc., Madison, WI, USA

Improving the Power Conversion Efficiency of Diode Lasers

Kanskar, Manoj; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 112-118; In English; Copyright; Avail: Other Sources

The heart of a diode laser is the gain medium, known as the quantum well, which is buried inside a waveguide in the middle of a semiconductor junction. The quantum well has appropriately tailored energy levels such that an electric current

through the diode produces a population inversion at the desired wavelength. The optical waveguide keeps the photons traveling in the proper direction. and a pair of mirrors completes the resonator. Unforfunately, each of these elements introduces loss that reduces the laser's power efficiency. These losses can occur optically (photons are scattered or absorbed) or electrically (electron-hole pairs fail to generate useful photons). An analysis of these phenomena yields five basic categories of loss.
Derived from text
Energy Conversion Efficiency; Semiconductor Lasers; Optimization; Losses; Quantum Wells; Laser Outputs

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*.

20050041877 Cummins Engine Co., Inc., Columbus, IN, USA, Westport Innovations, Inc., Vancouver, British Columbia, Canada
Development of the High-Pressure Direct-Injected, Ultra Low-NOx Natural Gas Engine
Duggal, V. K.; Lyford-Pike, E. J.; Wright, J. F.; Dunn, M.; Goudie, D.; 2004; In English
Report No.(s): DE2004-15007602; NREL/SR-540-35911; No Copyright; Avail: National Technical Information Service (NTIS)

Subcontractor report details work done by Cummins and Westport Innovations to develop a heavy-duty, low-NOx, high-pressure direct-injection natural gas engine for the Next Generation Natural Gas Vehicle activity.
NTIS
Natural Gas; Internal Combustion Engines

20050050956 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Thermal Insulation Testing Method and Apparatus
Fesmire, James E., Inventor; Augustynowicz, Stanislaw D., Inventor; November 30, 2004; 10 pp.; In English
Patent Info.: Filed 11 Dec. 2002
Report No.(s): US-Patent-6,824,306; US-Patent-Appl-SN-318665; No Copyright; Avail: CASI; A02, Hardcopy

A test apparatus and method of its use for evaluating various performance aspects of a test specimen is disclosed. A chamber within a housing contains a cold mass tank with a contact surface in contact with a first surface of a test specimen. The first surface of the test specimen is spaced from the second surface of the test specimen by a thickness. The second surface of the test specimen is maintained at a a constant temperature by a liquid disposed within the cold mass tank. A boil-off flow rate of the gas is monitored and provided to a processor along with the temperature of the first and second surfaces of the test specimen. The processor calculates thermal insulation values of the test specimen including comparative values for heat flux and apparent thermal conductivity k-value). The test specimen may be placed in any vacuum pressure level ranging from about 0.01 millitorr to 1,000,000 millitorr with different residual gases as desired. The test specimen may be placed under a mechanical load with the cold mass tank and another factors may be imposed upon the test specimen so as to simulate the actual use conditions.
Official Gazette of the U.S. Patent and Trademark Office
Thermal Insulation; Mechanical Engineering; Cryogenics; Thermal Conductivity

20050051584 NASA Glenn Research Center, Cleveland, OH, USA
Self-Tuning Impact Damper for Rotating Blades
Pufy, Kirsten P., Inventor; Brown, Gerald V., Inventor; Bagley, Ronald L., Inventor; December 07, 2004; 18 pp.; In English
Patent Info.: Filed 1 Feb. 2000; US-Patent-6,827,551; US-Patent-Appl-SN-498794; NASA-Case-LEW-16833-1; No Copyright; Avail: CASI; A03, Hardcopy

A self-tuning impact damper is disclosed that absorbs and dissipates vibration energy in the blades of rotors in compressors and/or turbines thereby dramatically extending their service life and operational readiness. The self-tuning impact damper uses the rotor speed to tune the resonant frequency of a rattling mass to an engine order excitation frequency. The rating mass dissipates energy through collisions between the rattling mass and the walls of a cavity of the self-tuning impact damper, as well as though friction between the rattling mass and the base of the cavity. In one embodiment, the self-tuning

impact damper has a ball-in-trough configuration with tire ball serving as the rattling mass.
Official Gazette of the U.S. Patent and Trademark Office
Rotation; Rotor Blades (Turbomachinery); Tuning; Damping

20050051586 NASA Glenn Research Center, Cleveland, OH, USA
Design and Manufacturing Processes of Long-Life Hollow Cathode Assembles
Patterson, Michael J., Inventor; Verhey, Timothy R., Inventor; Soulas, George C., Inventor; December 14, 2004; 17 pp.; In English
Patent Info.: Filed 8 Aug. 2002; US-Patent-6,829,920; US-Patent-Appl-SN-216681; NASA-Case-LEW-16056-7; No Copyright; Avail: CASI; A03, Hardcopy

A process for testing an impregnated insert of a Hollow Cathode Assembly (HCA) subsequent to every exposure of the HCA to air, and prior to ignition, using a heater and an oil-free assembly having a base pressure of less than 5.0 x 10(exp -6) torr. The process comprises the steps of: installing the HCA in a vacuum; energizing the heater to a particular current level; de-energizing the heater after one-half hour; again energizing the heater to a particular current level; and de-energizing the heater for at least one-half hour.
Official Gazette of the U.S. Patent and Trademark Office
Hollow Cathodes; Manufacturing; Service Life

20050051621 NASA Marshall Space Flight Center, Huntsville, AL, USA
Method of Fabricating Protective Coating for a Crucible with the Coating Having Channels Formed Therein
Grugel, Richard N., Inventor; October 12, 2004; 6 pp.; In English
Patent Info.: Filed 13 Jun. 2002; US-Patent-6,802,999; US-Patent-Appl-SN-173536; NASA-Case-MFS-31698-1; No Copyright; Avail: CASI; A02, Hardcopy

A method is provided for the fabrication of a protective coating for a crucible with channels being formed in the coating. A material is adhered to the outer wall of the crucible to form a pattern thereon. The outer wall of the crucible along with the pattern of material adhered thereto is next coated with another material. The material used to form the pattern should extend through the outer material coating to define at least one port therein. Next, the crucible with its pattern of material and outer coating material is heated to a temperature of transformation at which the pattern of material is transformed to a fluidic state while the crucible and outer coating material maintain their solid integrity. Such transformation could also be accomplished by using a solvent that causes the pattern of material to dissolve. Finally, the material in its fluidic state is removed via the at least one port formed in the outer material coating thereby leaving channels defined in the coating adjacent the outer wall of the crucible.
Official Gazette of the U.S. Patent and Trademark Office
Refractory Coatings; Fabrication; Crucibles; Grooves

20050051636 NASA Glenn Research Center, Cleveland, OH, USA
Noncontacting Finger Seal
Proctor, Margaret P., Inventor; Steinetz, Bruce M., Inventor; November 02, 2004; 19 pp.; In English
Patent Info.: Filed 8 Feb. 2003; US-Patent-6,811,154; US-Patent-Appl-SN-361168; NASA-Case-Lew-17129-1; No Copyright; Avail: CASI; A03, Hardcopy

An annular finger seal is adapted to be interposed between a high pressure upstream region and a lower pressure downstream region to provide noncontact sealing along a rotatable member. The finger seal comprises axially juxtaposed downstream and upstream finger elements, each having integrally spaced fingers. The downstream fingers each have a lift pad, whereas the upstream fingers lack a pad. Each pad extends in a downstream direction. Each upstream finger is spaced from the rotating member a greater distance than each pad. Upon sufficient rotational speed of the rotating member, each pad is operative to lift and ride on a thin film of fluid intermediate the rotating member and the Pad.
Official Gazette of the U.S. Patent and Trademark Office
Seals (Stoppers); Cushions; Rotating Bodies

20050051637 NASA Marshall Space Flight Center, Huntsville, AL, USA
Electro-Mechanical Coaxial Valve
Patterson, Paul R, Inventor; October 12, 2004; 4 pp.; In English

Patent Info.: Filed 30 Aug. 2002; US-Patent-6,802,488; US-Patent-Appl-SN-232974; NASA-Case-MFS-31761-1; No Copyright; Avail: CASI; A01, Hardcopy

Coaxial valves usually contain only one moving part. It has not been easy, then, to provide for electric motor actuation. Many actuators being proposed involve designs which lead to bulky packages. The key facing those improving coaxial valves is the provision of suitable linear actuation. The valve herein indudes a valve housing with a flow channel there-through. Arranged in the flow channel is a closing body. In alignment with the closing body is a ball screw actuator which includes a ball nut and a cylindrical screw. The ball nut sounds a threaded portion of the cylindrical screw. The cylindrical screw is provided with a passageway there-through through which fluid flows. The cylindrical screw is disposed in the flow channel to become a control tube adapted to move toward and away from the valve seat. To rotate the ball nut an actuating drive is employed driven by a stepper motor.

Official Gazette of the U.S. Patent and Trademark Office

Valves; Actuators; Electromechanical Devices; Screws

20050051659 NASA Glenn Research Center, Cleveland, OH, USA

Development and Testing of Ceramic Thermal Barrier Coatings

Zhu, Dongming; Choi, Sung R.; Miller, Robert A.; [2004]; 17 pp.; In English; International Conference on Metallurgical Coatings and Thin Films 2004, 19-23 Apr. 2004, San Diego, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 714-20-09; Copyright; Avail: CASI; A03, Hardcopy

Ceramic thermal barrier coatings will play an increasingly important role in future gas turbine engines because of their ability to effectively protect the engine components and further raise engine temperatures. Durability of the coating systems remains a critical issue with the ever-increasing temperature requirements. Thermal conductivity increase and coating degradation due to sintering and phase changes are known to be detrimental to coating performance. There is a need to characterize the coating behavior and temperature limits, in order to potentially take full advantage of the current coating capability, and also accurately assess the benefit gained from advanced coating development. In this study, thermal conductivity behavior and cyclic durability of plasma-sprayed ZrO2-8wt%Y2O3 thermal barrier coatings were evaluated under laser heat-flux simulated high temperature, large thermal gradient and thermal cycling conditions. The coating degradation and failure processes were assessed by real-time monitoring of the coating thermal conductivity under the test conditions. The ceramic coating crack propagation driving forces and resulting failure modes will be discussed in light of high temperature mechanical fatigue and fracture testing results.

Author

Ceramic Coatings; Thermal Control Coatings; Thermal Conductivity; Zirconium Oxides; Yttrium Oxides

20050051660 NASA Glenn Research Center, Cleveland, OH, USA

Sintering and Fracture Behavior of Plasma-Sprayed Thermal Barrier Coatings

Zhu, Dongming; Choi, Sung R.; Miller, Robert A.; [2004]; 21 pp.; In English; 106th Annual Meeting and Exposition of the American Ceramic Society, 18-21 Apr. 2004, Indianapolis, IN, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Thermal barrier coatings will be more aggressively designed to protect gas turbine engine hot-section components in order to meet future engine higher fuel efficiency and lower emission goals. There is a need to characterize the fundamental sintering and fracture behavior of the current ZrO2-(7 to 8)wt%Y2O3 coating, in order to fully take advantage of the coating capability. In addition, a thorough evaluation of the coating behavior and temperature limits will be useful for more accurately assessing the benefit gained from future advanced coating systems. In this study, the sintering behavior of plasma-sprayed ZrO2-8wt%Y2O3 coatings was systematically investigated as a function of temperature and time using a dilatometer in the temperature range of 1200-1500 C. The coating sintering kinetics obtained by dilatometry were compared with the coating thermal conductivity increase kinetics, determined by a steady-state laser heat-flux testing approach, under high temperature and thermal gradient sintering conditions. The mode I, mode II, and mixed mode I-mode II fracture behavior of as-processed and sintering-annealed coatings was determined in asymmetric flexure loading at ambient and elevated temperatures in order to evaluate the coating sintering effects on the fracture envelope of K(sub I) versus K(sub II). The coating thermal conductivity cyclic response associated with the interface delamination of the coating systems under simulated engine heat-flux conditions will be discussed in conjunction with the sintering and fracture testing results.

Author

Sintering; Fracture Mechanics; Sprayed Coatings; Thermal Control Coatings

20050051754 NASA Langley Research Center, Hampton, VA, USA
Non-Destructive Evaluation of Wire Insulation and Coatings
Madaras, Eric I, Inventor; Anastasi, Robert F., Inventor; November 02, 2004; 26 pp.; In English
Patent Info.: Filed 1 Aug. 2002; US-Patent-6,810,743; US-Patent-Appl-SN-212563; US-Patent-Appl-SN-396498; US-Patent-Appl-SN-433622; US-Patent-Appl-SN-311967; NASA-Case-LAR-16262-1; No Copyright; Avail: CASI; A03, Hardcopy

The present invention uses the generation and detection of acoustic guided waves to evaluate the condition of the insulation on electrical wiring. Low order axisymmetric and flexural acoustic modes are generated in the insulated wire and travel partially in the center conductor and partially in the outer insulation. The stiffness of the insulation and the insulation's condition affect the overall wave speed and amplitude of the guided wave. Analysis of the received signal provides information about the age or useful life of the wire insulation. In accordance with the present invention, signal transmission occurs at one location on the electrical wire to be evaluated, and detection occurs at one or more locations along the electrical wire. Additional receivers can be used to improve measurement accuracy. Either the transmission transducer or one or more receiver transducers may be angled at other than 90 degrees to the wire. Generation of the guided waves can be accomplished by imparting a pressure pulse on the wire. Alternative embodiments include generation via a laser, such as a Q-switched laser or a laser diode.
Official Gazette of the U.S. Patent and Trademark Office
Nondestructive Tests; Wire; Insulation; Coating

20050051860 Ramgen Power Systems, Inc., Bellevue, WA, USA
Development and Testing of a Pre-Prototype Ramgen Engine Budget Period 3
Jul. 2003; In English
Report No.(s): DE2004-826018; No Copyright; Avail: National Technical Information Service (NTIS)

The research and development effort of a new kind of compressor and engine is presented. The superior performance of these two products arises from the superior performance of rotating supersonic shock-wave compression. Several tasks were performed in compliance with the DOE award objectives. A High Risk Technology review was conducted and evaluated by a team of 20 senior engineers and scientists representing various branches of the federal government. The conceptual design of a compression test rig, test rotors, and test cell adaptor was completed. The work conducted lays the foundation for the completed design and testing of the compression test rig, and the design of a supersonic shock-wave compressor matched to a conventional combustor and turbine.
NTIS
Engines; Performance Tests

20050060643 NASA Glenn Research Center, Cleveland, OH, USA
Advanced High-Temperature Seal Development at NASA
Steinetz, Bruce M.; [2002]; 33 pp.; In English; Total Design Solutions Midwest Conference, 8-10 Oct. 2002, Cleveland, OH, USA
Contract(s)/Grant(s): RTOP 706-85-33; 22-714-70-42; No Copyright; Avail: CASI; A03, Hardcopy

NASA Glenn Research Center is developing advanced seals to meet the demands of next generation aircraft and rocket propulsion systems. Dr. Steinetz will summarize NASA Glenn's efforts of developing seals that can operate from ambient through rocket exhaust temperatures (\g 2000 F) without cooling and summarize the extensive test capability used to qualify seal performances under these extreme conditions. NASA programs benefiting from this research, that will be reviewed, include advanced commercial and military aircraft, the Space Shuttle, the Space Station Emergency Crew Return X-Vehicle, and futuristic reusable launch vehicles. Though the seal technology is being developed for NASA and military programs, there are many commercial and industrial spin-off applications.
Author
Seals (Stoppers); High Temperature; Engine Parts

20050061054 National Central Univ., Jung-Li, Taiwan
Dynamic Interpretation of Transmission Systems Using Advanced Time-Frequency Representations
Pan, Min-Chun; Huang, Jeng-Yi; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1087-1092; In English; See also 20050061039
Contract(s)/Grant(s): NSC-90-2212-E-008-015; Copyright; Avail: Other Sources

This study aims at developing and implementing advanced time-frequency representation algorithms. i.e., the Choi-William distribution. and cone-shape distribution, based on the spectrograms and smoothed Wigner-Ville distributions, both to improve time- and frequency-resolutions, as compared with those produced using spectrogram only. and smooth interferences resulting from the use of the Wigner-Ville distribution. A transmission-component test rig was built up to investigate dynamic characteristics of the gearbox, belt set and electro-magnetic brake during different operating conditions. The experiments we ran highlighted the justification for applying these advanced schemes in dynamic-interpretation and condition-monitoring tasks relevant to mechanical systems, which conventional spectral analysis approaches can not afford to do.

Author

Algorithms; Dynamic Characteristics; Time Signals; Spectrograms; Transmissions (Machine Elements); Spectrum Analysis; Frequencies

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QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20050041955 NASA Glenn Research Center, Cleveland, OH, USA

Reliability-Based Life Assessment of Stirling Convertor Heater Head

Shah, Ashwin R.; Halford, Gary R.; Korovaichuk, Igor; December 2004; 18 pp.; In English; Space Technology and Applications International Forum (STAIF-2004), 9-12 Feb. 2004, Albuquerque, NM, USA

Contract(s)/Grant(s): WBS 972-20-01

Report No.(s): NASA/TM-2004-213077; E-14553; No Copyright; Avail: CASI; A03, Hardcopy

Onboard radioisotope power systems being developed and planned for NASA's deep-space missions require reliable design lifetimes of up to 14 yr. The structurally critical heater head of the high-efficiency Stirling power convertor has undergone extensive computational analysis of operating temperatures, stresses, and creep resistance of the thin-walled Inconel 718 bill of material. A preliminary assessment of the effect of uncertainties in the material behavior was also performed. Creep failure resistance of the thin-walled heater head could show variation due to small deviations in the manufactured thickness and in uncertainties in operating temperature and pressure. Durability prediction and reliability of the heater head are affected by these deviations from nominal design conditions. Therefore, it is important to include the effects of these uncertainties in predicting the probability of survival of the heater head under mission loads. Furthermore, it may be possible for the heater head to experience rare incidences of small temperature excursions of short duration. These rare incidences would affect the creep strain rate and, therefore, the life. This paper addresses the effects of such rare incidences on the reliability. In addition, the sensitivities of variables affecting the reliability are quantified, and guidelines developed to improve the reliability are outlined. Heater head reliability is being quantified with data from NASA Glenn Research Center's accelerated benchmark testing program.

Author

Spacecraft Power Supplies; Stirling Engines; Life (Durability); Engine Parts; Heating Equipment

20050042034 NASA Langley Research Center, Hampton, VA, USA

Time-Frequency Analysis of the Dispersion of Lamb Modes

Prosser, W. H.; Seale, Michael D.; Smith, Barry T.; Journal of the Acoustical Society of America; May 1999; Volume 105, No. 5, pp. 2669-2676; In English; Copyright; Avail: CASI; A03, Hardcopy

Accurate knowledge of the velocity dispersion of Lamb modes is important for ultrasonic nondestructive evaluation methods used in detecting and locating flaws in thin plates and in determining their elastic stiffness coefficients. Lamb mode dispersion is also important in the acoustic emission technique for accurately triangulating the location of emissions in thin plates. In this research, the ability to characterize Lamb mode dispersion through a time-frequency analysis (the pseudo Wigner-Ville distribution) was demonstrated. A major advantage of time-frequency methods is the ability to analyze acoustic signals containing multiple propagation modes, which overlap and superimpose in the time domain signal. By combining time-frequency analysis with a broadband acoustic excitation source, the dispersion of multiple Lamb modes over a wide frequency range can be determined from as little as a single measurement. In addition, the technique provides a direct measurement of the group velocity dispersion. The technique was first demonstrated in the analysis of a simulated waveform in an aluminum plate in which the Lamb mode dispersion was well known. Portions of the dispersion curves of the A(sub 0), A(sub 1), S(sub 0), and S(sub 2)Lamb modes were obtained from this one waveform. The technique was also applied for the

analysis of experimental waveforms from a unidirectional graphite/epoxy composite plate. Measurements were made both along, and perpendicular to the fiber direction. In this case, the signals contained only the lowest order symmetric and antisymmetric modes. A least squares fit of the results from several source to detector distances was used. Theoretical dispersion curves were calculated and are shown to be in good agreement with experimental results.
Author
Velocity Distribution; Velocity Measurement; Coefficients; Detection; Fiber Orientation; Graphite-Epoxy Composites; Nondestructive Tests; Plates (Structural Members); Stiffness

20050050911 Army Research Lab., Hampton, VA, USA
Damage Tolerance Issues as Related to Metallic Rotorcraft Dynamic Components
Everett, R. A., Jr.; Elber, W.; January 2005; 13 pp.; In English; NATO/RTO Spring Symposium on Aging Systems: Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft, 21-21 Apr. 1999, Corfu, Greece; No Copyright; Avail: CASI; A03, Hardcopy

In this paper issues related to the use of damage tolerance in life managing rotorcraft dynamic components are reviewed. In the past, rotorcraft fatigue design has combined constant amplitude tests of full-scale parts with flight loads and usage data in a conservative manner to provide 'safe life' component replacement times. In contrast to the safe life approach over the past twenty years the USA Air Force and several other NATO nations have used damage tolerance design philosophies for fixed wing aircraft to improve safety and reliability. The reliability of the safe life approach being used in rotorcraft started to be questioned shortly after presentations at an American Helicopter Society's specialist meeting in 1980 showed predicted fatigue lives for a hypothetical pitch-link problem to vary from a low of 9 hours to a high in excess of 2594 hours. This presented serious cost, weight, and reliability implications. Somewhat after the U.S. Army introduced its six nines reliability on fatigue life, attention shifted towards using a possible damage tolerance approach to the life management of rotorcraft dynamic components. The use of damage tolerance in life management of dynamic rotorcraft parts will be the subject of this paper. This review will start with past studies on using damage tolerance life management with existing helicopter parts that were safe life designed. Also covered will be a successful attempt at certifying a tail rotor pitch rod using damage tolerance, which was designed using the safe life approach. The FAA review of rotorcraft fatigue design and their recommendations along with some on-going U.S. industry research in damage tolerance on rotorcraft will be reviewed. Finally, possible problems and future needs for research will be highlighted.
Author
Helicopters; Fatigue Life; Damage; Aerospace Safety; Failure Analysis

20050050940 Defence Science and Technology Organisation, Fishermans Bend, Australia
Proposed Framework for a Risk-Based Approach for the Environmental Certification of Adhesively Bonded Repairs
Rider, Andrew; Vodicka, Roger; October 2004; 57 pp.; In English
Report No.(s): DSTO-RR-0282; AR-013-224; Copyright; Avail: Other Sources

Bonded composite repairs have been successfully applied to damaged aircraft structure since the early 70s. One of the major restrictions preventing widespread usage of the technology on primary aircraft structure is the lack of any defined statistical processes to guarantee the environmental durability of the bonded repair for periods that may approach the service life of the aircraft. This paper describes a proposed framework for a risk-based approach to certify the environmental durability of bonded repairs. The proposed approach is based on both laboratory-based performance data of a variety of surface treatments and the durability of repairs that have been in service for a period of time. The approach provides flexibility in repair application choices that are tailored to the criticality of the repair task. The expected outcome is to gain a quantitative understanding of environmental durability issues which will provide a sound basis for making engineering decisions.
Author
Adhesive Bonding; Aircraft Maintenance; Aircraft Structures; Durability

20050060615 Thermo Electron Corp., Madison, WI, USA
New Spectroscopy Methods Discover the Tiniest Particles
Petty, Chris; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 54-55; In English; Original contains color illustrations; Copyright; Avail: Other Sources

As recently as a few decades ago, most manufacturing industries worried only about those contaminants in their processes that were large enough to cause product failure or customer complaints. In contrast. troubleshooting labs today run on continual improvements in quality and process, and the obvious contaminants typically have been worked out of the system.

As customer expectations and required materials performance have increased, the contaminants analyzed are smaller than ever. Analyzing greater numbers of the smallest particles and structures presents new challenges to spectroscopy, which is one of the principal techniques used to identify the chemical identity of a contaminant. To get at these smaller problems, users tend to rely on a variety of spectroscopy tools, rather than on just one.
Author
Spectroscopy; Nondestructive Tests; Contaminants; Manufacturing; Quality Control

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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*.

20050050955 NASA Dryden Flight Research Center, Edwards, CA, USA
Structural Analysis of Helios Filament-Wound Tanks Subjected to Internal Pressure and Cooling
Ko, William L; January 31, 2005; 40 pp.; In English
Contract(s)/Grant(s): WU 710-10-04-SE-29-00-SPU
Report No.(s): NASA/TM-2005-212855; H-2563; No Copyright; Avail: CASI; A03, Hardcopy

A finite-element stress analysis is performed on Helios filament-wound hydrogen tanks to examine the stress field and effect of end dome geometry on the stress field. Each tank is composed of a central circular cylindrical section with either geodesic or hemispherical end domes, which have metallic polar bosses. The tanks are subjected to combined and separate internal pressure and temperature loading conditions, and the stress contributions of each loading component are examined. The tank-wall-polar-boss interfacial meridional tensile stress in the hemispherical dome is found to be approximately 27 percent lower than that in the geodesic dome. The effects of both material anisotropy and the aluminum lining on the intensities of tensile meridional stress at the tank-wall-polar-boss bonding interface are examined.
Author
Structural Analysis; Tanks (Containers); Cylindrical Bodies; Stress Distribution; Tensile Stress; Internal Pressure

20050051644 Helber Hastert and Fee Planners, Inc., Honolulu, HI USA
Construction of Guam High School and Commander William C. McCool Elementary/Middle School, Naval Hospital Complex and Apra Harbor Naval Complex, Guam: Environmental Assessment
Sep. 2004; 96 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428843; No Copyright; Avail: Defense Technical Information Center (DTIC)

This Environmental Assessment (EA) was prepared in compliance with the National Environmental Policy Act (NEPA), USA Code title 42, sections 4321 to 4370f, as implemented by Council of Environmental Quality regulations provided in Code of Federal Regulations (CFR) Title 40, Parts 1500 to 1508 (40 CFR 1500, et seq.), Office of the Chief of Naval Operations Instruction 5090.1B, Change-4, Environmental and Natural Resources Programs Manual of June 4, 2003, and the Department of Navy Procedures for Implementing NEPA (32 CFR 775). This EA analyzes the potential impacts of the Proposed Action and alternatives, and it is intended to provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a Finding of No Significant Impact.
DTIC
Construction; Guam; Harbors; Hospitals; Schools

20050051726 NASA Glenn Research Center, Cleveland, OH, USA
Foreign Object Damage Resistance of Uncoated SiC/SiC Composites
Bhatt, R. T.; Choi, S. R.; Cosgriff, L. M.; Fox, D. S.; Lee, K. N.; January 2005; 6 pp.; In English; HTCMC-5 Conference, 12-15 Sep. 2004, Seattle, WA, USA
Contract(s)/Grant(s): 22-714-30-09; No Copyright; Avail: CASI; A02, Hardcopy

2-D woven SiC/SiC composites fabricated by melt infiltration method were impact tested at room temperature and at 1316 C in air using 1.59 mm steel-ball projectiles at projectile velocities ranging from 110 m/s to 400 m/s. The extent of substrate damage with increasing projectile velocity was imaged and analyzed using optical microscopy and nondestructive evaluation (NDE) methods. The impacted specimens were flexure and tensile tested at room temperature to determine their residual mechanical properties. Results indicate that as the projectile velocity increases, internal damage in the target material also

increases and the mechanical properties degrade. At velocities \g 300 m/s, the projectile penetrates through the target material, but it still retains approx. 50% ultimate strength of the as-fabricated composites and exhibits non-brittle failure.
Author
Foreign Bodies; Impact Damage; Composite Materials; Woven Composites; Silicon Carbides; Impact Tests

20050051828 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Simultaneous Phosphorus and Si Self-Diffusion in Extrinsic, Isotopically Controlled Silicon Heterostructures
Silvestri, H. H.; Bracht, H. A.; Sharp, I. D.; Hansen, J.; Nylandsted-Larsen, A.; 2002; 10 pp.; In English
Report No.(s): DE2004-826112; No Copyright; Avail: Department of Energy Information Bridge

We present experimental results of impurity and self-diffusion in an isotopically controlled silicon heterostructure extrinsically doped with phosphorus. As a consequence of extrinsic doping, the concentration of singly negatively charged native defects is enhanced and the role of these native defect charge states in the simultaneous phosphorus and Si self-diffusion can be determined. Multilayers of isotopically controlled (sup 28)Si and natural silicon enable simultaneous analysis of (sup 30)Si self-diffusion into the (sup 28)Si enriched layers and phosphorus diffusion throughout the multilayer structure. An amorphous 260 nm thick Si cap layer was deposited on top of the Si isotope heterostructure. The phosphorus ions were implanted to a depth such that all the radiation damage resided inside this amorphous cap layer, preventing the generation of excess native defects and enabling the determination of the Si self-diffusion coefficient and the phosphorus diffusivity under equilibrium conditions. These samples were annealed at temperatures between 950 and 1100 C to study the diffusion. Detailed analysis of the diffusion process was performed on the basis of a P diffusion model which involves neutral and positively charged mobile P species and neutral and singly negatively charged self-interstitial.
NTIS
Silicon Isotopes; Diffusion; Phosphorus

20050060915 NASA Langley Research Center, Hampton, VA, USA
Input Files and Procedures for Analysis of SMA Hybrid Composite Beams in MSC.Nastran and ABAQUS
Turner, Travis L.; Patel, Hemant D.; January 2005; 87 pp.; In English
Contract(s)/Grant(s): WU 23-781-10-13
Report No.(s): NASA/TM-2005-213517; L-19073; No Copyright; Avail: CASI; A05, Hardcopy

A thermoelastic constitutive model for shape memory alloys (SMAs) and SMA hybrid composites (SMAHCs) was recently implemented in the commercial codes MSC.Nastran and ABAQUS. The model is implemented and supported within the core of the commercial codes, so no user subroutines or external calculations are necessary. The model and resulting structural analysis has been previously demonstrated and experimentally verified for thermoelastic, vibration and acoustic, and structural shape control applications. The commercial implementations are described in related documents cited in the references, where various results are also shown that validate the commercial implementations relative to a research code. This paper is a companion to those documents in that it provides additional detail on the actual input files and solution procedures and serves as a repository for ASCII text versions of the input files necessary for duplication of the available results.
Author
Shape Memory Alloys; Computerized Simulation; Hybrid Composites; Computer Programs

20050061050 National Taiwan Univ., Taipei, Taiwan, Province of China
Stress-Strain Characteristics of the Taipei Silty Clay at Small Strain
Kung, Tung-Chin; Ou, Chang-Yu; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1077-1080; In English; See also 20050061039
Contract(s)/Grant(s): NSC-89-2211-E-011-080; Copyright; Avail: Other Sources

This study first developed a triaxial apparatus with the capability of small-strain measurement. Then a series of undrained triaxial tests were carried out to investigate the stress-strain behavior of the reconstituted Taipei silty clay at small strain. Test results show that the non-linear behavior of the normally consolidated Taipei silty clay at small strain (Epsilon =10(exp -5)-(10(exp -3) is significant irrespective of the initial effective stress state and the shearing rate. The peak deviator stress occurs at strain of 10(exp -3)-4 x 10(exp -3). The normalized initial elastic stiffness at strain of 10(exp -5) can reach 1600-2450. which is much higher than that measured by conventional triaxial tests.
Author
Stress-Strain Relationships; Clays; Strain Measurement

20050061051 National Central Univ., Chung-Li, Taiwan, Province of China

Ground Movement and Tunnel Stability when Tunneling in Sandy Ground

Lee, Chung-Jung; Chiang, Kuo-Hui; Kuo, Chia-Ming; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1021-1032; In English; See also 20050061039

Contract(s)/Grant(s): NSC 89-2211-E-008-101; Copyright; Avail: Other Sources

Tunneling may cause ground movements and damage to adjacent buildings and overlying facilities. In this study. the failure mechanism and ground movement behavior around tunnels embedded in sandy soil below the water table were investigated in a series of model tunnel tests in a centrifuge. The magnitudes and extents of the surface settlement troughs for the cases of various ground loss for tunnels buried at various depths are provided. A new failure mechanism is proposed and validated by comparison with the test results. The proposed mechanism enables accurate prediction of two of the key quantities in the design of linings for tunnels embedded in sandy soils, namely the minimum supporting pressure needed to retain tunnel stability and the vertical soil pressure acting on the tunnel crown.

Author

Soils; Tunneling (Excavation); Failure; Damage

20050061053 National Central Univ., Taoyuan, Taiwan, Province of China

Modified Toughness Used to Evaluate the Effect of Polymer Modified Asphalt on SMA

Lin, Jyh-Dong; Chen, Shih-Huang; Lin, Pei; Wang, Jian-Neng; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1013-1020; In English; See also 20050061039; Copyright; Avail: Other Sources

Toughness, as defined in ASTM D5801 is the work used to stretch a specimen until fracture and is used to evaluate the ability of polymer modified asphalt (PMA) to resist deformation. Fracture elongations in PMA are usually longer than 10 cm. However, it is almost impossible for asphalt concrete, with or without PMA. to endure such large deformation before fracture. It is presumed that an effective elongation exists for more effective determination of toughness. Principle component analysis (PCA) and single regression analysis were used in this study to evaluate the correlation between physical tests of PMA. including toughness and performance tests of Stonic Mastic Asphalt (SMA). Meanwhile. performance tests. including resilient modulus tests, creep tests and indirect tensile tests, were conducted on SMA samples. According to the results form Principle Components Analysis (PCA), it was observed that only a common factor affects the performance tests. Regression analyses were used to find common factors from physical tests of PMA. Correlation coefficients between toughness and performance tests were found to be better than other physical tests. When toughness was calculated with effective elongation (6.5 cm). R(sup 2) was 0.90. In our opinion, the desirable PMA should provide SMA enough work to resist the deformation while the deformation is still small. This result was also confirmed by observation of SEM and Rheological analysis. Modified toughness (calculated with effective elongation) considered as the common factor, is a simple method to evaluate the microstructure of PMA. Overall. modified toughness seems promising for use in evaluation of the effect of PMA on SMA.

Author

Toughness; Asphalt; Fracturing; Elongation; Performance Tests; Regression Analysis; Creep Tests; Deformation

20050061055 Vanung Univ., Chungli, Taiwan, Province of China

Stress Curves and Mechanical Properties of High Performance Concrete

Chang, Ping-Kun; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1081-1085; In English; See also 20050061039

Contract(s)/Grant(s): NSC-89-2211-E-009-087; Copyright; Avail: Other Sources

In this research. high performance concrete (HPC) was designed by the minimum void ratio method, and slag and silica fumes partially replaced cement, as well as fly ash replacing about 15% of sand. Stress curves for compressive. splitting and flexure strengths of HPC specimens were measured and indicated the experimental concretes had better pastes to void ratios than control batches ratio N=V(sub p)/V(sub v)=1.3. The result indicates that pozzolanic materials provide not only a chemical strength effect, but also a physical packing effect. The compressive stress curves may keep growing as the concrete ages. Key Words: stress curves, mechanical properties. high performance concrete (HPC), pozzolanic materials.

Author

Stresses; Concretes; Void Ratio; Slags; Chemical Effects; Compression Loads

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20050041880
License for the Konrad Deep Geological Repository
Biurrun, E.; Hartje, B.; 2003; 10 pp.; In English
Report No.(s): DE2004-827591; No Copyright; Avail: Department of Energy Information Bridge

Deep geological disposal of long-lived radioactive waste is currently considered a major challenge. Until present, only three deep geological disposal facilities have worldwide been operated: the Asse experimental repository (1967-1978) and the Morsleben repository (1971-1998) in Germany as well as the Waste Isolation Pilot Plant (WIPP) in the USA (1999 to present). Recently, the licensing procedure for the fourth such facility, the German Konrad repository, ended with a positive 'Planfeststellung' (plan approval). With its plan approval decision, the licensing authority, the Ministry of the Environment of the state of Lower Saxony, approved the single license needed pursuant to German law to construct, operate, and later close down this facility.
NTIS
Geology; Radioactive Wastes

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*.

20050041808 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Determining the Optimum Post Spacing of LIDAR-Derived Elevation Data in Varying Terrain for Flood Hazard Mapping Purposes in North Carolina and Texas
Berglund, Judith; Davis, Bruce; Estep, Lee; March 26, 2004; 1 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): SSTI-2220-0003-ESAD; No Copyright; Avail: Other Sources; Abstract Only

The major flood events in the USA in the past few years have made it apparent that many floodplain maps being used by State governments are outdated and inaccurate. In response, many Stated have begun to update their Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Maps. Accurate topographic data is one of the most critical inputs for floodplain analysis and delineation. Light detection and ranging (LIDAR) altimetry is one of the primary remote sensing technologies that can be used to obtain high-resolution and high-accuracy digital elevation data suitable for hydrologic and hydraulic (H&H) modeling, in part because of its ability to 'penetrate' various cover types and to record geospatial data from the Earth's surface. However, the posting density or spacing at which LIDAR collects the data will affect the resulting accuracies of the derived bare Earth surface, depending on terrain type and land cover type. For example, flat areas are thought to require higher or denser postings than hilly areas to capture subtle changes in the topography that could have a significant effect on flooding extent. Likewise, if an area has dense understory and overstory, it may be difficult to receive LIDAR returns from the Earth's surface, which would affect the accuracy of that bare Earth surface and thus would affect flood model results. For these reasons, NASA and FEMA have partnered with the State of North Carolina and with the U.S./Mexico Foundation in Texas to assess the effect of LIDAR point density on the characterization of topographic variation and on H&H modeling results for improved floodplain mapping. Research for this project is being conducted in two areas of North Carolina and in the City of Brownsville, Texas, each with a different type of terrain and varying land cover/land use. Because of various project constraints, LIDAR data were acquired once at a high posting density and then decimated to coarser postings or densities. Quality assurance/quality control analyses were performed on each dataset. Cross sections extracted form the high density and then the decimated datasets were individually input into an H&H model to determine the model's sensitivity to topographic variation and the effect of that variation on the resulting water profiles. Additional analysis was performed on the Brownsville, Texas, LIDAR data to determine the percentage of returns that 'penetrated' various types of canopy or vegetative cover. It is hoped that the results of these studies will benefit state and local communities as they consider the post spacing at which to

acquire LIDAR data (which affects cost) and will benefit FEMA as the Agency assesses the use of different technologies for updating National Flood Insurance Program and related products.
Author
North Carolina; Texas; Elevation; Terrain; Flood Plains; Remote Sensing; Optical Radar

20050041901 NASA Ames Research Center, Moffett Field, CA, USA
Application of Geostatistical Simulation to Enhance Satellite Image Products
Hlavka, Christine A.; Dungan, Jennifer L.; Thirulanambi, Rajkumar; Roy, David; [2004]; 1 pp.; In English; Seventh International Geostatistics Congress, 26 Sep. - 1 Oct. 2004, Banff, Alberta, Canada; No Copyright; Avail: Other Sources; Abstract Only

With the deployment of Earth Observing System (EOS) satellites that provide daily, global imagery, there is increasing interest in defining the limitations of the data and derived products due to its coarse spatial resolution. Much of the detail, i.e. small fragments and notches in boundaries, is lost with coarse resolution imagery such as the EOS MODerate-Resolution Imaging Spectroradiometer (MODIS) data. Higher spatial resolution data such as the EOS Advanced Spaceborn Thermal Emission and Reflection Radiometer (ASTER), Landsat and airborne sensor imagery provide more detailed information but are less frequently available. There are, however, both theoretical and analytical evidence that burn scars and other fragmented types of land covers form self-similar or self-affine patterns, that is, patterns that look similar when viewed at widely differing spatial scales. Therefore small features of the patterns should be predictable, at least in a statistical sense, with knowledge about the large features. Recent developments in fractal modeling for characterizing the spatial distribution of undiscovered petroleum deposits are thus applicable to generating simulations of finer resolution satellite image products. We will present example EOS products, analysis to investigate self-similarity, and simulation results.
Author
Earth Observing System (EOS); Fractals; Imaging Spectrometers; Satellite Imagery; Mathematical Models

20050051039 Scripps Institution of Oceanography, La Jolla, CA USA
Origin and Structure of Nearshore Internal Tides and Waves: Data Analysis and Linear Theory
Hendershott, Myrl; Jan. 2001; 3 pp.; In English
Contract(s)/Grant(s): N00014-98-1-0430
Report No.(s): AD-A428558; No Copyright; Avail: CASI; A01, Hardcopy

Analysis of the data set obtained during the 1996-97 summer and autumn deployments of ADCP and T-logger internal wave antennas of Mission Beach, CA, was the principle activity during the reporting period. The PhD Thesis of Jim Lerczak, completed during the reporting period, set forth the results (subsequently published). The main results are as follows: (1) descriptions of internal (diurnal and semidiurnal) tides and higher frequency internal waves over the slope and shelf with longer time series and with much finer spatial and time resolution than previous descriptions; and (2) understanding where these fields are generated, where they are strongly damped, and how they are made intermittent by lower frequency currents. DTIC
Internal Waves; Ocean Currents; Oceans; Tides; Wave Propagation

20050060660 Taverna (Michael A.), Cannes, France
Back to the Future
Taverna, Michael A.; Aviation Week and Space Technology; January 31, 2005; ISSN 0005-2175; Volume 162, No. 5, pp. 53; In English; Copyright; Avail: Other Sources

U.S. and European scientists say that serendipitous satellite observations of the tsunami that struck Southeast Asia on Dec. 26, 2004, suggest a global alert system could be feasible. Delegates to a United Nations conference on natural disasters in Kobe, Japan, earlier this month agreed to create an embryonic global network by mid 2007 through expansion of an existing network in the Pacific Ocean. However, the warning available from this surface network would be limited (it is approximately 4 min. in Japan, which has the most advanced system), without the addition of satellites and other assets.
Author
Early Warning Systems; Tsunami Waves; Satellite Observation; International Cooperation

20050060768 Wisconsin Univ., Madison, WI, USA
Validation of the Atmospheric Infrared Sounder (AIRS) over the Antarctic Plateau: Low Radiance, Low Humidity, and Thin Clouds
Tobin, David C.; January 2005; 2 pp.; In English
Contract(s)/Grant(s): NAG5-11155; No Copyright; Avail: CASI; A01, Hardcopy

The main goal of the project has been to use specialized measurements collected at the Antarctic Plateau to provide validation of the Atmospheric InfraRed Sounder (AIRS) spectral radiances and some AIRS Level 2 products. As proposed, efforts conducted at the University of Wisconsin are focused on providing technical information, data, and software in support of the validation studies.
Author
Antarctic Regions; Infrared Instruments; Radiance

20050060957 National Environmental Satellite Service, Madison, WI, USA
Recent Monitoring of Suspended Sediment Patterns along Louisiana's Coastal Zone using ER-2 based MAS Data and Terra Based MODIS Data
Moeller, Christopher C.; Gunshor, M. M.; Menzel, W. P.; Huh, O. K.; Walker, N. D.; Rouse, L. J.; [2001]; 4 pp.; In English; 11th Conference on Satellite Meteorology and Oceanography, 15-18 Oct. 2001, Madison, WI, USA
Contract(s)/Grant(s): NAG5-9688; No Copyright; Avail: CASI; A01, Hardcopy

The University nf Wisconsin and Louisiana State University have teamed to study the forcing of winter season cold frontal wind systems on sediment distribution patterns and geomorphology in the Louisiana coastal zone. Wind systems associated with cold fronts have been shown to model coastal circulation and resuspend sediments along the micro tidal Louisiana coast (Roberts et at. 1987, Moeller et al. 1993). Remote sensing data is being used to map and track sediment distribution patterns for various wind conditions. Suspended sediment is a building material for coastal progradation and wetlands renewal, but also restricts access to marine nursery environments and impacts oyster bed health. Transferring a suspended sediment concentration (SSC) algorithm to EOS MODerate resolution Imaging Spectroradiometer (MODIS; Barnes et al. 1998) observations may enable estimates of SSC globally.
Author
Environmental Monitoring; Mississippi Delta (LA); Sediments; Estuaries; Coastal Water

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*.

20050041881 National Rural Electric Cooperative Association, Arlington, VA, USA, Energy Signature Associates, Inc., Pittsburgh, PA, USA
Evaluation of the Field Performance of Residential Fuel Cells
Torrero, E.; McClelland, R.; May 2004; 144 pp.; In English
Report No.(s): DE2004-15007778; No Copyright; Avail: Department of Energy Information Bridge

Distributed generation has attracted significant interest from rural electric cooperatives and their customers. Cooperatives have a particular nexus because of inherently low customer density, growth patterns at the end of long lines, and an influx of customers and high-tech industries seeking to diversify out of urban environments. Fuel cells are considered a particularly interesting DG candidate for these cooperatives because of their power quality, efficiency, and environmental benefits. The National Rural Electric Cooperative Association Cooperative Research Network residential fuel cell program demonstrated RFC power plants and assessed related technical and application issues. This final subcontract report is an assessment of the program's results. This 3-year program leveraged Department of Energy (DOE) and National Renewable Energy Laboratory (NREL) funding.
NTIS
Fuel Cells; Renewable Energy; Power Efficiency

20050051136 QinetiQ Ltd., Gosport, UK
The Role of Fuel Cells in the Supply of Silent Power for Operations in Littoral Waters
Lakeman, J. B.; Browning, D. J.; Apr. 2004; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428713; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Fuel Cells; Hydrogen; Low Noise; Regions; Underwater Vehicles

20050051557 Department of the Navy, Washington, DC USA

Separated Flow Liquid Catholyte Aluminum Hydrogen Peroxide Seawater Semi Fuel Cell

Dow, Eric G., Inventor; Jan. 2002; 25 pp.; In English

Report No.(s): AD-D020170; No Copyright; Avail: CASI; A03, Hardcopy

This patent application discloses an improved semi-fuel cell and an improved cathode used therein. The semi-fuel cell stack comprises a housing, an anode within the housing, a porous cathode within the housing, an aqueous catholyte within the housing, an aqueous anolyte stream flowing in the housing, and a membrane for preventing migration of the catholyte through the porous cathode and into the anolyte stream. In a preferred embodiment of the present invention, the catholyte comprises an aqueous hydrogen peroxide solution, the anolyte comprises a NaOH/seawater solution, and the membrane permits passage of OH ions while inhibiting the passage of hydrogen peroxide. The membrane is attached to a surface of the cathode or, alternatively, impregnated into the cathode. (3 figures)

DTIC

Aluminum; Anodes; Aqueous Solutions; Cathodes; Catholytes; Electrolytes; Fuel Cells; Hydrogen Peroxide; Liquid Hydrogen; Patent Applications; Sea Water; Separated Flow

20050051904 Ohio Univ., Athens, OH, USA, Montana State Univ., Bozeman, MT, USA, Oak Ridge National Lab., TN, USA

Enhanced Practical Photosynthetic CO(sub 2) Mitigation. Quarterly Technical Report

Kremer, G.; Bayless, D. J.; Vis, M.; Prudich, M.; Cooksey, K.; Jan. 30, 2004; In English

Report No.(s): DE2004-825587; No Copyright; Avail: National Technical Information Service (NTIS)

This quarterly report documents significant achievements in the Enhanced Practical Photosynthetic Carbon Dioxide (CO(sub 2)) Mitigation project during the period from 10/2/2003 through 1/01/2004. As indicated in the list of accomplishments below we are preparing for the final tests necessary to meet our project goals. As indicated in the list of accomplishments below we have seen very encouraging results from the model scale tests in terms of organism growth rates and we have begun the final tests necessary to meet our project goals. The solar collector is working well and has survived the winter weather.

NTIS

Photosynthesis; Carbon Dioxide; Bioreactors

20050051976 Boston Univ., Boston, MA, USA

Transfer of Energy in the Variational Multiscale Formulation of LES

Oberai, A. A.; Gravemeier, V.; Burton, G. C.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 123-132; In English; See also 20050051959; No Copyright; Avail: CASI; A02, Hardcopy

The transfer of energy from resolved scales to the subgrid scales in homogeneous isotropic turbulence is studied, within the context of the variational formulation of large eddy simulation. In particular, the relative contributions to this transfer from the coarse and the fine resolved scales are evaluated and their dependence on the choice of an ideal LES solution is examined. It is found that when the L(sub 2) projection of the DNS solution onto a truncated Fourier space is selected as the ideal LES solution, the energy transfer from the fine resolved scales is the dominant contribution. On the other hand, when the ideal LES solution is defined to be the nodal interpolant of the DNS solution on a coarse finite element mesh, contributions from both the coarse and refined scales are important. These observations are made performing a-priori analysis using a DNS database and are also explained using an analytical theory of turbulence closure. These results indicate that within the variational formulation of LES, the definition of a 'good model' is closely tied to the choice of the ideal LES solution, which in turn is dependent on the function space utilized in solving the problem.

Author

Energy Transfer; Large Eddy Simulation; Homogeneous Turbulence; Computational Grids; Direct Numerical Simulation; Isotropic Turbulence

20050060647 NASA Glenn Research Center, Cleveland, OH, USA

Extended Operation of Stirling Convertors

Roth, Mary Ellen; Schreiber, Jeffrey G.; Pepper, Stephen V.; [2004]; 15 pp.; In English; Second International Energy Conversion Engineering Conference (IECEC-2004), 16-19 Aug. 2004, Providence,RI, USA

Contract(s)/Grant(s): 22-972-20-01; No Copyright; Avail: CASI; A03, Hardcopy

A high-efficiency 110 watt Stirling Radioisotope Generator 110 (SRG110) is being developed for potential NASA exploration missions. The SRG system efficiency is greater than 20%, making it an attractive candidate power system for deep space missions and unmanned rovers. The Department of Energy SRG110 Project team consists of the System Integrator, Lockheed Martin (LM), Stirling Technology Company (STC), and NASA Glenn Research Center (GRC). One of the GRC roles is to provide Independent Verification and Validation of the Stirling TDC's. At the request of LM, a part of this effort includes the extended operation of the TDC's in the dynamically balanced dual-opposed configuration. Performance data of the Stirling Converters over time is required to demonstrate that an SRG110 can meet long-duration mission requirements. A test plan and test system were developed to evaluate TDC's #13 and #14 steady-state performance for a minimum of 5000 hours and insure safe, round-the-clock operation of the TDC's. This paper will discuss the design and development, and status of the Extended Operation Test.
Author
Stirling Cycle; Radioactive Isotopes; Spacecraft Power Supplies

20050060649 NASA Glenn Research Center, Cleveland, OH, USA
Reliability Issues in Stirling Radioisotope Power Systems
Schreiber, Jeffrey; Shah, Ashwin; January 2005; 22 pp.; In English; 2nd International Energy Conversion Engineering Conference (IECEC-2004), 16-19 Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): WBS 972-20-01; No Copyright; Avail: CASI; A03, Hardcopy

Stirling power conversion is a potential candidate for use in a Radioisotope Power System (RPS) for space science missions because it offers a multifold increase in the conversion efficiency of heat to electric power and reduced requirement of radioactive material. Reliability of an RPS that utilizes Stirling power conversion technology is important in order to ascertain long term successful performance. Owing to long life time requirement (14 years), it is difficult to perform long-term tests that encompass all the uncertainties involved in the design variables of components and subsystems comprising the RPS. The requirement for uninterrupted performance reliability and related issues are discussed, and some of the critical areas of concern are identified. An overview of the current on-going efforts to understand component life, design variables at the component and system levels, and related sources and nature of uncertainties are also discussed. Current status of the 110 watt Stirling Radioisotope Generator (SRG110) reliability efforts is described. Additionally, an approach showing the use of past experience on other successfully used power systems to develop a reliability plan for the SRG110 design is outlined.
Author
Reliability Analysis; Stirling Cycle; Radioactive Isotopes; Energy Conversion Efficiency

45
ENVIRONMENT POLLUTION

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

20050041902 Princeton Univ., NJ, USA
Conceptual Design of Optimized Fossil Energy Systems with Capture and Sequestration of Carbon Dioxide
2004; In English
Report No.(s): DE2004-825241; No Copyright; Avail: National Technical Information Service (NTIS)

In this semi-annual progress report, we describe research results from an ongoing study of fossil hydrogen energy systems with CO(sub 2) sequestration. This work was performed under NETL Award No. DE-FC26-02NT41623, during the six-month period September 2002 through March 2003. The primary objective of the study is to better understand system design issues and economics for a large-scale fossil energy system co-producing H(sub 2) and electricity with CO(sub 2) sequestration. This is accomplished by developing analytic and simulation methods for studying the entire system in an integrated way. We examine the relationships among the different parts of a hydrogen energy system, and attempt to identify which variables are the most important in determining both the disposal cost of CO(sub 2) and the delivered cost of H(sub 2). A second objective is to examine possible transition strategies from today's energy system toward one based on fossil-derived H(sub 2) and electricity with CO(sub 2) sequestration. We are carrying out a geographically specific case study of development of a fossil H(sub 2) system with CO(sub 2) sequestration, for the Midwestern USA, where there is presently substantial coal conversion capacity in place, coal resources are plentiful and potential sequestration sites in deep saline aquifers are widespread.
NTIS
Carbon Dioxide; Fossil Fuels; Air Pollution; Pollution Control

20050041959 North Dakota Univ., Grand Forks, ND, USA

JV Task 26-Mercury and Lead Sampling at Minnesota Power's Boswell Energy Center

Aug. 2000; 30 pp.; In English

Report No.(s): DE2004-824930; No Copyright; Avail: Department of Energy Information Bridge

At the request of the Minnesota Power, Inc., the Energy& Environmental Research Center (EERC) sampled for lead at the stack (or duct directly leading to the stack) for three units at the Boswell Energy Center. All sampling was done in triplicate using U.S. Environmental Protection Agency (EPA) Method 12, with sampling procedures following EPA Methods 1 through 4. During the test program, lead sampling was done using EPA Method 12 in the duct at the outlet of the baghouse serving Unit 2 and the duct at the outlet of the wet particulate scrubber serving Unit 3. For Unit 4, lead sampling was done at the stack. The specific objective for the project was to determine the concentration of lead in the flue gas being emitted into the atmosphere from the Boswell Energy Center. The test program was performed during the period of May 8 through 11, 2000. This report presents the test data, sample calculations, and results, and a discussion of the lead sampling performed at the Boswell Energy Center. The detailed test data and test results, raw test data, process data, laboratory reports, and equipment calibration records are provided in Appendices A, B, and C.

NTIS

Calibrating; Data Processing Equipment; Environment Protection; Particulates

20050041988 NASA Langley Research Center, Hampton, VA, USA

The CERES S'COOL Project: Operational but not Routine

Chambers, Lin H.; Young, David F.; Green, Carolyn J.; Haeffelin, Martial P.; Racel, Anne M.; Proceedings of the Eighth Education Symposium of the 79th Annual Meeting of the American Meteorological Society; [1999], pp. 176-179; In English; Eighth Education Symposium of the 79th Annual Meeting of the American Meteorological Society, 10-15 Jan. 1999, Dallas, TX, USA; Copyright; Avail: CASI; A01, Hardcopy

The first Clouds and the Earth's Radiant Energy System (CERES) instrument has been returning useful data on Earth's radiation budget from the Tropical Rainfall Measuring Mission (TRMM) spacecraft since late 1997. Validation of the initial data is now intensively underway. As one component of this validation, the CERES Students Cloud Observations On-Line (S'COOL) project has been operational since April 1998 - the 2nd CERES validation month. S'COOL involves school children in over 140 schools in 15 countries on 5 continents in making and reporting observations and measurements which they and CERES scientists can then compare to the satellite retrievals. The project is planned to continue through the life of the CERES Project (nominally 15 years), and new participants are invited to join on a continuous basis. This paper will report on the first year of the operational phase of the project, during which a number of exciting events occurred (a demonstration of the project to First Lady Hillary Rodham Clinton, and visits by CERES personnel to participating schools, among others). It will further report on some of the noteworthy observations and comparisons which have been made possible by this project. We have found that schools are often located in interesting places, in terms of the clouds found there and the satellite's ability to observe these clouds. The paper will also report on the learning opportunities delivered by this project, and on new questions about the planet and its climate which arise in the students minds as a result of their active participation.

Author

Radiant Flux Density; Clouds (Meteorology); Earth Radiation Budget; Schools; TRMM Satellite; Atmospheric Circulation; Tropical Meteorology; Education

20050041993 North Dakota Univ., Grand Forks, ND, USA

Value-Added Sorbent Development

Jul. 2000; In English

Report No.(s): DE2004-824975; No Copyright; Avail: National Technical Information Service (NTIS)

On a worldwide basis, the projected increase in coal usage over the next two decades in China, India, and Indonesia will dwarf the current U.S. coal consumption of 1 billion tons/year. Therefore, in the USA, coal will be the dominant source of mercury emissions, and worldwide, coal may be the cause of significantly increased mercury emissions unless an effective control strategy is implemented. However, there is much uncertainty over the most technically sound and cost-effective approach for reducing mercury emissions from coal-fired boilers. Several approaches are suggested for mercury control from coal-fired boilers, including enhancing the ability of wet scrubbers to retain mercury. However, many coal-fired boilers are not equipped with wet scrubbers. On the other hand, since almost all coal-fired boilers are equipped with either an electrostatic precipitator (ESP) or a baghouse, sorbent injection upstream of either an ESP or baghouse appears attractive, because it has the potential to control both Hg(sup 0) and Hg(sup 2+), would appear to be easy to retrofit, and would be applicable to both

industrial and utility boilers. Since mercury in the gas stream from coal combustion is present in only trace quantities, only very small amounts of sorbent may be necessary.
NTIS
Coal; Boilers; Combustion

20050041994 Fluor Daniel Hanford, Inc., Richland, WA, USA
Chemical Hazards Assessment Prior to D&D of the Plutonium Finishing Plant, Hanford Nuclear Reservation
Hopkins, A. M.; Prevette, S. S.; Sherwood, A. R.; Fitch, L. R.; Ranade, D. G.; Feb. 2003; 20 pp.; In English
Report No.(s): DE2004-825942; No Copyright; Avail: Department of Energy Information Bridge

This report describes the evaluation methods and results of a chemical safety status assessment of the process equipment at the U.S. Department of Energy Hanford Nuclear Reservation Plutonium Finishing Plant. This assessment, designated as the Plutonium Finishing Plant Residual Chemical Hazards Assessment, focused particular emphasis on the idle and inactive plant systems, though certain active areas also were examined to the extent that these were examined during a previous facility vulnerability assessment completed in 1999. The Plutonium Finishing Plant is located in the 200 West Area of the Hanford Nuclear Reservation that is situated in south central Washington State.
NTIS
Plutonium; Safety; Waste Management

20050041997 Reaction Engineering International, Salt Lake City, UT
Oxidation of Mercury Across SCR Catalysts in Coal-Fired Power Plants Burning Low Rank Fuels
Senior, C.; Apr. 30, 2004; In English
Report No.(s): DE2004-825259; No Copyright; Avail: National Technical Information Service (NTIS)

This is the fifth Quarterly Technical Report for DOE Cooperative Agreement No: DE-FC26-03NT41728. The objective of this program is to measure the oxidation of mercury in flue gas across SCR catalyst in a coal-fired power plant burning low rank fuels using a slipstream reactor containing multiple commercial catalysts in parallel. The Electric Power Research Institute (EPRI) and Argillon GmbH are providing co-funding for this program. This program contains multiple tasks and good progress is being made on all fronts. During this quarter, the available data from laboratory, pilot and full-scale SCR units was reviewed, leading to hypotheses about the mechanism for mercury oxidation by SCR catalysts.
NTIS
Oxidation; Mercury (Metal); Flue Gases

20050041998 California State Univ., San Marcos, CA, USA
Calcium Carbonate Production by Coccolithophorid Algae in Long Term, Carbon Dioxide Sequestration
Fabry, V. J.; Apr. 26, 2004; In English
Report No.(s): DE2004-825263; No Copyright; Avail: National Technical Information Service (NTIS)

Predictions of increasing levels of anthropogenic carbon dioxide (CO(sub 2)) and the specter of global warming have intensified research efforts to identify ways to sequester carbon. A number of novel avenues of research are being considered, including bioprocessing methods to promote and accelerate biosequestration of CO(sub 2) from the environment through the growth of organisms such as coccolithophorids, which are capable of sequestering CO(sub 2) relatively permanently. Calcium and magnesium carbonates are currently the only proven, long-term storage reservoirs for carbon. Whereas organic carbon is readily oxidized and releases CO(sub 2) through microbial decomposition on land and in the sea, carbonates can sequester carbon over geologic time scales. This proposal investigates the use of coccolithophorids single-celled, marine algae that are the major global producers of calcium carbonate to sequester CO(sub 2) emissions from power plants. Cultivation of coccolithophorids for calcium carbonate (CaCO(sub 3)) precipitation is environmentally benign and results in a stable product with potential commercial value. Because this method of carbon sequestration does not impact natural ecosystem dynamics, it avoids controversial issues of public acceptability and legality associated with other options such as direct injection of CO(sub 2) into the sea and ocean fertilization. Consequently, cultivation of coccolithophorids could be carried out immediately and the amount of carbon sequestered as CaCO(sub 3) could be readily quantified. The significant advantages of this approach warrant its serious investigation. The major goals of the proposed research are to identify the growth conditions that will result in the maximum amount of CO(sub 2) sequestration through coccolithophorid calcite production and to evaluate the costs/benefits of using coccolithophorid cultivation ponds to abate CO(sub 2) emissions from power plants.
NTIS
Carbon Dioxide; Algae; Calcium Carbonates

20050042042 Eastern Research Group, Inc., Morrisville, NC

User's Guide for the 2005 Gulfwide Offshore Activities Data System (GOADS-2005), Final Report

Wilson, D.; Blackard, A.; Finn, S.; Boyer, B.; Oct. 2004; 88 pp.; In English

Report No.(s): PB2005-101460; No Copyright; Avail: CASI; A05, Hardcopy

The Minerals Management Service (MMS) mandated that offshore operators in the Gulf of Mexico participate in an annual survey program for the years 2000 and 2005. For 2000, MMS collected information regarding offshore operations. The purpose of the survey was to assist the MMS in constructing an emission inventory for the entire Gulf of Mexico. For the 2000 inventory effort, MMS funded the development of the Gulfwide Offshore Activities Data System (GOADS-2000) software in order to assist offshore operators in complying with the MMS mandate. The GOADS software assists users in recording information regarding emissions-related offshore activities and generates computer data files that can be delivered to the MMS. For the 2005 inventory effort, significant improvements have been made to the original software; the new version is GOADS-2005. The GOADS-2005 software will be used to record information regarding emissions-related offshore activities for calendar year 2005.

NTIS

Surveys; Computer Storage Devices; Minerals

20050042043 National Defence Research Establishment, Umea, Sweden

Representative Sampling of Aerosol

Johansson, C.; Jun. 2004; 32 pp.; In Swedish

Report No.(s): PB2005-100724; FOI-R-1288-SE; No Copyright; Avail: CASI; A03, Hardcopy

In order to obtain representative samples of aerosol, without deviations in particle size, distribution, properly designed and positioned measurement probes are required. The particle settling velocity has to be known for proper selection of probes and prove positioning. Using the settling velocity, it can be determined whether or not the criteria for stationary aerosol are applicable as well as the ideal probe design for each individual situation. In order to obtain representative samples of non-stationary aerosol properly designed and positioned isokinetic probes are required. The isokinetic probes assure that the same flow velocity is obtained in the probe as in the surrounding environment. Isokinetic probes must be positioned head on against the flow direction. In sampling of stationary aerosol the probes have to be designed so as to avoid deviations in the sampled particle size distribution due to particle inertia and settling velocity. Probes designed for stationary conditions are preferably positioned horizontally but other inclinations are possible if the probes' design permits it. Probe design is dependent on the sample flow of the instrument it is connected to, the density and size of the aerosol particles, the density and viscosity of the gas phase of the aerosol and, in certain cases, the cross-section area of the duct the aerosol is moving through.

NTIS

Aerosols; Ducts; Gas Viscosity; Particle Size Distribution

20050042061 Environmental Protection Agency, Washington, DC, USA

Acid Rain Program, 2001 Progress Report

Nov. 2002; In English

Report No.(s): PB2005-102082; No Copyright; Avail: National Technical Information Service (NTIS)

The Acid Rain Program was established under Title IV of the 1990 Clean Air Act Amendments. The program requires major reductions of sulfur dioxide (SO2) and nitrogen oxides (NOx) emissions, the pollutants that cause acid rain. Using an innovative market-based or cap and trade approach to environmental protection, the program sets a permanent cap on the total amount of SO2 that may be emitted by electric power plants nationwide. The cap is set at about one half of the amount of SO2 emitted in 1980, and the trading component allows flexibility for individual fossil fuel-fired combustion units to select their own methods of compliance. The program also sets NOx emission limitations (in pounds per million British thermal units or lb/mmBtu) for certain coal-fired electric utility boilers, representing about a 27% reduction from 1990 levels.

NTIS

Acid Rain; Sulfur Dioxides; Environment Protection; Fossil Fuels; Air Quality

20050042062 Environmental Protection Agency, Washington, DC, USA

Acid Rain Program

Nov. 2003; In English

Report No.(s): PB2005-102083; No Copyright; Avail: National Technical Information Service (NTIS)

This 2002 Progress Report updates the key Acid Rain Program data reported in the 2001 Progress Report. This update

includes: emission levels; compliance with the sulfur dioxides and nitrogen oxides components of the program; sulfur dioxides allowance market information; and status and trends in acid deposition and related air quality.
NTIS
Acid Rain; Air Quality; Nitrogen Oxides; Sulfur Dioxides

20050042063 Environmental Protection Agency, Washington, DC, USA
Exposure Assessment Approaches for Chemicals Used As Soil Fumigants: Consideration of the Fumigant Exposure Modeling System (FEMS) - A Case Study with Metam-Sodium
Aug. 2004; In English
Report No.(s): PB2005-102107; No Copyright; Avail: National Technical Information Service (NTIS)
On August 24-25, August 26-27, and September 9-10, 2004, the FIFRA Scientific Advisory Panel (SAP) will hold three separate meetings to consider and review three fumigant bystander exposure models. At the August 24-25 meeting the SAP will review the Probabilistic Exposure and Risk model for FUMigants (PERFUM) using iodomethane as a case study. On August 26-27, the SAP will review the Fumigant Exposure Modeling System (FEMS) using metam sodium as a case study. On September 9-10, the SAP will review the SOil Fumigant Exposure Assessment system (SOFEA(copyright)) using telone as a case study. In preparing for these meeting, preparation of this document, and development of questions for the Panel, the Agency has worked closely with scientists from the California Department of Pesticide Regulation who have significant experience with inhalation exposure modeling. The purpose of this document is to provide general background information for the FIFRA Science Advisory Panel (SAP) meeting pertaining to the evaluation of the Fumigant Exposure Modeling System (or FEMS). FEMS represents a potential evolution of the Agency's current methodology for calculating exposures to bystanders who can be exposed by being in close proximity to fields treated with soil fumigants prior to planning crops such as strawberries or tomatoes.
NTIS
Soils; Fumigation; Models; Environment Pollution

20050042067 ARCADIS Geraghty and Miller, Inc., Durham, NC, USA, Environmental Protection Agency, Research Triangle Park, NC
Engineering and Economic Factors Affecting the Installation of Control Technologies for Multipollutant Strategies
Oct. 2002; 90 pp.; In English
Report No.(s): PB2005-102110; EPA-600/R-02/073; No Copyright; Avail: CASI; A05, Hardcopy
This report evaluates the engineering and economic factors of installing air pollution control technologies to meet the requirements of multipollutant control strategies. The implementation timing and reduction stringency of such strategies affect the quantity of resources required to complete the control technology installations and the ability of markets to adjust and to provide more resources where needed. Using the Integrated Planning Model (IPM), the U.S. Environmental Protection Agency (EPA) estimated the number and size of facilities that need to install new emissions control equipment to meet the implementation dates and emission reductions set forth in the Clear Skies Act. This study provides an estimate of the resources required for the installation of control technologies to obtain emission reductions of sulfur dioxide (SO2), nitrogen oxides (NOx), and mercury under the Clear Skies Act.
NTIS
Air Pollution; Economic Factors; Pollution Control; Control Equipment

20050042068 Environmental Protection Agency, Research Triangle Park, NC
Technical Support Document for the Clear Skies Act 2003 Air Quality Modeling Analyses
Oct. 2003; In English
Report No.(s): PB2005-102093; No Copyright; Avail: National Technical Information Service (NTIS)
This document describes the procedures and results of the air quality modeling analyses used to quantify the impacts and benefits of the Clear Skies Act (CSA) of 2003. The air quality modeling was conducted to support several components of the legislation including: an assessment of the costs and benefits associated with the Act, and an assessment of the expected impact of the Act on ozone and particulate matter levels. The air quality model applications include episodic regional scale ozone modeling for the Eastern U.S. and annual particulate matter (PM), visibility, and deposition modeling on a continental scale covering the 48 contiguous States. 1996 Base Year simulations were made to examine the ability of the modeling systems to replicate observed concentrations of these pollutants. This was followed by simulations using a 2001 proxy emissions

inventory. The 2001 inventory was created for the purpose of aligning the current year ozone and particulate matter design values (1999-2001) to the emissions inventory year.
NTIS
Air Quality; Environment Models; Contaminants; Ozone

20050042069 Environmental Protection Agency, Washington, DC, USA
Acid Rain Program: Annual Progress Report, 2000
Aug. 2001; In English
Report No.(s): PB2005-102094; EPA-430-R-01-008; No Copyright; Avail: National Technical Information Service (NTIS)

The Acid Rain Program was established under Title IV of the 1990 Clean Air Act Amendments (the Act). The program calls for major reductions of sulfur dioxide (SO2) and nitrogen oxides (NOX), the pollutants that cause acid rain. Using a new, market-based approach to environmental protection, the program sets a permanent cap on the total amount of SO2 that may be emitted by electric utilities nationwide at about one half of the amount emitted in 1980, and allows flexibility for individual utility combustion units to select their own methods of compliance. The program also sets NOX emission limitations (in lb/mmBtu) for certain electric utility boilers, representing about a 27 percent reduction from 1990 levels. The Acid Rain Program is being implemented in two phases: Phase 1 ran from 1995 through 1999 for SO2 and from 1996 through 1999 for NOX; Phase 2 for both pollutants began in 2000 and involves over 2,000 units. In 2000, there were 2,262 units affected by the SO2 provisions of the Acid Rain Program, meaning they operated, submitted emissions data for SO2, and were subject to annual reconciliation of allowable emissions with actual emissions.
NTIS
Acid Rain; Contaminants; Environment Protection; Nitrogen Oxides; Sulfur Dioxides

20050042070 Environmental Protection Agency, Washington, DC, USA
Exposure Assessment Approaches for Chemicals Used As Soil Fumigants: Consideration of the Probabilistic Exposure and Risk Model for Fumigants (PERFUM) - A Case Study With Iodomethane
Aug. 2004; In English
Report No.(s): PB2005-102097; No Copyright; Avail: National Technical Information Service (NTIS)

On August 24-25, August 26-27, and September 9-10, 2004, the FIFRA Scientific Advisory Panel (SAP) will hold three separate meetings to consider and review three fumigant bystander exposure models. At the August 24-25 meeting the SAP will review the Probabilistic Exposure and Risk model for FUMigants (PERFUM) using iodomethane as a case study. On August 26-27, the SAP will review the Fumigant Exposure Modeling System (FEMS) using metam sodium as a case study. On September 9-10, the SAP will review the SOil Fumigant Exposure Assessment system (SOFEA(copyright)) using telone as a case study. In preparing for these meeting, preparation of this document, and development of questions for the Panel, the Agency has worked closely with scientists from the California Department of Pesticide Regulation who have significant experience with inhalation exposure modeling. The purpose of this document is to provide general background information for the FIFRA Science Advisory Panel (SAP) meeting pertaining to the evaluation of the Probabilistic Exposure And Risk Model For Fumigants (or PERFUM). PERFUM represents a potential evolution of the Agency's current methodology for calculating exposures to bystanders who can be exposed by being in close proximity to fields treated with soil fumigants prior to planting crops such as strawberries or tomatoes.
NTIS
Exposure; Soils; Fumigation; Risk; Methane

20050042075 Environmental Protection Agency, Washington, DC, USA
USA and Canada: Air Quality Agreement, Progress Report, 2004
2004; In English
Report No.(s): PB2005-102092; No Copyright; Avail: National Technical Information Service (NTIS)

The 2004 Progress Report, prepared by the bilateral Air Quality Committee, is the seventh biennial report compiled under the 1991 USA-Canada Air Quality Agreement. While building upon previous progress reports, this report reviews key actions taken by the USA and Canada in the last two years to address transboundary air pollution under the Agreement. It also covers each country's progress in achieving the requirements of Annex 1-the Acid Rain Annex. In addition, this report specifically focuses on actions taken by each country to meet new requirements under Annex 3-the Ozone Annex.
NTIS
Air Pollution; Air Quality; Acid Rain

20050051569 NASA Langley Research Center, Hampton, VA, USA

Aerosol Chemical Composition in Asian Continental Outflow during the TRACE-P Campaign: Comparison with PEM-West B

Dibb, Jack E.; Talbot, Robert W.; Scheuer, Eric M.; Seid, Garry; Avery, Melody A.; Singh, Hanwant B.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D21, pp. 36-1 - 36-13; In English

Contract(s)/Grant(s): NCC1-410; Copyright; Avail: Other Sources

Aerosol associated soluble ions and the radionuclide tracers (7)Be and (210)Pb were quantified in 414 filter samples collected in spring 2001 from the DC-8 during the Transport and Chemical Evolution over the Pacific (TRACE-P) campaign. Binning the data into near Asia (flights from Hong Kong and Japan) and remote Pacific (all other flights) revealed large enhancements of NO3(-), SO4(-), C2O4(-), NH4(+), K(+), Mg2(+), and Ca2(+) near Asia. The boundary layer and lower troposphere were most strongly influenced by continental outflow, and the largest enhancements were seen in Ca2(+) (a dust tracer) and NO3(-) (reflecting uptake of HNO3 onto the dust). Comparing the TRACE P near Asia bin with earlier results from the same region during PEM-West B (in 1994) shows at least twofold enhancements during TRACE P in most of the ions listed above. Calcium and NO3(-) were most enhanced in this comparison as well (more than sevenfold higher in the boundary layer and threefold higher in the lower troposphere). Independent estimation of Asian emissions of gaseous precursors of the aerosol-associated ions suggest only small changes between the two missions, and precipitation fields do not suggest any significant difference in the efficiency of the primary sink, precipitation scavenging. It thus appears that with the possible exception of dust, the enhancements of aerosol-associated species during TRACE P cannot be explained by stronger sources or weaker sinks. We argue that the enhancements largely reflect the fact that TRACE P focused on characterizing Asian outflow, and thus the DC-8 was more frequently flown into regions that were influenced by well-organized flow off the continent.

Author

Radioactive Isotopes; Beryllium 7; Lead Isotopes; Aerosols; Chemical Composition; Atmospheric Chemistry

20050051570 NASA Langley Research Center, Hampton, VA, USA

Chemical and Physical Properties of Bulk Aerosols within Four Sectors Observed during TRACE-P

Jordan, C. E.; Anderson, B. E.; Talbot, R. W.; Dibb, J. E.; Fuelberg, E.; Hudgins, C. H.; Kiley, C. M.; Russo, R.; Scheuer, E.; Seid, G., et al.; Journal of Geophysical Research; November 15, 2003; ISSN 0148-0227; Volume 108, No. D21, pp. 34-1 - 34-5; In English

Contract(s)/Grant(s): NCC1-410; Copyright; Avail: Other Sources

Chemical and physical aerosol data collected on the DC-8 during TRACE-P were grouped into four sectors based on back trajectories. The four sectors represent long-range transport from the west (WSW), regional circulation over the western Pacific and Southeast Asia (SE Asia), polluted transport from Northern Asia with substantial sea salt at low altitudes (NNW) and a substantial amount of dust (Channel). WSW has generally low mixing ratios at both middle and high altitudes, with the bulk of the aerosol mass due to non-sea-salt water-soluble inorganic species. Low altitude SE Asia also has low mean mixing ratios in general, with the majority of the aerosol mass comprised of non-sea-salts, however, soot is also relatively important m this region. ‘w had the highest mean sea salt mixing ratios, with the aerosol mass at low altitudes (a km) evenly divided between sea salts, mm-sea-salts, and dust. The highest mean mixing ratios of water-soluble ions and soot were observed at the lowest altitudes (a km) in the Channel sector. The bulk of the aerosol mass exported from Asia emanates h m Channel at both low and midaltitudes, due to the prevalence of dust compared to other sectors. Number densities show enhanced fine particles for Channel and NNW, while their volume distributions are enhanced due to sea salt and dust Low-altitude Channel exhibits the highest condensation nuclei ((34) number densities along with enhanced scattering coefficients, compared to the other sectors. At midaltitudes (2-7 km), low mean CN number densities coupled with a high proportion of nonvolatile particles (265%) observed in polluted sectors (Channel and NNW) are attributed to wet scavenging which removes hygroscopic CN particles. Low single scatter albedo m SE Asia reflects enhanced soot

Author

Aerosols; Atmospheric Composition; Asia; Pollution Monitoring

20050051571 NASA Langley Research Center, Hampton, VA, USA

Uptake of Nitrate and Sulfate on Dust Aerosols during TRACE-P

Jordan, C. E.; Dibb, J. E.; Anderson, B. E.; Fuelberg, H. E.; Journal of Geophysical Research; September 24, 2003; ISSN 0148-0227; Volume 108, No. D21, pp. 38-1 - 38-10; In English

Contract(s)/Grant(s): NCC1-410; Copyright; Avail: Other Sources

Aerosol data collected near Asia on the DC-8 aircraft platform during TRACE-P has been examined for evidence of

uptake of NO3(-) and SO4(-) on dust surfaces. Data is compared between a sector where dust was predominant and a sector where dust was less of an influence. Coincident with dust were higher mixing ratios of anthropogenic pollutants. HNO3, SO2, and CO were higher in the dust sector than the nondust sector by factors of 2.7, 6.2, and 1.5, respectively. The colocation of dust and pollution sources allowed for the uptake of NO3(-) and nss-SO4(-) on the coarse dust aerosols, increasing the mixing ratios of these particulates by factors of 5.7 and 2.6 on average. There was sufficient nss-SO4(-) to take up all of the NH4(+) present, with enough excess nss-SO4(-) to also react with dust CaCO3. This suggests that the enhanced NO3(-) was not in fine mode NH4NO3. Particulate NO3(-) (p-NO3(-)) constituted 54% of the total NO3(-), (t-NO3(-)) on average, reaching a maximum of 72% in the dust sector. In the nondust sector, p-NO3(-) contributed 37% to t-NO3(-), likely due to the abundance of sea salts there. In two other sectors where the influence of dust and sea salt were minimal, p-NO3(-), accounted for \h 15% of t-NO3(-).
Author
Nitrates; Sulfates; Aerosols; Dust; Atmospheric Composition

20050051572 New Hampshire Univ., Durham, NH, USA
Measurements of HNO3, SO2 High Resolution Aerosol SO4 (sup 2-), and Selected Aerosol Species Aboard the NASA DC-8 Aircraft: During the Transport and Chemical Evolution Over the Pacific Airborne Mission (TRACE-P)
Talbot, Robert W.; Dibb, Jack E.; [2004]; 86 pp.; In English
Contract(s)/Grant(s): NCC1-410; No Copyright; Avail: CASI; A05, Hardcopy

The UNH investigation during TRACE-P provided measurements of selected acidic gases and aerosol species aboard the NASA DC-8 research aircraft. Our investigation focused on measuring HNO3, SO2, and fine (less than 2 microns) aerosol SO4(sup 2-) with two minute time resolution in near-real-time. We also quantified mixing ratios of aerosol ionic species, and aerosol (210)Pb and (7)Be collected onto bulk filters at better than 10 minute resolution. This suite of measurements contributed extensively to achieving the principal objectives of TRACE-P. In the context of the full data set collected by experimental teams on the DC-8, our observations provide a solid basis for assessing decadal changes in the chemical composition and source strength of Asian continental outflow. This region of the Pacific should be impacted profoundly by Asian emissions at this time with significant degradation of air quality over the next few decades. Atmospheric measurements in the western Pacific region will provide a valuable time series to help quantify the impact of Asian anthropogenic activities. Our data also provide important insight into the chemical and physical processes transforming Asian outflow during transport over the Pacific, particularly uptake and reactions of soluble gases on aerosol particles. In addition, the TRACE-P data set provide strong constraints for assessing and improving the chemical fields simulated by chemical transport models.
Author
Acidity; Aerosols; Air Quality; Asia; Sulfur Dioxides; Research Aircraft; Pacific Ocean; Nitric Acid; Air Pollution; Atmospheric Chemistry; Beryllium; Atmospheric Composition; Ions

20050051573 NASA Langley Research Center, Hampton, VA, USA
Reactive Nitrogen in Asian Continental Outflow over the Western Pacific: Results from the NASA Transport and Chemical Evolution over the Pacific (TRACE-P)Airborne Mission
Talbot, R.; Dibb, J.; Scheuer, E.; Seid, G.; Russo, R.; Sandholm, S.; Tan, D.; Blake, D.; Blake, N.; Singh, H., et al.; Journal of Geophysical Research; October 31, 2003; ISSN 0148-0227; Volume 108, No. D20, pp. 24-1 - 24-17; In English
Contract(s)/Grant(s): NCC1-410; Copyright; Avail: Other Sources

We present here results for reactive nitrogen species measured aboard the NASA DC-8 aircraft during the Transport and Chemical Evolution over the Pacific TRACE-P) mission. The large-scale distributions total reactive nitrogen (NO(sub y,sum) = NO + NO2 + HNO3 + PAN + C(sub 1)-C(sub 5) alkyl nitrates) and O3 and CO were better defined in the boundary layer with significant degradation of the relationships as altitude increased. Typically, NO(sub y,sum) was enhanced over background levels of approx.260 pptv by 20-to-30-fold. The ratio C2H2/CO had values of 1-4 at altitudes up to 10 km and as far eastward as 150degE, implying significant vertical mixing of air parcels followed by rapid advection across the Pacific. Analysis air parcels originating from five principal Asian source regions showed that HNO3 and PAN dominated NO(sub y,sum). Correlations of NO(sub y,sum) with C2Cl4 (urban tracer) were not well defined in any of the source regions, and they were only slightly better with CH3Cl (biomass tracer). Air parcels over the western Pacific contained a complex mixture of emission sources that are not easily resolvable as shown by analysis of the Shanghai mega-city plume. It contained an intricate mixture of pollution emissions and exhibited the highest mixing ratios of NO(sub y,sum) species observed during TRACE-P. Comparison of tropospheric chemistry between the earlier PEM-West B mission and the recent TRACE-P data showed that in the boundary layer significant increases in the mixing ratios of NO(sub y,sum)species have occurred, but the middle and

upper troposphere seems to have been affected minimally by increasing emissions on the Asian continent over the last 7 years. Author

Chemical Evolution; Nitrogen; Atmospheric Chemistry; Mixing Ratios; Troposphere; Atmospheric Composition

20050051578 NASA Langley Research Center, Hampton, VA, USA

Chemical Composition of Asian Continental Outflow over the Western Pacific: Results from Transport and Chemical Evolution over the Pacific (TRACE-P)

Russo, R. S.; Talbot, R. W.; Dibb, J. E.; Scheuer, E.; Seid, G.; Jordan, C. E.; Fuelberg, H. E.; Sachse, G. W.; Avery, M. A.; Vay, S. A., et al.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D20, pp. 25-1 - 25-19; In English

Contract(s)/Grant(s): NCC1-410; Copyright; Avail: Other Sources

We characterize the chemical composition of Asian continental outflow observed during the NASA Transport and Chemical Evolution over the Pacific (TRACE-P) mission during February-April 2001 in the western Pacific using data collected on the NASA DC-8 aircraft. A significant anthropogenic impact was present in the free troposphere and as far east as 150degE longitude reflecting rapid uplift and transport of continental emissions. Five-day backward trajectories were utilized to identify five principal Asian source regions of outflow: central, coastal, north-northwest(NNW), southeast (SE), and west-southwest (WSW). The maximum mixing ratios for several species, such as CO, C2Cl4, CH3Cl, and hydrocarbons, were more than a factor of 2 larger in the boundary layer of the central and coastal regions due to industrial activity in East Asia. CO was well correlated with C2H2, C2H6, C2Cl4, and CH3Cl at low altitudes in these two regions (r(sup 2) approx. 0.77-0.97). The NNW, WSW, and SE regions were impacted by anthropogenic sources above the boundary layer presumably due to the longer transport distances of air masses to the western Pacific. Frontal and convective lifting of continental emissions was most likely responsible for the high altitude outflow in these three regions. Photochemical processing was influential in each source region resulting in enhanced mixing ratios of O3, PAN, HNO3, H2O2, and CH3OOH. The air masses encountered in all five regions were composed of a complex mixture of photcrchemically aged air with more recent emissions mixed into the outflow as indicated by enhanced hydrocarbon ratios (C2H2/CO greater than or equal to 3 and C3H8/C2H6 greater than or equal to 0.2). Combustion, industrial activities, and the burning of biofuels and biomass all contributed to the chemical composition of air masses from each source region as demonstrated by the H6, SO2, and C2Cl4 were compared for the TRACE-P and PEM-West B missions. In the more northern regions, O3, CO, and SO2 were higher at low altitudes during TRACE-P. In general, mixing ratios were fairly similar between the two missions in the southern regions. A comparison between CO/CO2, CO/CH4, C2H6/C3H8, NO(x)/SO2, and NO(y)/(SO2 + nss-SO4) ratios for the five source regions and for the 2000 Asian emissions summary showed vay close agreement indicating that Asian emissions were well represented by the TRACE-P data and tbe emissions inventory.

Author

Atmospheric Composition; Chemical Composition; Chemical Evolution; Environment Effects; Man Environment Interactions; Photochemical Reactions

20050051847 Swedish Environmental Protection Agency, Stockholm, Sweden

Carbon Dioxide Emission Factor for Combustion of Swedish Peat

Nilsson, K.; 2004; 28 pp.; In English

Report No.(s): PB2005-102036; IVL-B-1595; No Copyright; Avail: CASI; A03, Hardcopy

The Swedish carbon dioxide emission factor for combustion of energy peat is reviewed. Three year old peat analysis from two Swedish peat producers indicated a notably lower emission factor than 107.3 g CO2/MJ which is the value used in Sweden's National Emission Inventory Report 2003 submitted under the United Nations Convention on Climate Change. New calculations based on both the old analysis and complementing data were performed in order to calculate an emission factor representative to the entire Swedish production of energy peat.

NTIS

Carbon Dioxide; Emission; Combustion; Peat

20050051853 Swedish Environmental Protection Agency, Stockholm, Sweden

Allowance Allocation and CO2 Intensities in the EU Energy Sectors

Ahman, M.; 2004; In English

Report No.(s): PB2005-102037; IVL-B-1592; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of the study is to investigate whether the national allocation plans of the EU member states are fair and

reasonable, for the energy sectors. The carbon dioxide (CO2) intensities and allocations are investigated for each member state. The study concludes that there is very little correlation between CO2 intensity in the energy sector and the generosity of the allocation to the sector in the respective member states.
NTIS
Allocations; Carbon Dioxide

20050051863 Office of Air Quality Planning and Standards, Research Triangle Park, NC
Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper, Second Draft, January 2005
Jan. 2005; 534 pp.; In English
Report No.(s): PB2005-102178; EPA/452/D-05/001; No Copyright; Avail: CASI; A23, Hardcopy

This draft Staff Paper, prepared by staff in the U.S. Environmental Protection Agency's (EPA) Office of Air Quality Planning and Standards (OAQPS), evaluates the policy implications of the key studies and scientific information contained in the document, Air Quality Criteria for Particulate Matter, henceforth referred to as the Criteria Document (CD) and cited as CD, prepared by EPA's National Center for Environmental Assessment (NCEA). This document, which builds upon an earlier first draft Staff Paper, also presents and interprets results from updated and expanded staff analyses (e.g., air quality analyses, human health risk assessments, and visibility analyses) that staff believes should be considered in EPA's current review of the national ambient air quality standards (NAAQS) for particulate matter (PM). This draft Staff Paper presents provisional staff conclusions and recommendations as to potential revisions of the primary (health-based) and secondary (welfare-based) PM NAAQS, based on consideration of the available scientific information and analyses and related limitations and uncertainties. The final version of this document will be informed by comments received through an independent scientific review and public comments on this draft document.
NTIS
Air Quality; Environment Protection; Particulates

20050051868 Delaware Univ., Newark, DE, USA
Electrochemical Processes for In-situ Treatment of Contaminated Soils
2004; In English
Report No.(s): DE2004-826070; No Copyright; Avail: National Technical Information Service (NTIS)

Soils at typical DOE (Department of Energy) waste sites are known to be contaminated by a host of hazardous organic chemicals, heavy metals and radionuclides. Typical hazardous organic contaminants include chlorinated solvents such as trichloroethylene (TCE), tetrachloroethylene (PCE), chloroform, and carbon tetrachloride, and polycyclic aromatic hydrocarbons (PAHs) such as naphthalene, fluorene, phenanthrene, anthracene and pyrene. It is also known that major toxic heavy metals such as Pb, Cr, As, Zn, Cu, Hg, and Cd and major radionuclides such as Tritium, U, Sr90, Pu, Cs137, and Tc are also commonly present at some DOE waste sites. Some of these chemicals are relatively mobile and can migrate down to the vadose zone and/or the aquifer region. Among these hazardous chemicals, the treatment of organic contaminants is the focus of this project. Heavy metals, as well as radionuclides, can be readily separated by various commercioally available methods once they are desorbed from the soil surface and collected in the solution phase, In this project, electro-kinetic (EK) and electro-Fenton (EF) processes will be studied and integrated for in-situ treatment of soils containing mixed contaminants. It is to achieve the following objectives: (a) To study important parameters controlling the mobilization and transport of selected organics and metals in soils by electrokinetic (EK) process. (b) To study the important factors governing the oxidation of selected organic contaminants by the electro-Fenton (EF) process. (c) To understand the mechanisms of the oxidation of selected organic contaminants by electro-Fenton oxidation process.
NTIS
Soil Pollution; Contamination; Environmental Cleanup

20050051893 ADA Environmental Solutions, LLC, Littleton, CO, USA
Field Test Program for Evaluation of Sorbent Injection for Mercury Control
Sjostrom, S.; Feb. 12, 2004; 24 pp.; In English
Report No.(s): DE2004-825258; No Copyright; Avail: Department of Energy Information Bridge

The power industry in the U.S. is faced with meeting new regulations to reduce the emissions of mercury compounds from coal-fired plants. These regulations are directed at the existing fleet of nearly 1,100 boilers. These plants are relatively old with an average age of over 40 years. Although most of these units are capable of operating for many additional years, there is a

desire to minimize large capital expenditures because of the reduced (and unknown) remaining life of the plant to amortize the project. Injecting a sorbent such as powdered activated carbon into the flue gas represents one of the simplest and most mature approaches to controlling mercury emissions from coal-fired boilers. The overall objective of this test program described in this quarterly report is to evaluate the capabilities of activated carbon injection at four plants with configurations that together represent 78% of the existing coal-fired generation plants. This technology was successfully evaluated in NETL's Phase I tests at scales up to 150 MW, on plants burning subbituminous and bituminous coals and with ESPs and fabric filters. The tests also identified issues that still need to be addressed, such as evaluating performance on other configurations, optimizing sorbent usage (costs), and gathering longer term operating data to address concerns about the impact of activated carbon on plant equipment and operations. The four sites identified for testing are Sunflower Electric's Holcomb Station, AmerenUE's Meramec Station, AEP's Conesville Station, and Ontario Power Generation's Nanticoke Station. This is the first quarterly report for this project. This report includes an overview of the plans for the project.
NTIS
Mercury Compounds; Sorbents; Injection

20050051901 Kentucky Univ., Lexington, KY, USA
Carbon Sequestration on Surface Mine Lands. Annual Report
Graves, D. H.; Barton, C.; Sweigard, R.; Warner, R.; 2003; 16 pp.; In English
Report No.(s): DE2004-825274; No Copyright; Avail: Department of Energy Information Bridge

The 2002-2003 Department of Energy plantings amounted to 164 acres containing 111,520 tree seedlings in eastern and western Kentucky. Data gathered on these trees included an inventory to determine survival of all planted species. A sub-sample of seedlings was selected to assess the height and diameter of individual species of seedlings established. Additional efforts involved collection of soil sample and litter samples, analysis of herbaceous ground cover from vegetation clip plots and leaf area on each tree species, and development of tissue collections. All areas were sampled for penetration resistance, penetration depth (or depth to refusal), and bulk density at various depths. Rain fall events and flow rates were recorded. The water quality of runoff samples involved the determination of total and settleable solids and particle size distribution. A study was initiated that will focus on the colonization of small mammals from forest edges to various areas located on reclaimed surface mines. This effort will provide a better understanding of the role small mammals and birds have in the establishment of plant communities on mine lands that will be useful in developing and improving reclamation techniques.
NTIS
Carbon; Seedlings (Botany); Soil Sampling; Vegetation

20050051902 EERGC Corp., Irvine, CA, USA
Preliminary Field Evaluation of Mercury Control Using Combustion Modifications. Annual Report January 23, 2003 - January 22, 2004
Lissianski, V.; Marquez, A.; Feb. 19, 2004; In English
Report No.(s): DE2004-825582; No Copyright; Avail: National Technical Information Service (NTIS)

In this project General Electric Energy and Environmental Research Corporation conducts a preliminary field evaluation of a novel technology, referred to as Hg/NO(sub x), that can reduce emissions of both mercury (Hg) and oxides of nitrogen (NO(sub x)) from coal-fired power plants. The evaluation takes place in Green Station Unit 2 operated by Western Kentucky Energy. Reduction of Hg and NO(sub x) emissions in Unit 2 is achieved using coal reburning. Activities during first project year (January 23, 2003--January 22, 2004) included measurements of baseline Hg emissions in Unit 2 and pilot-scale testing. Baseline testing of Hg emissions in Green Unit 2 has been completed.
NTIS
Mercury Oxides; Coal; Combustion

20050051905 EnviRes, LLC, Lexington, KY, USA
Reducing Ultra-Clean Transportation Fuel Costs with HyMelt (TRADE MARK) Hydrogen
Malone, D. P.; Renner, W. R.; Jan. 2003; In English
Report No.(s): DE2004-825599; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes activities for the fifth quarter of work performed under this agreement. A third round of atmospheric testing was conducted as scheduled on December 9 through December 12, 2003. The test results demonstrated a much-improved rate of carbon dissolution with gas yields close to thermodynamic equilibrium at nearly doubled feed rates

of September testing and a commercially viable feed and oxygen injection technique. Additional super-atmospheric testing to perform the last task in the MEFOS experimental program is scheduled for the week of August 2004.
NTIS
Transportation; Clean Fuels; Thermodynamic Equilibrium

20050051907 EnviRes, LLC, Lexington, KY, USA
Reducing Ultra-Clean Transportation Fuel Costs with HyMelt (TRADE MARK) Hydrogen
Malone, D. P.; Renner, W. R.; Apr. 2004; In English
Report No.(s): DE2004-825602; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes activities for the sixth quarter of work performed under this agreement. MEFOS conducted a third round of atmospheric testing as scheduled on December 9 through December 12, 2003. We reported experimental activities of this testing last quarter. We report process calculations and results this quarter. The test results demonstrated a much-improved rate of carbon dissolution with gas yields close to thermodynamic equilibrium at nearly doubled feed rates of September testing and a commercially viable feed and oxygen injection technique. Additional super-atmospheric testing to perform the last task in the MEFOS experimental program is scheduled for the last quarter of 2004.
NTIS
Transportation; Clean Fuels; Thermodynamic Equilibrium; Injection

20050051916 ALSTOM Power, Inc.,, Windsor, CT, USA
Greenhouse Gas Emissions Control by Oxygen Firing in Circulating Fluidized Bed Boilers, Volume 1, Phase 1, A Preliminary Systems Evaluation: Evaluation of Advanced Coal Combustion and Gasification Power Plants with Greenhouse Gas
May 15, 2003; In English
Report No.(s): DE2004-825796; No Copyright; Avail: National Technical Information Service (NTIS)

Given that fossil fuel fired power plants are among the largest and most concentrated producers of CO(sub 2) emissions, recovery and sequestration of CO(sub 2) from the flue gas of such plants has been identified as one of the primary means for reducing anthropogenic CO(sub 2) emissions. In this study, ALSTOM Power Inc. (ALSTOM) has investigated several coal fired power plant configurations designed to capture CO(sub 2) from effluent gas streams for use or sequestration. Additionally, ALSTOM has identified several advanced/novel plant configurations, which improve the efficiency and cost of the CO(sub 2) product cleanup and compression process. An economic analysis indicates that the proposed oxygen-firing technology in circulating fluidized boilers could be developed and deployed economically in the near future in enhanced oil recovery (EOR) applications or enhanced gas recovery (EGR), such as coal bed methane recovery. ALSTOM received a Cooperative Agreement from the US Department of Energy National Energy Technology Laboratory (DOE) in 2001 to carry out a project entitled 'Greenhouse Gas Emissions Control by Oxygen Firing in Circulating Fluidized Bed Boilers.' This two-phased project is in effect from September 28, 2001, to October 27, 2004. Phase I consisted of an evaluation of the technical feasibility and economics of alternate CO(sub 2) capture technologies applied to Greenfield US coal-fired electric generation power plants, and supporting bench-scale testing. And Phase II consists of pilot-scale testing, supporting a refined performance and economic evaluation of the oxygen-fired AFC concept. Phase I, detailed in this report, entails a comprehensive study evaluating the technical feasibility and economics of alternate CO(sub 2) capture technologies applied to Greenfield US coal-fired electric generation power plants. Thirteen separate but related cases (listed below), representing various levels of technology development, were evaluated as described herein. The first seven cases represent coal combustion cases in CFB type equipment. The next four cases represent Integrated Gasification Combined Cycle (IGCC) systems. The last two cases represent advanced Chemical Looping systems, which were completely paid for by ALSTOM and included herein for completeness.
NTIS
Power Plants; Greenhouse Effect; Exhaust Emission

20050051934 Argonne National Lab., IL
Resource Handbook on DOE Transportation Risk Assessment
Chen, S. Y.; Kapoor, A.; 2003; 20 pp.; In English
Report No.(s): DE2004-825872; No Copyright; Avail: Department of Energy Information Bridge

In an attempt to bring forth increased efficiency and effectiveness in assessing transportation risks associated with radioactive materials or wastes, the U. S. Department of Energy's (DOE's) National Transportation Program (NTP) published

a resource handbook in 2002. The handbook draws from the broad technical expertise among DOE national laboratories and industry, which reflects the extensive experience gained from DOE's efforts in conducting assessments (i. e., environmental impact assessments) within the context of the National Environmental Policy Act (NEPA) in the past 20 years. The handbook is intended to serve as a primary source of information regarding the approach and basis for conducting transportation risk assessments under normal or accidental conditions that are associated with shipping radioactive materials or wastes. It is useful as a reference to DOE managers, NEPA assessors, technical analysts, contractors, and also stakeholders. It provides a summary of pertinent U. S. policies and regulations on the shipment of radioactive materials, existing guidance on preparing transportation risk assessments, a review of previous transportation risk assessments by DOE and others, a description of comprehensive and generally accepted transportation risk assessment methodologies, and a compilation of supporting data, parameters, and assumptions. The handbook also provides a discussion paper on an issue that has been identified as being important in the past. The discussion paper focuses on cumulative impacts, illustrating the ongoing evolution of transportation risk assessment. The discussion may be expanded in the future as emerging issues are identified. The handbook will be maintained and periodically updated to provide current and accurate information.
NTIS
Radioactive Materials; Transportation; Environment Management; Handbooks

20050052021 Studsvik Material A.B., Nykoeping, Sweden
Characterisation and Handling of 7,500 Old Drums in Studsvik
Ehrs, C.; Lindberg, M.; Lorenzen, J.; 2003; In English
Report No.(s): DE2004-825894; No Copyright; Avail: National Technical Information Service (NTIS)
7,500 old drums were characterized and sorted into a number of categories. The sorting had two main purposes the first is to divide the drums into fractions that have the same content or origin or some other sorting criteria. The second purpose is not less important, it was to limit the amount of drums to work with at each point in time and therefore get a good overview of the drums. The third reason for handling the drums were that some was in poor condition since they previously had been stored outdoors. The drums were sorted into two main fractions, one with Studsvik-ID numbers and one without. These two fractions were then divided into sub-fractions depending on content, origin, dose-rate and a recommended final repository. The work is not yet completed but the procedures are established and work well.
NTIS
Drums (Containers); Characterization; Waste Management

20050060636 Sheffield Univ., UK
Long-Term Safe Storage and Disposal of Spent Sealed Radioactive Sources in Borehole Type Repositories
Ojovan, M. I.; Dmitriev, S. A.; Sobolev, I. A.; 2004; 16 pp.; In English
Report No.(s): DE2004-827505; No Copyright; Avail: Department of Energy Information Bridge
Russian Federation has the leading experience in applying borehole storage/disposal method for SRS. A new immobilization technology for sources being disposed of in underground repositories was mastered by 1986 and since then it is used in the country. This method uses all advantages of borehole type repositories supplementing them with metal encapsulation of sources. Sources being uniformly allocated in the volume of underground vessel are fixed in the metal block hence ensuring long-term safety. The dissipation of radiogenic heat from SRS is considerably improved, radiation fields are reduced, and direct contact of sources to an environment is completely eliminated. The capacity of a typical borehole storage/disposal facility is increased almost 6 times applying metal immobilization. That has made new technology extremely favourable economically. The metal immobilization of SRS is considered as an option in Belarus and Ukraine as well as Bulgaria. Immobilization of sources in metal matrices can be a real solution for retrieval of SRS from inadequate repositories.
NTIS
Boreholes; Radioactivity; Radiogenic Materials

20050060644 Battelle Memorial Inst., Columbus, OH, Jason Associates Corp., Oak Ridge, TN, USA
Transportation Risk Assessment Tool for Analyzing the Transport of Spent Nuclear Fuel and High Level Radioactive Waste to the Proposed Yucca Mountain Repository
McSweeney, T.; Winnard, T.; Ross, S.; Best, R.; 2004; 12 pp.; In English
Report No.(s): DE2004-805675; No Copyright; Avail: Department of Energy Information Bridge
The Yucca Mountain Transportation Database was developed as a data management tool for assembling and integrating data from multiple sources to compile the potential transportation impacts presented in the Draft Environmental Impact

Statement (DEIS) for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. The database uses the results from existing models and codes such as RADTRAN, RISKIND, INTERLINE, and HIGHWAY to estimate transportation-related impacts of transporting spent nuclear fuel and high-level radioactive waste from commercial reactors and U. S. Department of Energy (DOE) facilities to Yucca Mountain.
NTIS
Spent Fuels; Nuclear Fuels; Transport Theory

20050060652 Siemens Westinghouse Power Corp., Pittsburgh, PA, USA
Filter Component Assessment Ceramic Candles
Alvin, M. A.; Apr. 23, 2004; In English
Report No.(s): DE2004-828279; No Copyright; Avail: National Technical Information Service (NTIS)

Efforts at Siemens Westinghouse Power Corporation (SWPC) have been focused on development of hot gas filter systems as an enabling technology for advanced coal and biomass-based gas turbine power generation applications. SWPC has been actively involved in the development of advanced filter materials and component configuration, has participated in numerous surveillance programs characterizing the material properties and microstructure of field tested filter elements, and has undertaken extended, accelerated filter life testing programs. This report summarizes the results of SWPC's filter component assessment efforts, identifying the performance and stability of porous monolithic, fiber reinforced, and filament wound ceramic hot gas candle filters, potentially for 3 years of viable pressurized fluidized-bed combustion (PFBC) service operating life.
NTIS
Ceramics; Service Life; High Temperature Gases; Air Filters

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*.

20050051222 Aerospace Corp., El Segundo, CA USA
Aerothermal Heating for Satellite Reentry Conditions
Stern, Richard G.; Sep. 2004; 21 pp.; In English
Contract(s)/Grant(s): FA8802-05-C-0001
Report No.(s): AD-A428861; TR-2004(8506)-2; SMC-TR-05-08; No Copyright; Avail: CASI; A03, Hardcopy

Equations are presented which provide heating rates for objects reentering the Earth's atmosphere. The relationships are appropriate for estimating the survival or aerothermal breakup of a reentering vehicle. The relationships presented in this report predict heating which is an order of magnitude less than predicted by existing theory. The results presented in this report are based on numerous satellite reentry experiments conducted over the last three decades.
DTIC
Aerodynamic Heating; Aerothermodynamics; Earth Atmosphere; Heating

20050051575 California Inst. of Tech., Pasadena, CA, USA
Temporal Variability in the Accretion Rate of Interplanetary Dust Using (3)He as a Tracer
Farley, K. A.; January 2005; 9 pp.; In English
Contract(s)/Grant(s): NAG5-10470; No Copyright; Avail: CASI; A02, Hardcopy

The research supported by this grant falls under three topics: 1) Weekly Interplanetary Dust Sampling via (3)He; 2) Extraterrestrial (3)He at Major Impact Boundaries; 3) Completing a Moderately-High Resolution Record of Extraterrestrial (3)He Flux: A Major Asteroidal Break up Event at 8.2 Ma.
CASI
Earth (Planet); Interplanetary Dust; Helium Isotopes; Meteoritic Composition; Meteorite Collisions

20050060914 Louisiana State Univ., Baton Rouge, LA, USA

Sedimentation along the Eastern Chenier Plain Coast: Down Drift Impact of a Delta Complex Shift

Huh, Oscar K.; Walker, Nan D.; Moeller, Christopher; Journal of Coastal Research; Winter 2001; ISSN 0749-0206; Volume 17, No. 1, pp. 72-81; In English

Contract(s)/Grant(s): NAG5-9688; Copyright; Avail: Other Sources

The Mississippi River Chenier Plain is a shore parallel landform (down-drift from the Atchafalaya distributary of the Mississippi River) consisting of an alternating series of transgressive sand-shell ridges and regressive, progradational mudflats. The late 1940s shift of 1/3 of the flow of the Mississippi to the newly developing Atchafalaya delta complex to the west has resulted in injection of the river waters and suspended sediment into the westward flowing currents of the coastal current system. This has reactivated the dormant processes of mud accumulation along this coast. These environmental circumstances have provided the opportunity to: (1) investigate the depositional processes of the prograding, fine grained, mud flat facies of the open Chenier main coast and (2) to test the hypothesis that the impacts of the frequent cold front passages of fall, winter and spring exceed those of the occasional and more localized hurricane in shaping the coast and powering the dominant sedimentary processes. We conducted field investigations with the benefit of multi - scale, time series environmental surveillance by remote sensing systems, including airborne and satellite sensors. These systems provided invaluable new information on areal geomorphic patterns and the behavior of the coastal waters. This is a classic case of weather impacting inner shelf waters and sediments and causing the development of a new landform. It is clear that mud flats of the eastern chenier plain are prograding seaward, as well as progressively growing in a westerly direction.

Derived from text

Sediments; Coastal Water; Surveillance; Landforms; Atchafalaya River Basin (LA)

20050060955 California Univ., Santa Cruz, CA, USA

Coastal Mudflat Accretion under Energetic Conditions, Louisiana Chenier-Plain Coast, USA

Draut, Amy E.; Kineke, Gail C.; Huh, Oscar K.; Grymes, John M., III; Westphal, Karen A.; Moeller, Christopher C.; Marine Geology; 2005; Volume 214, pp. 23-47; In English

Contract(s)/Grant(s): N00014-98-0083; NAG5-9688; Copyright; Avail: Other Sources

Mudflat accretion on the chenier-plain coast of Louisiana, northern Gulf of Mexico, is anomalous in an area that otherwise experiences widespread land loss due to rapid relative sea level rise. Accretion is shown to be related to energetic events (Winta cold fronts and occasional tropical-dcprrssion srmms) using a 17-year record of meteorological conditions and aerial surveys The results indicate substantial differences between the behavior of sand- and mud-dominated coastal systems under energetic conditions. Comparison of the Louisiana chenier plain to other mud-rich coasts indicates that certain conditions are necessary for mudflat accretion to occur during energetic atmospheric activity. These include an abundant supply of fine-grained fluvial sediment and resuspension events that maintain an unconsolidated sea floor, dominant onshore wind direction during energetic conditions, particularly when onshore winds coincide with high fluvial sediment input to the coastal ocean, and a low tidal range.

Author

Mud; Sediments; Erosion; Sands; Coasts; Tides

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20050041876

Test Bed Doppler Wind Lidar and Intercomparison Facility At NASA Langley Research Center

[2004]; 9 pp.; In English; SPIE's 4th International Asia-Pacific Symposium on Remote Sensing of the Atmosphere, Ocean, Environment, and Space, 8-12 Nov. 2004, Honolulu, HI, USA

Contract(s)/Grant(s): 288-13-00; No Copyright; Avail: CASI; A02, Hardcopy

State of the art 2-micron lasers and other lidar components under development by NASA are being demonstrated and validated in a mobile test bed Doppler wind lidar. A lidar intercomparison facility has been developed to ensure parallel alignment of up to 4 Doppler lidar systems while measuring wind. Investigations of the new components; their operation in a complete system; systematic and random errors; the hybrid (joint coherent and direct detection) approach to global wind measurement; and atmospheric wind behavior are planned. Future uses of the VALIDAR (VALIDation LIDAR) mobile lidar

may include comparison with the data from an airborne Doppler wind lidar in preparation for validation by the airborne system of an earth orbiting Doppler wind lidar sensor.
Author
Optical Radar; Test Stands; Wind (Meteorology); Remote Sensing; Doppler Radar

20050041974 NASA Langley Research Center, Hampton, VA, USA
Using a Web Browser for Environmental and Climate Change Studies
Bess, T. Dale; Stackhouse, Paul; Mangosing, Daniel; Smith, G. Louis; [2002]; 4 pp.; In English; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy

A new web browser for viewing and manipulating meteorological data sets is located on a web server at NASA, Langley Research Center. The browser uses a live access server (LAS) developed by the Thermal Modeling and Analysis Project at NOAA's Pacific Marine Environmental Laboratory. LAS allows researchers to interact directly with the data to view, select, and subset the data in terms of location (latitude, longitude) and time such as day, month, or year. In addition, LAS can compare two data sets and can perform averages and variances, LAS is used here to show how it functions as an internet/web browser for use by the scientific and educational community. In particular its versatility in displaying and manipulating data sets of atmospheric measurements in the earth s radiation budget (ERB) or energy balance, which includes measurements of absorbed solar radiation, reflected shortwave radiation (RSW), thermal outgoing longwave radiation (OLR), and net radiation is demonstrated. These measurements are from the Clouds and the Earth s Radiant Energy System (CERES) experiment and the surface radiation budget (SRB) experiment.
Author
Websites; Climate Change; Information Systems

20050042039 Stockholm Univ., Sweden
Linear Modeling of the Air Flow over the Vatnajoekull Glacier
Parmhed, O.; Aug. 24, 2004; 26 pp.; In English
Report No.(s): PB2005-100721; No Copyright; Avail: CASI; A03, Hardcopy

A linear Boussinesq model of stable uniform flow is applied to the real three-dimensional topography of Europe's largest glacier, the Vatnajoekull glacier on Iceland. Solutions are obtained with and without Coriolis effects. The linear model solutions are compared to surface observations from the Vatnajoekull glacier. A fair agreement is found between the model solutions and the observations, except in the wake of the topography. It is observed that the linear model agreement with the observation often increases in time, under stationary, external conditions. Including rotation mostly improves the model's agreement with observations.
NTIS
Air Flow; Glaciers; Topography; Wakes

20050042049 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Land Surface Temperature. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Sikorski, R. J.; Kealy, P. S.; May 2002; In English
Report No.(s): PB2005-102022; SBRS-Y2399; No Copyright; Avail: National Technical Information Service (NTIS)

This is the Algorithm Theoretical Basis Document (ATBD) for the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Visible/Infrared Imager/ Radiometer Suite (VIIRS) Land Surface Temperature (LST) algorithm for retrieval of the IST Environmental Data Record (EDR). LST is an input variable for other VIIRS products such as soil moisture, land type classification, and infrared (IR) band emissivity. The VIIRS LST algorithms are based on physical regression methods to retrieve skin LST. They use radiances sensed by VIIRS Infrared (IR) channels. The VIIRS baseline LST algorithm establishes one equation for each land cover type and uses four thermal band brightness temperatures. This algorithm does not need emissivity information. The atmospheric correction, the complexity of land surface types, and the sensor performance limit the accuracy of satellite LST measurements. The VIIRS LST algorithm requires 2.5 K measurement accuracy and 0.5 K measurement precision. The VIIRS baseline dual split window algorithm (Land cover approach) meets the threshold for all Precipitable Water (PW) ranges and for all viewing angles. The validation of LST is limited by the availability of in situ observations. The VIIRS LST is defined as the skin temperatures of the uppermost layer of the land

surface, while in situ observations are usually shelter temperatures. Reliable observed or analyzed skin temperatures will be a critical factor in validating the VIIRS LST retrieval.
NTIS
Algorithms; Infrared Radiation; Infrared Radiometers; Land Surface Temperature; Light (Visible Radiation)

20050042051 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Snow Cover. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Jensen, K. A.; Appel, I.; May 2002; In English
Report No.(s): PB2005-102023; SBRS-Y2401; No Copyright; Avail: National Technical Information Service (NTIS)
This Algorithm Theoretical Basis Document (ATBD) explains the mathematical background to derive the Snow Cover Environmental Data Record (EDR). This document covers the theoretical basis for the derivation of the Snow Cover EDR, which consists of a snow/no snow binary map and snow fraction in a horizontal cell. The purpose and scope of the document are described in Section 1, while Section 2 provides an overview of the snow cover retrieval objectives. Section 3 describes the algorithm, its input data, the theoretical background, and some practical considerations. Section 4 contains the EDR performance analysis and error budget. Section 5 contains the pre-launch and post-launch plan for verification and validation. Section 6 contains assumptions and limitations.
NTIS
Algorithms; Infrared Radiometers; Snow Cover; Mathematical Models; Light (Visible Radiation)

20050042052 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Cloud Effective Particle Size and Cloud Optical Thickness. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Ou, S. C.; Liou, K. N.; Takano, Y.; Higgins, G. J.; George, A.; May 2002; 200 pp.; In English
Report No.(s): PB2005-102021; SBRS-Y2393; No Copyright; Avail: CASI; A09, Hardcopy
This document covers the algorithm theoretical basis for the retrieval of the cloud optical thickness and effective particle size using VIIRS channel reflectances and radiances. Section 1 describes the purpose and scope of the document. Section 2 provides a scientific and historical background. The processing concept and algorithm description is presented in Section 3. Section 4 summarizes relevant assumptions and limitations. Finally, literature references used throughout the document are provided in Section 5.
NTIS
Algorithms; Infrared Radiometers; Optical Thickness; Radiance; Clouds (Meteorology)

20050042053 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Surface Reflectance. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Miller, S. W.; May 2002; 88 pp.; In English
Report No.(s): PB2005-102027; SBRS-Y2411; No Copyright; Avail: CASI; A05, Hardcopy
This Algorithm Theoretical Basis Document (ATBD) describes the algorithms used to retrieve the Surface Reflectance Intermediate Product (IP) from Visible/Infrared Imager/Radiometer Suite (VIIRS) Sensor Data Records (SDRs). It identifies the sources of input data, both VIIRS and non-VIIRS, that are required for Surface Reflectance retrievals. It provides the physical theory and mathematical background underlying the approach, and it includes top-level implementation details. The VIIRS Science Data System Team is using information continued in this document to establish the requirements and functionality of the data processing software.
NTIS
Infrared Radiometers; Spectral Reflectance; Algorithms; Light (Visible Radiation)

20050042054 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Imagery. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Jensen, K. A.; Hutchison, K.; Julian, R.; Apr. 2002; In English
Report No.(s): PB2005-102028; SBRS-Y2466; No Copyright; Avail: National Technical Information Service (NTIS)
This Imagery Algorithm Theoretical Basis Document (ATBD) describes the background, theory, and analysis of the algorithmic process required to create Imagery Environmental Data Records (EDRs) from the sensor Raw Data Records (RDRs) of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Visible/Infrared Imager/

Radiometer Suite (VIIRS). The process has been developed to satisfy the requirements of the VIIRS Sensor Requirements Document (SRD), Version 3, released by the Integrated Program Office (IPO). This document is version 5 of the Imagery ATBD. It is intended to completely supersede previous versions. The document covers all VIIRS imagery processing. In particular, it describes algorithms for producing four imagery products: Explicit Imagery, Near Constant Contrast (NCC) Visible Imagery, Manually Generated Cloud Data, and Sea Ice Data.
NTIS
Algorithms; Imagery; Infrared Radiometers; Light (Visible Radiation); Remote Sensing

20050042055 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
User's Guide for VIIRS Cloud Imagery Products, Version 5.1
Jensen, K. A.; Hutchison, K.; Miller, S.; Apr. 2002; In English
Report No.(s): PB2005-102029; SBRS-Y2466-APP; No Copyright; Avail: National Technical Information Service (NTIS)

This text introduces the reader to the fundamental principles necessary to manually interpret surface and atmospheric features in multispectral meteorological satellite imagery. The text is aimed at those familiar with integral calculus and offers such individuals detailed insights into the signatures of clouds and land surfaces in both daytime and nighttime imagery along with background material that could be useful in the design of future satellite sensors. Those with a less extensive mathematical background can also become very knowledgeable in the interpretation of multispectral imagery through the careful review of the many examples contained in the text.
NTIS
Remote Sensing; Meteorological Satellites; Clouds (Meteorology); Satellite Imagery; Infrared Radiometers; Light (Visible Radiation); User Manuals (Computer Programs)

20050042056 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Precipitable Water. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Huang, H. L.; Woolf, H. M.; Miller, S. W.; Sikorski, R. J.; May 2002; In English
Report No.(s): PB2005-102030; SBRS-Y3251; No Copyright; Avail: National Technical Information Service (NTIS)

Precipitable Water is one of more than two dozen Environmental Data Records (EDRs) explicitly required as products to be derived from the Visible/Infrared Imager/Radiometer Suite (VIIRS) sensor slated to fly onboard the National Polar-orbiting Operational Environmental Satellite System (NPOESS), which is scheduled for launch in the late 2000's. This Algorithm Theoretical Basis Document (ATBD) describes the algorithms used to retrieve the Precipitable Water (PW) Environmental Data Record (EDR) for VIIRS. The primary purpose of this ATBD is to establish guidelines for the production of the PW EDR. This document will describe the required inputs, the theoretical foundation of the algorithms, the sources and magnitudes of the errors involved, practical considerations for post-launch implementation, and the assumptions and limitations associated with the products.
NTIS
Algorithms; Infrared Radiometers; Water Vapor; Light (Visible Radiation); Infrared Imagery

20050042057 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Aerosol Optical Thickness and Particle Size Parameter. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Vermote, E.; Slonaker, R.; Vibert, S.; Kilcoyne, H.; Hoyt, D.; May 2002; In English
Report No.(s): PB2005-102019; SBRS-Y2388-Rev; No Copyright; Avail: National Technical Information Service (NTIS)

Atmospheric aerosol plays a role in the Earth's radiation budget through radiative forcing and chemical perturbations. Quantifying this forcing requires accurate information on the global distribution of aerosol optical thickness, size distribution, and single scattering albedo. Aerosols play an important role in global warming by affecting the rate at which warming occurs, as the aerosols effectively cool the atmosphere by influencing the reflective and absorbing properties of clouds. Aerosol information is also vital to the atmospheric correction for the Sea Surface Temperature and Vegetation Index, climate modeling, and battlefield visibility modeling. Due to the high spatial and temporal variability of the aerosol particles, the satellite approach is the only feasible choice. This document describes the operational retrieval algorithm of the Visible/Infrared Imager/Radiometer Suite (VIIRS) aerosol optical thickness and particle size parameter products. Retrieval of these products will be performed globally on a daily basis except over bright surfaces and cloudy conditions. Because the reflective properties of ocean and land are very different, separate retrieval approaches are used over the land and the ocean.

Aerosol products are calculated over the ocean using the known reflectance of the ocean surface with look-up tables of pre-computed values of TOA reflectance for several aerosol types, optical thicknesses, and solar and viewing angles. The look-up table accounts for multiple scattering in the atmosphere by molecules and aerosol particles, and angular reflection of the surface. Over the land, a dark pixel method introduced by Kaufman et al. (1997) for the Moderate Resolution Imaging Spectroradiometer (MODIS) is adopted to identify areas where dense vegetation allows retrieval. The VIIRS sensor design includes a band at 2.25 m to detect the dark pixels required for retrieval of optical thickness, and thus aerosol particle size parameter, over land. Measured radiance at satellite level is inverted into the aerosol optical thickness using look-up tables. Error analyses and validations have been performed and the results are presented in this document.
NTIS
Aerosols; Size Distribution; Spatial Distribution

20050042059 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Radiometric Calibration. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Byerly, W. P.; Clement, J. E.; Dorman, T.; Engel, J.; Julian, R.; May 2002; In English
Report No.(s): PB2005-102032; SBRS-Y3261; No Copyright; Avail: National Technical Information Service (NTIS)

This Algorithm Theoretical Basis Document (ATBD) describes the algorithm used to produce calibrated top of atmosphere (TOA) radiances, calibrated TOA reflectances, and calibrated TOA brightness temperatures for National Polar-orbiting Operational Environmental Satellite System (NPOESS) Visible/Infrared Imager/Radiometer Suite (VIIRS) sensor data. These are the primary Sensor Data Record (SDR) products of the VIIRS. The calibrated TOA radiance (except Day/Night Band (DNB)) and reflectance products are defined to match the corresponding MODIS Level 1B. The DNB calibrated TOA radiances are integrated radiance in W/cm(sub 2)-sr whereas the calibrated TOA radiances for the moderate and imagery resolution bands are spectral radiance in W/m(sub 2)-sr-micron.
NTIS
Algorithms; Calibrating; Infrared Radiometers; Light (Visible Radiation); Remote Sensing

20050042065 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Cloud Cover/Layers. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Huang, H. L.; Slonaker, R.; Woolf, H. M.; Solomon, R. L.; May 2002; In English
Report No.(s): PB2005-102020; SBRS-Y2392; No Copyright; Avail: National Technical Information Service (NTIS)

Total cloud cover and layered cloud structure are basic components of an image analysis procedure called 'nephanalysis'. Many operational users of cloud data require analysis of the extent, type, and physical characteristics of vertically distributed cloud layers. For example, inflight aircraft refueling has stringent requirements for cloud-free visibility between aircraft at flight altitude. Icing specification and forecasts depend on accurate initial depiction of the constituent particle sizes and state (liquid or frozen) of clouds at specific altitudes. Many other uses, such as accurate prediction of lines-of-sight for aerial reconnaissance, depend on accurate classification of clouds into the classic cloud families. These diverse needs are best met by a novel algorithm called Property Distance Clustering (PDC) that adapts the K-means cluster algorithm by using the local similarity relationships among pixels to combine them in clusters. This document includes a thorough description of the established behavior of the Cloud Cover/Layers (CC/L) Environmental Data Record (EDR) processing approach. This algorithm with initial heritage from K-means clustering requires no VIIRS SDR input; instead, input includes pixel-level information such as the Cloud Top Height, the Effective Particle Size, and the Cloud Optical Thickness. The pixel-level cloud mask and cloud phase intermediate products (IP) are used as well. Since both cloud macro (height and phase) and micro (effective particle size and optical thickness) properties are used in characterizing distinct cloud layers, the algorithm can meet the objective of the CC/L EDR to identify the vertical structure of clouds consistent with pixel-level observations within each horizontal (aggregation) cell over a VIIRS image.
NTIS
Cloud Cover; Cloud Height Indicators; Cloud Physics

20050042066 National Oceanic and Atmospheric Administration, Silver Spring, MD, USA, NASA, Washington, DC, USA
GEWEX America Prediction Project (GAPP) Science and Implementation Plan
Sep. 01, 2004; 82 pp.; In English
Report No.(s): PB2005-102109; No Copyright; Avail: CASI; A05, Hardcopy

The purpose of this Science and Implementation Plan is to describe GAPP science objectives and the activities required to meet these objectives, both specifically for the near-term and more generally for the longer-term. The GEWEX Americas Prediction Project (GAPP) is part of the Global Energy and Water Cycle Experiment (GEWEX) initiative that is aimed at observing, understanding and modeling the hydrological cycle and energy fluxes at various time and spatial scales. The mission of GAPP is to demonstrate skill in predicting changes in water resources over intraseasonal-to-interannual time scales, as an integral part of the climate system.
NTIS
Hydrological Cycle; Water Resources; Climate Models

20050042071 Environmental Protection Agency, Washington, DC, USA
Annotated Summary of Climate Change Related Resources
Mar. 2000; 124 pp.; In English
Report No.(s): PB2005-102118; EPA-236-B-00-001; No Copyright; Avail: CASI; A06, Hardcopy
The purpose of this annotated summary is to provide the reader with a tool for identifying the range of available resources pertaining to climate change. The information contained in this resource guide is intended to assist researchers and decision makers, particularly those from developing countries, in their efforts to develop, implement, and evaluate climate change programs and conduct climate change studies (e.g. , emission inventories, mitigation assessments, vulnerability and adaptation analysis). While a wide variety of analytic and assessment tools, guidelines, and information resources are available, these resources are dispersed among numerous public and private entities throughout the world, making it difficult for potential users to identify and access relevant materials. Furthermore, because decision makers in developing countries face significant challenges in pursuing development objectives, efforts to address climate change are typically evaluated in light of how they may affect sustainable development goals and near-term local environmental conditions. Therefore, the annotations in this resource guide identify which environmental protection or sustainable development objective might also be addressed by each climate change resource.
NTIS
Climate Change; Information Management

20050042073 National Oceanic and Atmospheric Administration, Silver Spring, MD, USA, NASA, Washington, DC, USA
Investigation of the Seasonal Freeze/Thaw Cycle of Soils in the GAPP Regions
2004; In English
Report No.(s): PB2005-102122; No Copyright; Avail: National Technical Information Service (NTIS)
The objective of this project is to understand the current and future impacts and feedbacks of seasonally frozen ground on the regional and global climate system and the ecosystem as a whole. More specifically, we proposed to: investigate the dynamics of the seasonally freezing and thawing processes and their relations to current climatic conditions through in situ data analysis and numerical modeling; develop a comprehensive algorithm to detect surface soil freeze/thaw status for snow-free land surface using passive microwave remote sensing data and for snow-covered land surface using numerical modeling, and validate the algorithm and numerical model using available ground-based measurements; investigate seasonal and inter-annual variations of frozen soils in the GAPP regions using data generated from the new validated algorithm and their relations to the environmental factors such as air temperature, snow cover, surface morphology, soil type and soil moisture; generate a frozen soil data set which describes the timing, duration, thickness, and area extent of seasonally frozen ground for the period from 1978 to present. The proposed research will be accomplished through data analysis, remote sensing, and numerical modeling.
NTIS
Freezing; Mathematical Models; Remote Sensing; Soil Moisture; Melting; Seasons

20050050892 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of Meteorological Satellite Center: October 2004
October 2004; In Japanese; In English; Copyright; Avail: Other Sources
The CD-ROM concerning the October 2004 of the Meteorological Satellite Center (MSC) Contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the polar orbital meteorological satellites operated by NOAA. The CD-ROM contains following observation data: Full Disk Earth's Cloud, Cloud Image of Japan and its Vicinity, Cloud Amount, Sea Surface Temperature, Cloud Motion Wind, Water Vapor Motion Wind, Equivalent Blackbody Temperature, OLR (Outgoing Longwave Radiation), Solar Radiation, Snow and Ice Index, Orbit Data, Attitude Data, VISSR

Image Data Catalog, (Cartridge Magnetic Tape (CMT), Micro Film), TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water, TOVS Total Ozone Amount. Although this user's guide is revised yearly, it may happen that a change of contents of the Monthly Report is not reflected in the user's guide, if the change is carried out between revisions of the user's guide. The latest contents of the Monthly Report and the detailed information of the contents are described in document files which are contained in the CD-ROM. Please read the document files.
Author
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Satellite Imagery; Meteorological Satellites; Japan; NOAA Satellites; Japanese Spacecraft

20050050927 NASA Langley Research Center, Hampton, VA, USA
Differences between ERBE and CERES Tropical Mean Fluxes: ENSO, Climate Change or Calibration?
Wielicki, Bruce A.; Wong, Takmeng; Young, David F.; Barkstrom, Bruce R.; Lee, R. B., III; Haeffelin, Martial; January 2005; 4 pp.; In English; American Meteorological Society 10th Conference on Atmospheric Radiation, 28 Jun. - 2 Jul. 1999, Madison, WI, USA; No Copyright; Avail: CASI; A01, Hardcopy

Verner E. Soumi was the father of radiation budget measurements from space. He directed the team at the University of Wisconsin that developed the first radiation budget measurements on the Iota (Explorer VII) coverage) spacecraft in 1959. The first data published was from hand calculations of night-time long-wave fluxes, with absolute accuracy estimated as better than 10 percent, and the data shown as hand drawn maps with lines of equal 'long-wave radiation loss, in Langleys per minute X 10(exp -3) (isolangleys)'. The first comparisons of the new radiation data with nephanalyses showed that clouds dominated the radiation patterns. Soumi immediately proposed using the radiation fields to help understand the atmospheric heat sources necessary to drive the atmospheric circulation. This early work already pointed to the relationship between the outgoing longwave radiation at the top of the atmosphere and the vertical flux divergence of infrared radiation within the atmosphere. In the next 30 years, global satellite observations of the radiation balance of the planet have advanced both in accuracy, stability, and in their ability to address cause and effect in the climate system. The purpose of the present paper is to examine early results of the new Clouds and the Earth's Radiant Energy System (CERES) data on Tropical Rainfall Measuring System (TRMM) which started data collection in January, 1998. CERES is a direct descendant of the legacy of Soumi's foresight on understanding the global energetics using satellite observations of broadband radiation.
Author
Atmospheric Circulation; Atmospheric Radiation; Calibrating; Climate Change; El Nino; Radiant Flux Density; Satellite Observation; Tropical Meteorology; Tropical Regions

20050050934 Massachusetts Inst. of Tech., Cambridge, MA, USA
Advanced Global Atmospheric Gases Experiment (AGAGE)
Prinn, Ronald G.; Kurylo, Michael, Technical Monitor; December 28, 2004; 18 pp.; In English
Contract(s)/Grant(s): NAG5-12669; No Copyright; Avail: CASI; A03, Hardcopy

We seek funding from NASA for the third year (2005) of the four-year period January 1, 2003 - December 31, 2006 for continued support of the MIT contributions to the multi-national global atmospheric trace species measurement program entitled Advanced Global Atmospheric Gases Experiment (AGAGE). The case for real-time high-frequency measurement networks like AGAGE is very strong and the observations and their interpretation are widely recognized for their importance to ozone depletion and climate change studies and to verification issues arising from the Montreal Protocol (ozone) and Kyoto Protocol (climate). The proposed AGAGE program is distinguished by its capability to measure over the globe at high frequency almost all of the important species in the Montreal Protocol and almost all of the significant non-CO2 gases in the Kyoto Protocol.
Derived from text
Atmospheric Composition; Trace Elements; Ozone Depletion; Climate Change; Carbon Dioxide

20050051221 Naval Research Lab., Bay Saint Louis, MS USA
Forecast Verification of the Polar Ice Prediction System (PIPS) Sea Ice Concentration Fields
Van Woert, Michael L.; Zou, Cheng-Zhi; Meier, Walter N.; Hovey, Philip D.; Preller, Ruth H.; Oct. 2003; 16 pp.; In English
Report No.(s): AD-A428859; NRL/JA/7320-03-122; No Copyright; Avail: CASI; A03, Hardcopy

The National Ice Center relies upon a coupled ice-ocean model called the Polar Ice Prediction System (PIPS) to provide guidance for its 24-l20-h Sea ice forecasts. Here forecast skill assessments of the sea ice concentration (C) fields from PIPS for the period 1 May 2000- 31 May 2002 are presented. Methods of measuring the sea ice forecast skill are adapted from the

meteorological literature and applied to locations where the forecast or analysis sea ice fields changed by at least +/-5%. The forecast skill referenced to climatology was high (\g0.85, relative to a maximum score of 1.0) for all months examined. This is because interannual variability in the climatology, which is used as a reference field, is much greater than the day-to-day variability in the forecast field. The PIPS forecasts were also evaluated against persistence and combined climatological-persistance forecasts. Compared to persistence, 24-h forecast was found to be skillful (\g0.2) for all months studied except during the freezing up months of December 2000 and January 2001. Relative to the combined reference field, the 24-h forecast was also positive for the non-freeze up months; however, the skill scores were lower (^0.1). During the poorly performing freeze-up months, a linear combination of persistence (^95% weight) and climatology (^5% weight) appears to provide the best available sea ice forecast.
DTIC
Forecasting; Ice; Ice Formation; Prediction Analysis Techniques; Proving; Sea Ice; Weather Forecasting

20050051574 NASA Langley Research Center, Hampton, VA, USA
TAMDAR Sensor Validation in 2003 AIRS II
Daniels, Taumi S.; Murray, John J.; Anderson, Mark V.; Mulally, Daniel J.; Jensen, Kristopher R.; Grainger, Cedric A.; Delene, David J.; [2005]; 6 pp.; In English; 43rd Aerospace Sciences Meeting and Exhibit Conference, 10-14 Jan. 2005, Reno, NV, USA
Report No.(s): AIAA Paper 2005-0259; Copyright; Avail: CASI; A02, Hardcopy

This study entails an assessment of TAMDAR in situ temperature, relative humidity and winds sensor data from seven flights of the UND Citation II. These data are undergoing rigorous assessment to determine their viability to significantly augment domestic Meteorological Data Communications Reporting System (MDCRS) and the international Aircraft Meteorological Data Reporting (AMDAR) system observational databases to improve the performance of regional and global numerical weather prediction models. NASA Langley Research Center participated in the Second Alliance Icing Research Study from November 17 to December 17, 2003. TAMDAR data taken during this period is compared with validation data from the UND Citation. The data indicate acceptable performance of the TAMDAR sensor when compared to measurements from the UND Citation research instruments.
Author
Troposphere; Numerical Weather Forecasting; Meteorological Radar; Sensors; Data Transmission; Aircraft Icing

20050060654 North Dakota Univ., Grand Forks, ND, USA
Evaluating Short-Term Climate Variability in the Late Holocene of the Northern Great Plains
Hartman, J. H.; Sep. 1999; 56 pp.; In English
Report No.(s): DE2004-824980; No Copyright; Avail: Department of Energy Information Bridge

This literature study investigated methods and areas to deduce climate change and climate patterns, looking for short-term cycle phenomena and the means to interpret them. Many groups are actively engaged in intensive climate-related research. Ongoing research might be (overly) simplified into three categories: (1) historic data on weather that can be used for trend analysis and modeling; (2) detailed geological, biological (subfossil), and analytical (geochemical, radiocarbon, etc.) studies covering the last 10,000 years (about since last glaciation); and (3) geological, paleontological, and analytical (geochemical, radiometric, etc.) studies over millions of years. Of importance is our ultimate ability to join these various lines of inquiry into an effective means of interpretation. At this point, the process of integration is fraught with methodological troubles and misconceptions about what each group can contribute. This project has met its goals to the extent that it provided an opportunity to study resource materials and consider options for future effort toward the goal of understanding the natural climate variation that has shaped our current civilization. A further outcome of this project is a proposed methodology based on ‘climate sections’ that provides spatial and temporal correlation within a region.
NTIS
Climate Models; Climate; Climate Change

20050060913 Wisconsin Univ., Madison, WI, USA
Estimating Coastal Turbidity using MODIS 250 m Band Observations
Davies, James E.; Moeller, Christopher C.; Gunshor, Mathew M.; Menzel, W. Paul; Walker, Nan D.; [2004]; 11 pp.; In English
Contract(s)/Grant(s): NAG5-9688; No Copyright; Avail: CASI; A03, Hardcopy

Terra MODIS 250 m observations are being applied to a Suspended Sediment Concentration (SSC) algorithm that is under development for coastal case 2 waters where reflectance is dominated by sediment entrained in major fluvial outflows. An

atmospheric correction based on MODIS observations in the 500 m resolution 1.6 and 2.1 micron bands is used to isolate the remote sensing reflectance in the MODIS 25Om resolution 650 and 865 nanometer bands. SSC estimates from remote sensing reflectance are based on accepted inherent optical properties of sediment types known to be prevalent in the U.S. Gulf of Mexico coastal zone. We present our findings for the Atchafalaya Bay region of the Louisiana Coast, in the form of processed imagery over the annual cycle. We also apply our algorithm to selected sites worldwide with a goal of extending the utility of our approach to the global direct broadcast community.
Author
Algorithms; Atmospheric Correction; Remote Sensing; MODIS (Radiometry); Broadcasting

20050060917 Wisconsin Univ., Madison, WI, USA, Louisiana State Univ., LA, USA
Chenier Plain Sediment Burial Pipe Measurements
Moeller, Chris; Gunshor, Mat; Huh, Oscar; Winch, Dale; November 15, 2000; 39 pp.; In English
Contract(s)/Grant(s): NAG5-9688; No Copyright; Avail: CASI; A03, Hardcopy

These field notes describe the logistical circumstances and field conditions experienced by the researchers, who measured the waterlines on a series of vertical pipes previously buried in shallow coastal water. The purpose of the measurements was to monitor a portion of the Gulf coast in Louisiana for erosion.
CASI
Coastal Water; Shallow Water; Water Depth; Erosion; Environmental Monitoring

20050060920 Wisconsin Univ., Madison, WI, USA
Application of Remote Sensing to Assess the Impact of Short Term Climate Variability on Coastal Sedimentation
Menzel, W. Paul; Huh, Oscar K.; Walker, Nan; December 2004; 91 pp.; In English
Contract(s)/Grant(s): NAG5-9688; No Copyright; Avail: CASI; A05, Hardcopy

The purpose of this joint University of Wisconsin (UW) and Louisiana State University (LSU) project has been to relate short term climate variation to response in the coastal zone of Louisiana in an attempt to better understand how the coastal zone is shaped by climate variation. Climate variation in this case largely refers to variation in surface wind conditions that affect wave action and water currents in the coastal zone. The primary region of focus was the Atchafalaya Bay and surrounding bays in the central coastal region of Louisiana. Suspended solids in the water column show response to wind systems both in quantity (through resuspension) and in the pattern of dispersement or transport. Wind systems associated with cold fronts are influenced by short term climate variation. Wind energy was used as the primary signature of climate variation in this study because winds are a significant influence on sediment transport in the micro-tidal Gilf of Mexico coastal zone. Using case studies, the project has been able to investigate the influence of short term climate variation on sediment transport. Wind energy data, collected daily for National Weather Service (NWS) stations at Lake Charles and New Orleans, LA, were used as an indicator of short term climate variation influence on seasonal time scales. A goal was to relate wind energy to coastal impact through sediment transport. This goal was partially accomplished by combining remote sensing and wind energy data. Daily high resolution remote sensing observations are needed to monitor the complex coastal zone environment, where winds, tides, and water level all interact to influence sediment transport. The NASA Earth Observing System (EOS) era brings hope for documenting and revealing response of the complex coastal transport mosaic through regular high spatial resolution observations from the Moderate resolution Imaging Spectrometer (MODIS) instrument. MODIS observations were sampled in this project for information content and should continue to be viewed as a resource for coastal zone monitoring. The project initialized the effort to transfer a suspended sediment concentration (SSC) algorithm to the MODIS platform for case 2 waters. MODIS enables monitoring of turbid coastal zones around the globe. The MODIS SSC algorithm requires refinements in the atmospheric aerosol contribution, sun glint influence, and designation of the sediment inherent optical properties (IOPs); the framework for continued development is in place with a plan to release the algorithm to the MODIS direct broadcast community.
Derived from text
Climate; Coastal Water; Earth Observing System (EOS); Sediment Transport; Variability; Information; Coasts; Aerosols

20050060993 Massachusetts Inst. of Tech., Cambridge, MA, USA
Two-Way Biosphere-Atmosphere Interactions: Their Implications for Satellite Observations of Regional Land Cover Changes
Eltahir, Elfatih; February 08, 2005; 3 pp.; In English
Contract(s)/Grant(s): NAG5-8617; No Copyright; Avail: CASI; A01, Hardcopy

This final report describes accomplishments of the project, divided into three sections: 1) Progress in the first year; 2) Progress in the second year; 3) Progress in the third and fourth year.
Derived from text
Biosphere; Earth Atmosphere; Satellite Observation; Air Land Interactions

20050061081 Stanford Univ., Stanford, CA, USA
Droplet Growth by Turbulent Coagulation
Riemer, N; Wexler, A. S.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 317-330; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

Rain formation and the role of clouds in climate and atmospheric chemistry are closely linked to the evolution of the cloud droplet spectra. Our understanding of theses processes is still fragmentary. This implies that the treatment of clouds leads to large uncertainties in weather and climate predictions. Cloud droplets are initially produced by condensation of water vapor onto nuclei. Condensation alone, however, cannot form drops that are large enough to precipitate. In the absence of the ice phase this requires the coagulation of smaller droplets resulting in a larger drop. The process of coagulation relies on relative velocities between the droplet. One mechanism to provide relative velocities is the gravitational settling of the droplets. The larger droplets fall faster and collect smaller droplets on their way.
Author
Atmospheric Chemistry; Drops (Liquids); Climate; Water Vapor; Precipitates; Coagulation; Rain

20050061082 NASA Ames Research Center, Moffett Field, CA, USA
Study of Near-Surface Models in Large-Eddy Simulations of a Neutrally Stratified Atmospheric Boundary Layer
Senocak, I.; Ackerman, A. S.; Kirkpatrick, M. P.; Stevens, D. E.; Mansour, N. N.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 343-353; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

Large-eddy simulation (LES) is a widely used technique in armospheric modeling research. In LES, large, unsteady, three dimensional structures are resolved and small structures that are not resolved on the computational grid are modeled. A filtering operation is applied to distinguish between resolved and unresolved scales. We present two near-surface models that have found use in atmospheric modeling. We also suggest a simpler eddy viscosity model that adopts Prandtl's mixing length model (Prandtl 1925) in the vicinity of the surface and blends with the dynamic Smagotinsky model (Germano et al, 1991) away from the surface. We evaluate the performance of these surface models by simulating a neutraly stratified atmospheric boundary layer.
Author (revised)
Atmospheric Boundary Layer; Large Eddy Simulation

20050061112 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Radiation Studies in Support of the CRYSTAL-FACE Project
Valero, Francisco P. J.; Pope, Shelly K.; Bush, Brett C.; [2005]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-11637; NASA Proj. CRYSTAL-0000-0091; No Copyright; Avail: CASI; A01, Hardcopy

As proposed, we successfully completed radiometric observations aboard the ER-2 and WB-57 platforms during the field phase of the CRYSTAL-FACE campaign. Quick look plots of the data were immediately archived after the missions and quality-controlled and completely processed find data products were archived in a timely manner to the CRYSTAL-FACE data archive. The specific radiometric instrumentation operated aboard the two NASA airborne platforms is summarized.
Derived from text
Atmospheric Radiation; Radiometers; Airborne Equipment

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OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20050041813 NASA Stennis Space Center, Bay Saint Louis, MS, USA

Determining CDOM Absorption Spectra in Diverse Coastal Environments Using a Multiple Pathlength, Liquid Core Waveguide System. Measuring the Absorption of CDOM in the Field Using a Multiple Pathlength Liquid Waveguide System

Miller, Richard L.; Belz, Mathias; DelCastillo, Carlos; Trzaska, Rick; October 1, 2000; 25 pp.; In English; Ocean Optics 15th Conference, 16-20 Oct. 2000, Monaco

Report No.(s): SE-2000-11-0020-SSC; No Copyright; Avail: CASI; A03, Hardcopy

We evaluated the accuracy, sensitivity and precision of a multiple pathlength, liquid core waveguide (MPLCW) system for measuring colored dissolved organic matter (CDOM) absorption in the UV-visible spectral range (370-700 nm). The MPLCW has four optical paths (2.0, 9.8, 49.3, and 204 cm) coupled to a single Teflon AF sample cell. Water samples were obtained from inland, coastal and ocean waters ranging in salinity from 0 to 36 PSU. Reference solutions for the MPLCW were made having a refractive index of the sample. CDOM absorption coefficients, a(sub CDOM), and the slope of the log-linearized absorption spectra, S, were compared with values obtained using a dual-beam spectrophotometer. Absorption of phenol red secondary standards measured by the MPLCW at 558 nm were highly correlated with spectrophotometer values (r \g 0.99) and showed a linear response across all four pathlengths. Values of a(sub CDOM) measured using the MPLCW were virtually identical to spectrophotometer values over a wide range of concentrations. The dynamic range of a(sub CDOM) for MPLCW measurements was 0.002 - 231.5/m. At low CDOM concentrations (a(sub 370) \h 0.1/m) spectrophotometric a(sub CDOM) were slightly greater than MPLCW values and showed larger fluctuations at longer wavelengths due to limitations in instrument precision. In contrast, MPLCW spectra followed an exponential to 600 nm for all samples. The maximum deviation in replicate MPLCW spectra was less than 0.001 absorbance units. The portability, sampling, and optical characteristics of a MPLCW system provide significant enhancements for routine CDOM absorption measurements in a broad range of natural waters.

Author

Dissolved Organic Matter; Coastal Water; Water Color; Absorption Spectroscopy; Ultraviolet Spectra

20050060954 Oklahoma Univ., Norman, OK, USA

Quantification of Surface Suspended Sediments along a River Dominated Coast with NOAA AVHRR and SeaWiFS Measurements: Louisiana, USA

Myint, S. W.; Walker, N. D.; International Journal of Remote Sensing; 2002; ISSN 0143-1161; Volume 23, No. 16, pp. 3229-3249; In English

Contract(s)/Grant(s): NAG5-9688; Copyright; Avail: Other Sources

The ability to quantify suspended sediment concentrations accurately over both time and space using satellite data has been a goal of many environmental researchers over the past few decades This study utilizes data acquired by the NOAA Advanced Very High Resolution Radiometer (AVHRR) and the Orbview-2 Sea-viewing wide field-of-view (SeaWiFS) ocean colour sensor, coupled with field measurements to develop statistical models for the estimation of near-surface suspended sediment and suspended solids 'Ground truth' water samples were obtained via helicopter, small boat and automatic water sampler within a few hours of satellite overpasses The NOAA AVHRR atmospheric correction was modified for the high levels of turbidity along the Louisiana coast. Models were developed based on the field measurements and reflectance/radiance measurements in the visible and near infrared Channels of NOAA-14 and Orbview-2 SeaWiFS. The best models for predicting surface suspended sediment concentrations were obtained with a NOAA AVHRR Channel 1 (580-680nm) cubic model, Channel 2 (725-1100 nm) linear mod$ and SeaWiFs Channel 6 (660-68Onm) power modeL The suspended sediment models developed using SeaWiFS Channel 5 (545-565 nm) were inferior, a result that we attribute mainly to the atmospheric correction technique, the shallow depth of the water samples and absorption effects from non-sediment water constituents.

Author

Sediments; Advanced Very High Resolution Radiometer; Sea-Viewing Wide Field-of-View Sensor; Mathematical Models

20050060956 Louisiana State Univ., Baton Rouge, LA, USA

Satellite-Based Assessment of Sediment Transport, Distribution and Resuspension Associated with the Atchafalaya River Discharge Plume

Walker, Nan; Roberts, Harry; Stone, Gregory; Bentley, Samuel; Huh, Oscar; Sheremet, Alexandru; Rouse, Larry; Inoue, Masamichi; Welsh, Susan; Hsu, S. A., et al.; Gulf Coast Association of Geological Societies Transactions; 2002; Volume 52, pp. 967-973; In English

Contract(s)/Grant(s): NAG5-9688; Copyright; Avail: Other Sources

Tbe Atchafalaya River discharges over 80 x 10(exp 6) tons of sediment annually onto the broad shallow continental shelf of central and western Louisiana. Satellite imagery from the NOAA AVHRR and Terra MODIS are used in this paper to quantify suspended sediment concentrations and to assess sediment transport processes along the Louisiana shelf under varying conditions of river discharge and wind forcing. The image data reveal the maim sources of sediment, direction of transport amd regional extent of wind-wave resuspension. The prevailing easterly winds transport much of the suspended sediments westward toward the Chernier Plain in a well-defined mud stream. Westerly flow rates of 25-50 cm/s (21-43 km per day) have been measured, yielding a transit time of about 1.5-2.5 days from the mouth of Atchafalaya Bay to the Chernier Plain. Progradation rates along the Chernier Plain coast reach 50 m per year. The westward-flowing Atchafalaya 'mud stream' is rapidly disrupted by westerly winds and northerly winds, which accompany frequent winter storms and less frequent tropical storms or hurricanes. During these events, the coastal current reverses and sediments are rapidly transported out of Atchafalaya Bay and offshore where substantial sedimentary deposits can also be found. Offshore sediment fluxes during storm events, in combination with wind-wave resuspension, can result in surface sediment 'plumes' extending 70 km offshore and 150 km alongshore. Field measurements of suspended sediment concentrations, current and wind velocities, and directions are used to assess sediment transport processes on the shelf. These combined processes are extending the pro-delta deposits of the Atchafalaya-Wax Lake delta complex far onto the continental shelf and supplying sediments for a renewal era of progradation along tbe downdrift Chernier Plain coast.

Author

Sediment Transport; Plumes; Atchafalaya River Basin (LA); Advanced Very High Resolution Radiometer; Satellite Imagery; Sediments; Coastal Currents

20050061077 Stanford Univ., Stanford, CA, USA

A Computational and Experimental Investigation of Flow Inside Branched Coral Colony

Chang, S.; Iaccarino, G.; Elkins, C.; Eaton, J.; Monismith, S.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 45-54; In English; See also 20050061070

Contract(s)/Grant(s): NSF OCE-01-17859; NSF OCE-04-25312; No Copyright; Avail: CASI; A02, Hardcopy

Coral reefs have the highest biodiversity of any marine ecosystem. Though they cover only 15% of the ocean surface between the depth of 0 to 30 meters, coral reefs shelter nearly a quarter of all marine life. The host of organisms that thrive in the reef system, of which only about 10% have been described, bears tremendous potential for modern medicine. Furthermore, coral reefs are important economic resources, serving as fisheries and breakwaters for coastal communities. Derived from text

Computation; Experimentation; Colonies; Coral Reefs; Ecosystems; Marine Biology

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*.

20050041945 Columbia Univ., New York, NY, USA

Development and Function of the Mouse Vestibular System in the Absence of Gravity Perception

Wolgemuth, Debra J.; January 2005; 5 pp.; In English

Contract(s)/Grant(s): NAG2-1345; No Copyright; Avail: CASI; A01, Hardcopy

The hypothesis that was tested in this research was that the absence of gravity perception, such as would occur in space, would affect the development and function of the vestibular and central nervous systems. Further, we postulated that these effects would be more significant at specific stages of post-natal development of the animal. We also proposed the use of molecular genetic approaches that would provide important information as to the hierarchy of gene function during the

development and subsequent function of the vestibular system. The tilted (tlt) mutant mouse has been characterized as lacking the ability to provide sensory input to the gravity receptors. The tlt/tlt mutant mice were a particularly attractive model for the study of vestibular function since the primary defect was limited to the receptor part of the vestibular system, and there were no detectable abnormal phenotypes in other organ systems. The goal of the proposed studies was to assess immediate and delayed effects of the lack of gravity perception on the vestibular system. Particular attention was paid to characterizing primarily affected periods of vestibular morphogenesis, and to identifying downstream genetic pathways that are altered in the CNS of the tlt/tlt mutant mouse. The specific aims were: (1) to characterize the postnatal morphogenesis of the CNS in the tlt mutant mouse, using detailed morphometric analysis of isolated vestibular ganglia and brain tissue at different stages of postnatal development and assessment of apoptotic cell death; (2) to examine the expression of selected genes implicated by mutational analysis to be important in vestibular development or function by in situ hybridization or immunohistochemistry in the mutant mice; and (3) to identify other genes involved in vestibular development and function, using differential cloning strategies to isolate genes whose expression is changed in the mutant versus normal vestibular system.
Author
Gravitational Effects; Mice; Mutations; Vestibules; Gravity Perception; Gravitational Physiology

20050050935 Defence Science and Technology Organisation, Edinburgh, Australia
Overview of Biotechnology Futures: Possible Applications to Land Force Development
Egudo, Margaret; November 2004; 35 pp.; In English
Contract(s)/Grant(s): ARM-01/066
Report No.(s): DSTO-GD-0419; DODA-AR-013-254; Copyright; Avail: Other Sources

This review of selected scientific and technological advances occurring in the field of biotechnology discusses their possible impact for Land Force capability development in the next decade or two. Some studies suggest that the socio-technical impact of biotechnology may surpass that of the Information Revolution, and it could become a major force in the 21st Century. Its synergy with nanotechnology, materials and information technology has led to the development of new and revolutionary applications that are likely to be adopted in agriculture, health, environmental applications, manufacturing industries, and by the military. The implication of this technological impact has raised complex social, political and legal issues all of which will impact to some degree on the future Land Forces and their operational environment. This report discusses these issues both in relation to how they may affect society and hence future contexts, and their pertinence to the future military in terms of direct application of these technologies.
Author
Biotechnology; Military Technology; Technology Assessment

20050051007 RAND Corp., Santa Monica, CA USA
The First National Report Card on Quality of Health Care in America
Jan. 2004; 4 pp.; In English
Report No.(s): AD-A427447; No Copyright; Avail: CASI; A01, Hardcopy

How good is the quality of health care in America? To answer this question Elizabeth McGlynn led a team of experts in the largest and most comprehensive examination ever conducted of health care quality in the USA. Called the Community Quality Index Study it assessed the extent to which recommended care was provided to a representative sample of the U.S. population for a broad range of conditions in 12 metropolitan areas. Designing a National Report Card on Quality of Care The Community Quality Index Study differs from previous assessments of quality because it was more comprehensive, examined quality across the nation rather than in one geographic area, and included people with all types of insurance and a wide range of conditions. The research team used random telephone surveys to interview more than 13,000 adults in 12 metropolitan areas regarding their health care experiences (see Figure 1). About 6,700 individuals provided written consent for researchers to review their medical records and use the information to evaluate performance on 439 clinical indicators of quality for 30 acute and chronic conditions, such as diabetes mellitus, asthma, hypertension (high blood pressure) and heart disease, and for related preventive care.
DTIC
Cardiovascular System; Cards; Health; Heart Diseases; Management Systems; Medical Services

20050051008 Queens Univ., Kingston, Ontario Canada
The Role of Fps in Tumor-Associated Angiogenesis
Sangrar, Waheed; Greer, Peter A.; Jul. 2004; 114 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0382
Report No.(s): AD-A428164; No Copyright; Avail: CASI; A06, Hardcopy

Fps and Fer are members of a unique family of cytoplasmic tyrosine kinases. Transgenic expression of Fps in mice (fps(exp MF)) gave rise to hyper-vascularity and multi-focal hemangiomas implicating this kinase in angiogenic regulation. This phenotype suggested that tumorigenesis and metastases may be promoted in these mice and conversely, inhibited in fps loss-of-function mice. Surprisingly, we observed early onset of tumors in fps loss-of-function mice (relative to wild type) suggesting that Fps has a tumor suppressor-like function. Characterization of the vessels in fps(exp MF) mice showed that their vessels were leaky, and that vascularity was increased approximately 1.7-fold. In addition, it was shown that the vascular defects in these mice correlated with VFGF- and PDGF-activation of gain-of-function Fps in endothelial cells. Numerous hematological and hemostatic defects associated with the angiogenic phenotype were also observed. Interestingly, these abnormalities were reminiscent of Kasabach Merritt Syndrome and disseminated intravascular coagulation. Collectively, these data suggested that the vascular abnormalities in fps(exp MF) mice are a result of a defect/delay in vascular maturation. As well, they suggest that Fps influences the processes of angiogenesis and hemostasis through regulatory effects on the endothelium.
DTIC
Breast; Cancer; Cytoplasm; Endothelium; Mammary Glands; Tumors

20050051009 Colorado Univ., Denver, CO USA
Index of Suspicion Case Report 16 y/o Boy with X-Linked Adrenoleukodystrophy Presented as Degenerative CNS Disorder
Phalen, James A.; Moe, Paul G.; Jan. 2004; 8 pp.; In English
Report No.(s): AD-A428340; CI04-903; No Copyright; Avail: CASI; A02, Hardcopy

A 16-year-old boy comes to the neurologist because of new-onset seizures. He had two generalized tonic seizures one week apart. Since starting carbamazepine, he has had no further events. The boy denies recent illness or fever, and use of medications, alcohol, tobacco, or illicit substances. His mother describes problems with memory and activities of daily living. Gestation, delivery, and early development were uneventful. He requires special education for attention-deficit/hyperactivity disorder (ADHD) and slowly worsening learning difficulties. Cognitive testing at age 13 showed a full-scale intelligence quotient (IQ) of 80. On physical examination, the boy is of average height, but thin with a body mass index of 17.5 (5th percentile). He has large ears, high-arched palate, normal-sized testes, and no pertinent skin findings. He has mild generalized hypotonia, slightly decreased sensation to vibration and proprioception in his legs, and mild ataxia on tests of coordination and gait. A urine drug screen, serum chemistry panel, and complete blood count are normal. Lumbar puncture reveals a slightly elevated cerebrospinal fluid (CSF) protein of 51 mg/dL (normal, 15 to 45 mg/dL). Computed tomography (CT) of the brain shows hypoattenuation of the white matter and mild dilation of the posterior-lateral ventricles. Magnetic resonance imaging (MRI) with contrast shows moderately extensive symmetric deep white matter disease, mostly posteriorly, without mass effect or contrast enhancement. Electroencephalography (EEG) is normal. Neuropsychological testing reveals dementia and a 28-point drop in full-scale IQ from 80 to 52 over the past 3 years. A blood test leads to the correct diagnosis.
DTIC
Central Nervous System; Convulsions; Disorders; Electroencephalography; Mental Health; Neurology

20050051010 State Univ. of New York, Albany, NY USA
Investigation of Post-Patient Tapered Monolithic Optics for Mammography
Nail, Noor; Jun. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0518
Report No.(s): AD-A428343; No Copyright; Avail: CASI; A02, Hardcopy

Polycapillary x-ray optics, arrays of hollow capillary tubes used to guide x rays by total reflectance, have been shown to have potential in medical imaging at mammographic energies. Placing these optics after the object to be imaged provides very efficient rejection of Compton scatter because of the low angular acceptance of the capillaries. A Polycapillary tapered optic produced reduction in scatter fraction of a factor of 5 at 27 keV and 3 at 45 keV for a 53 mm thick polymethyl methacrylate phantom. The contrast enhancement was a factor of 2 at 27 keV and 1.5 at 45 keV. The scatter fraction and contrast data performed with energy sensitive and imaging detectors were in good agreement. A detailed calculation for comparing these broadband and monoenergenic-input scatter fraction data was performed. The agreement provides an innovative new way to - predict the effect of input spectrum on contrast of an image at different energies. The PI also participated, as part of his training, in a variety of other imaging measurements at mammographic energies, including the use of DCC optics.
DTIC
Medical Services; Patients; X Ray Optics

20050051011 Maryland Univ., Baltimore, MD USA

Genetic Alteration of Metabolism and Tumorigenicity of Prostate Cancer Cells

Feng, Pei; Jun. 2004; 72 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0072

Report No.(s): AD-A428429; No Copyright; Avail: CASI; A04, Hardcopy

It has been well documented that normal prostate contains the highest zinc levels among all other soft tissues in the body. However, once the normal prostate cells transform to malignant cells, the zinc levels decreased significantly. We have demonstrated two major functions of zinc in prostate: metabolic effect and growth effect. This proposal aimed to establish that the prostatic tumor cells are citrate oxidizing cells; and to demonstrate that the alteration of zinc accumulation will alter the citrate production and eventually inhibit the tumor cell growth. The third year study was focused on: 1) to continue the study of the zinc effect on prostate tumorigenicity in vivo; 2) to study the mechanism of zinc induced PC-3 cell apoptosis; 3) to extend our understanding of zinc effect on the relationship of metabolism and growth in prostate tumor cell, the effect of zinc on prostate TRAMP cells was studied. Over the past three years with DOD grant support, we have published 6 papers in peer reviewed journals and prepared 2 manuscripts for submission. We have also presented our research data with 14 published abstracts in academic meetings (see Appendix).

DTIC

Cancer; Genetics; Metabolism; Prostate Gland; Zinc

20050051015 Texas Univ., Dallas, TX USA

Prediction of Breast Cancer Risk by Aberrant Methylation in Mammary Duct Lavage

Euhus, David M.; Milchgrub, Sara; Ashfraq, Raheela; Jul. 2004; 7 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0421

Report No.(s): AD-A428491; No Copyright; Avail: CASI; A02, Hardcopy

Women found to have atypical hyperplasia on a breast biopsy are at significantly increased risk for breast cancer. Nipple duct lavage (NDL) is being promoted by some as a new screening test for atypical hyperplasia, but cytological interpretation is a subjective art and experience indicates that the underlying conditions represented by cytological atypia on NDL can range from intraductal papilloma to ductal carcinoma in situ (DCIS). Laboratory studies indicate that methylation of tumor suppressor genes is an early event in breast carcinogenesis and often represents a cell's attempt to defeat cell cycle control. We have shown previously that methylation of RASSF1A or APC in benign breast epithelium correlates with calculated breast cancer risk and the finding of Cyclin D2 methylation is specific for malignant transformation. We are applying these objective methylation tests to cells obtained by NDL from women with breast cancer, women at increased risk of breast cancer, and women at low or average risk of breast cancer. Successful completion of the project will provide new tools for the objective evaluation of breast epithelial cells obtained by NDL in order to accurately risk stratify women and to enhance the early detection of DCIS.

DTIC

Aberration; Abnormalities; Breast; Cancer; Ducts; Genes; Mammary Glands; Methylation; Risk

20050051018 Chicago Univ., Chicago, IL USA

Modulation of Ras Signaling by NF1 and CrkL in Development

Imamoto, Akira; Jun. 2004; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0639

Report No.(s): AD-A428504; No Copyright; Avail: CASI; A02, Hardcopy

NF1 gene mutations are the genetic basis of neurofibromatosis type 1, a common genetic disorder predisposing patients to neoplasia in the peripheral nervous system and other tissues. The NF1 gene encodes a protein called neurofibromin that may negatively regulate the small G-protein Ras. Abnormal activation of Ras can cause sustained cell survival and growth in some cells (a hallmark of cancer). Aberrant Ras signaling due to a mutation in the NF1 gene is thought to contribute to the development of dermal neurofibromas and malignant peripheral nerve sheath tumors, characteristic features of neurofibromatosis type I. We have recently generated a model in which the gene encoding the adapter protein CrkL is disrupted resulting in a phenotype similar to that of NF1 disruption, including heart defects (double outlet right ventricle and ventricular septal defect), exencephaly and peripheral nerve defects. Our preliminary analysis of the CrkL mutant phenotype indicates that CrkL is essential for neural crest cells. We propose in this application to study the biological role of CrkL during development in conjunction with NF1 (Specific Aim 1) and to determine the role of the CrkL protein in regulation of Ras signaling in neural crest cells (Specific Aim 2).

DTIC

Modulation; Proteins

20050051019 Baylor Coll. of Medicine, Houston, TX USA

Progesterone Regulation of Insulin Receptor Substrates Mediates Focal Adhesion Formation in Breast Cancer Cells

Cui, Xiaojiang; Lee, Adrian; Jul. 2004; 34 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0133

Report No.(s): AD-A428512; No Copyright; Avail: CASI; A03, Hardcopy

Both progesterone and the IGFs are critically involved in the development of the mammary gland and breast cancer. How they interact with each other to regulate breast cancer progression is not clear yet. In this study, we found that progesterone potentiates IGF-I action in breast cancer cells. Specifically, IRS-2 expression was markedly induced by progesterone, while IRS-i and lOF-IR levels were not changed. This progesterone effect on IRS-2 was mediated by PR-B and via a transcriptional mechanism. Furthermore, progesterone treatment enhanced activation of IGF-I-induced Erk and Akt signaling downstrearn of IRS -2. Iterestingly, progesterone enhanced IGF-induced cell mobility while it showed no or little effect on cell cycle progression. This progesterone increase of IGF-I-induced cell motility was mediated by IRS-2 increase as blockade of IRS-2 expression by IRS-2 si-RNA transfection impaired the progest&one effect, which was probably not via Erk and Akt signaling. These data, together with previous findings that IRS-2 is activated by integrins, suggest that IRS-2 may be involved in progestin increase of IGF-induced cell motility. Our study may also provide a clue to the question of why progestins in hormone replacement therapy would enhance the risk of breast cancer in comparison to estrogen use.

DTIC

Adhesion; Breast; Cancer; Females; Hormones; Insulin; Substrates

20050051020 California Univ., San Francisco, CA USA

Effects of Low Level Radiation Exposure on Neurogenesis and Cognitive Function: Mechanisms and Prevention

Fike, John R.; Sep. 2004; 61 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0820

Report No.(s): AD-A428521; No Copyright; Avail: CASI; A04, Hardcopy

Studies were carried out to investigate the radiation response of neural precursor cells in vitro and in vivo, to determine the role of reactive oxygen species (ROS) in the reactions of those cells, and to determine if antioxidant treatment could modify those responses. Our data show that proliferating precursor cells and their progeny are extremely sensitive to low/moderate x-ray doses (2-10 Gy), and that ROS play a major role in the sensitivity on these cells and may act in concert with p53 and cell cycle-dependent processes. In addition, conditions of reduced cell density, such as that seen after radiation exposure of the dentate subgranular zone, are associated increased ROS, which may stimulate proliferation in surviving cells. Modulating ROS using antioxidant compounds may provide a means to control proliferation in damaged cells allowing for repair and recovery after radiation injury. We have begun to address specific mechanistic factors that are not only associated with oxidative processes, but that may provide additional targets for interventional treatment. The ability to ameliorate the radiation effects on neural precursor cells may provide a potential protective strategy for individuals exposed-to unplanned exposure to low/moderate doses of irradiation.

DTIC

Prevention; Radiation Dosage; Radiation Effects

20050051021 Thomas Jefferson Univ., Philadelphia, PA USA

Intermittent Ultrasound Imaging of Prostate Cancer

Halpern, Ethan J.; Aug. 2004; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0061

Report No.(s): AD-A428523; No Copyright; Avail: CASI; A03, Hardcopy

This study proposed to evaluate contrast-enhanced ultrasound imaging with a microbubble contrast agent in 300 subjects in order to improve the detection of prostate cancer. Between October 2001 and January 2004 a total of 301 subjects were enrolled. Laboratory blood tests (PSA) and ultrasound evaluations were completed on all 301 subjects (including the primary ultrasound interpretation worksheet). Independent blinded readers have reviewed the first 241 subjects. Pathological review for the presence and grade of cancer has been completed for all 301 subjects. CD3l staining for micro-vessel density has been performed on the first 40 subjects. All available data has been entered into a computer database using an Excel spreadsheet. A statistical analysis of the prostate cancer detection data from all 301 subjects was incorporated into two abstracts that have been accepted for presentation at the 2004 annual meeting of the Radiological Society of North America (see appendix). A preliminary microvessel density analysis was presented at the annual meeting of the American Institute of Ultrasound in

Medicine (see appendix). A one year no cost extension has been requested to allow completion of the micro-vessel density analysis as well as the blinded review of the final 60 subjects.
DTIC
Cancer; Imaging Techniques; Medical Science; Prostate Gland; Ultrasonics

20050051022 City of Hope Medical Center, Duarte, CA USA
Anti-Angiogenic Gene Therapy of Prostate Cancer with Lentiviral Vectors
Yes, Jiing-Kuan; Jul. 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0043
Report No.(s): AD-A428533; No Copyright; Avail: CASI; A03, Hardcopy

Tumor progression induces the growth of endothelial cells by releasing angiogenic factors. This is accompanied by down-regulation of local tissue inhibitors of endothelian cell proliferation such as angiostatin and endostatin. Both proteins target normal endothelial cells and effectively regress large tumors in animals. However, animal studies demonstrate that an effective treatment requires long-term administration of angiogenesis inhibitors. Thus, delivery of angiogenesis inhibitor genes to tumor sites should increase local concentration of these proteins, leading to the retardation of tumor progression and metastasis. During this finding period, we have established stable human prostate cancer cell lines derived from PC3 cells transduced with HIV7/endo, HIV7/angio or both together. Expression of the angiogenesis inhibitors did not affect the proliferation of PC3 cells significantly. These PC cell lines produced and secreted sufficient amounts of angiogenesis inhibitors to inhibit the proliferation of primary human primary human umbilical vein endothelial cells (HUVEC) in culture. Subcutaneous implantation of these cells onto nude mice demonstrates that both proteins exert an effect on the ability of PC3 cells to form tumor in vivo.
DTIC
Cancer; Gene Therapy; Prostate Gland

20050051023 International Medical Programs, Albany, NY USA
IMPGSS - International Medical Program Global Satellite System
Ciccio, Samuel S.; Feb. 2004; 81 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0058
Report No.(s): AD-A428534; No Copyright; Avail: CASI; A05, Hardcopy

The advantages and disadvantages of advanced medical education content delivery via different C currently commercially available means such as satellite, internet subscriber digital network (ISDN) lines and the Internet are being examined in-depth. A viable and adaptable Transmission Configuration profile, with a range of associated utilization parameters and capabilities, will result as a basis for cost-efficient, value-added advanced medical education content dissemination. This Transmission Configuration profile will be highly relevant and adaptable to country content delivery strategies where a reasonably effective wide area network (WAN) is available. The range of offerings will encompass one-way through highly interactive expert/participant sessions with possibly segmented (segmented with different physical or electronic positioning of session moderators/managers/leaders) local/regional and international panel leaders. Additionally, the use of different software, techniques, electronic educational tools, system integration approaches in combination with adaptation of evaluation/feedback input allowed by the recent evolution of available electronic education software, provides the basis for designing content delivery strategies that result in more effective knowledge transfer. The end result will lead to an enhanced ability to better leverage the knowledge transfer and exchange process.
DTIC
Global Positioning System; Medical Science; Satellite Networks; Wide Area Networks

20050051024 Finch Univ. of Health Sciences/Chicago Medical School, Chicago, IL USA
Improving Quality of Life in Ovarian Cancer Patients: A Brief Intervention for Patients and Their Partners
Zakowski, Sandra G.; Sep. 2004; 28 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0722
Report No.(s): AD-A428535; No Copyright; Avail: CASI; A03, Hardcopy

The current study examines the effects of a psychological intervention that encourages emotional expression in ovarian cancer patients and their partners. Ovarian cancer patients (n=130) and their partners are randomly assigned to an intervention or a control group. Following Pennebaker's model, subjects in the intervention group are asked to write about their deepest thoughts and feelings regarding their cancer experience for 20 minutes each day for three consecutive days. The control group

is asked to write about trivial non- emotional topics. Outcome variables including psychological distress, quality of life, and physical symptoms is assessed at baseline and over a period of nine months after the intervention (one week, three, six, and nine months). In accordance with our approved Statement of Work data collection is currently underway. To date 80 subjects have been enrolled and are at various stages of the data collection process. Data processing is continuing as planned, including data entry and verification, which has been completed for all subjects currently enrolled in the project. Preliminary data analyses are being conducted.
DTIC
Cancer; Ovaries; Patients

20050051025 Yale Univ., New Haven, CT USA
Interdisciplinary Research Training in Breast Cancer
McCorkle, Ruth; Jul. 2004; 25 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0509
Report No.(s): AD-A428536; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this predoctoral and postdoctoral training program is to prepare clinical researchers who will impact the care of women with breast cancer or women who are at risk for breast cancer. The predoctoral program prepares the beginning researcher with the knowledge and skills necessary to develop and test clinical interventions. This program builds on the Yale School of Nursing's current doctoral program. Postdoctoral training prepares the investigator to conduct more complex studies which involve an interdisciplinary perspective or the need for sophisticated analytic techniques. The research training program in breast cancer has completed its second year and all positions have been filled with outstanding trainees. Faculty across disciplines are collaborating and joint initiatives have been established. These activities are enhancing our ability to contribute to the knowledge base related to the care of women with breast cancer or women at risk to develop breast cancer.
DTIC
Breast; Cancer; Education; Mammary Glands; Research Management

20050051026 Beth Israel Deaconess Medical Center, Boston, MA USA
A Novel Prostate Epithelium-Specific Transcription Factor in Prostate Cancer
Libermann, Towia A.; Jun. 2004; 34 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0023
Report No.(s): AD-A428537; No Copyright; Avail: CASI; A03, Hardcopy

Prostate cancer has become the most common solid cancer in older men and is one of the most frequent causes of cancer deaths. The poor prognosis for advanced prostate cancer reflects in part the lack of knowledge about the tumor's basic biology. Our goal is to understand the role of a novel prostate-specific transcription factor, PDEF, a member of an oncogene family in human-prostate cancer. Expression of this factor is significantly elevated in cancerous portions of the-prostate. PDEF appears to be involved in regulating expression of the diagnostic prostate cancer marker PSA and cooperates with the androgen receptor. Thus, our hypothesis is that PDEF contributes to the progression from an initially hormone-dependent prostate cancer to a hormone-independent cancer. We propose to determine the role of this novel gene in prostate cancer using , cell culture models, animal models and patient samples of prostate cancer. Our results strongly suggest that PDEF plays a critical role in prostate cancer formation - or progression. Our long term goal is to explore the possibility to use this new factor as another diagnostic tool and as a potential therapeutic target for prostate cancer.
DTIC
Cancer; Epithelium; Prostate Gland

20050051027 Albert Einstein Coll. of Medicine, Bronx, NY USA
Mts1: A Molecular Link Between the Cytoskeleton and Breast Tumor Metastasis
Breanick, Anna; Jul. 2004; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0122
Report No.(s): AD-A428538; No Copyright; Avail: CASI; A03, Hardcopy

The objectives of this grant are: (1) examine how mts1 expression alters directed cellular motility in vitro; (2) generate myosin-IIA antibodies that mimic mts1 binding to examine how the regulation of myosin-IIA affects directed motility in vitro; and (3) utilize an intravital imaging system to evaluate the impact of mts1 expression on metastasis in live animal models. We have established MTC cell lines with high, reliable and heritable mts1 expression and have made significant progress on our in vitro analysis evaluating the effects of mts1 expression on chemoallractant-stimulated motility. In conjunction with these

in vitro analyses, our intravital imaging studies, which visualize the motile behavior of mts1 expressing tumor cells within the primary tumor in situ, are in progress. These combined analyses Nill allow us to obtain a comprehensive behavioral phenotype and will identify which aspects of directed motility are sensitive to the expression of mts1. In addition, we identified 16 residues in the myosin-IIA heavy chain that comprise the mtsi binding site and have generated a rabbit polyclonal antibody to the mts1 binding site on the myosin-IIA heavy chain. Immunoblot and immunoprecipitation analyses indicate that the mts1 binding site antibody specifically reacts with nonmuscle myosin-IIA. In vitro assays demonstrate that the mts1 binding site antibody has the same affect on the assembly and actin-activated ATPase activity of myosin-IIA as ntsl. In vivo studies are now direcuy testing if alterations in the directed motility of MTO-mts1 cells are due to the regulation of myosin-IIA function by mts1.
DTIC
Breast; Cancer; Mammary Glands; Metastasis; Neoplasms; Tumors

20050051028 Washington Univ., Seattle, WA USA
Factors Affecting African American Women's Participation in Breast Cancer Screening Programs: A Qualitative Study of Uninsured Low Income Women
Lewis, Frances M.; Aug. 2004; 123 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0493
Report No.(s): AD-A428540; No Copyright; Avail: CASI; A06, Hardcopy

Breast cancer screening programs offer the greatest promise for many detection but rates of participation in free screening programs have been disappointing or challenged populations. The purpose of the current study was to elaborate the beliefs and culturally embedded meanings that a population of low income, uninsured African American women held toward breast cancer and breast cancer screening. Both Phase I and 2 work and analyses have been completed. Phase I involved case intensive elicitation interviews of a population data base of over 600 women who were offered but declined participation in free screening mammogram through the Breast & Cervical Health Program (BCHP) in Washington state. Phase 2 involved focus groups of these women during which time they were asked to critique or elaborate on the results from Phase I analyses. Triangulated and integrated results across both phases of research revealed that an of the assumptions underlying the BCHP are challenged by the beliefs and attitudes of the study participants. Results also offer compelling reasons why NEW educational, outreach and training materials are needed in order to more successfully engage fiscally challenged African American women in breast cancer screening programs.
DTIC
Africa; Breast; Cancer; Females; Income; Mammary Glands

20050051029 Fox Chase Cancer Center, Philadelphia, PA USA
Pharmacogenetic Factors Contributing to Variation in Response to Tamoxifen at Raloxifene
Raftogianis, Rebecca B.; Jul. 2004; 51 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0248
Report No.(s): AD-A428541; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of these studies was to elucidate the pharmacogenetic factors that contribute to variation in human response to tamoxifen (TAM) and raloxifene (RAL). We had previously identified and partially characterized common genetic polymorphisms in two human drug-metabolizing genes, SULT1A1 and UGT1A6. We hypothesized that these polymorphisms contributed to variation in TAM or RAL metabolism. These studies were divided into three aims with the purpose of 1) biochemically characterizing the contribution of these enzymes to the metabolism of TAM and RAL; 2) developing cell model systems to study allele-specific differences in cellular response to these molecules and; 3) perform a clinical pharmacogenetic study to evaluate the association of common genetic polymorphisms in drug metabolizing genes with variable clinical response to TAM. We determined that SULT1A1 and UGT1A6 contributed to the inactivation of 4-hydroxytamoxifen (OHT), the active metabolite of TAM, and that a separate enzyme, UGT1A9 catalyzed the glucuronidation of RAL. We established MCF-7 breast cancer cell lines stably expressing the wildtype and variant SULT1A1 alleles and have measured allele-specific differences in the response of these cells to estrogens and OHT. These studies suggest that pharmacogenetic factors might contribute to variable cellular response to antiestrogens.
DTIC
Breast; Cancer; Mammary Glands

20050051030 Strang Cancer Prevention Center, New York, NY USA
Cox Model for Interval Censored Data in Breast Cancer Follow-Up Studies
Wong, George Y.; Jul. 2004; 46 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0448
Report No.(s): AD-A428542; No Copyright; Avail: CASI; A03, Hardcopy

The overall objective of this research proposal is semi-parametric inference of the Cox proportional hazards (pH) regression model for a survival function Pr(X \g x I Z = z) = S(x I z) = S 0 (x)ezbeta , where X is a time-to-event variable. which is subject to interval censoring, Z represents the covariates, S0 is a baseline survival function, and beta represents the regression coefficients. The main objective of our research is to develop asymptotic inferences of the generalized maximum likelihood estimators (GMLE) of beta and S(. I z). A critical limitation with GMLE under interval censoring is that it is computationally feasible only for a small data set. We therefore propose to also investigate asymptotic properties of a computationally simpler alternative to GMLE, namely two-stage estimators (TSE) of beta and S(. I z) obtained by a two-stage modified Newton-Raphson algorithm involving data grouping. In the four years of our research, we have implemented a foolproof algorithm for obtaining TSE, proved consistency and established asymptotic normality for both GMLE and TSE under both discrete and continuous distributional assumptions, and proposed new diagnostic method for PH assumption. Also, we have successfully applied our asymptotic Cox regression methodology to the analysis of a large-scale, long-term breast cancer relapse follow-up study. Our results will be useful to data analysis of breast cancer relapse follow-up studies, chemoprevention intervention trials and genetic studies on familial aggregation of breast cancer and related cancers.
DTIC
Breast; Cancer; Censored Data (Mathematics); Mammary Glands

20050051031 Arizona Univ., Tucson, AZ USA
A Molecular Model for Repression of BRCA-1 Transcription by the Aryl Hydrocarbon Receptor
Romagnolo, Donato F.; Jul. 2004; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0130
Report No.(s): AD-A428543; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this project is to investigate whether or not regulation of expression of the BRCA-1 gene in breast epithelial cells exposed to polycyclic aromatic hydrocarbons (PAHs) is mediated by the aryl hydrocarbon receptor (AhR). The scope of the project is to examine whether or not the AhR complexed with the AhR-nuclear transporter (ARNT protein, binds to several xenobiotic responsive elements (XRE) strategically located at -539 bp (CCGTGGAA=Cyp1A1-like) and +20base pairs (bp) (GCGTG=XRE-1) from the transcription start site on exon-1A. Two additional XREs (GCGTG) have been localized at -107 bp in the intervening sequence upstream (XRE-2) and +218 bp (XRE-3) into exon-1B. Findings of the experiments conducted during the lest period include: 1) Completed testing of mutation contructs for XRE2 and investigated the effects of antagonists of the AhR and ER-alpha on regulation of BRCA-1 transcription by estrogen and the dioxin-like compound TCDD in breast cancer MCF-7 cells. 2) Characterized the mechanism of interaction between the ER-alpha and the AhR at the XRE-2 by chromatin immunoprecipitation assay (ChIP).
DTIC
Breast; Cancer; Hydrocarbons; Mammary Glands; Radicals

20050051032 Texas Univ., Houston, TX USA
New Agents for Taxol-Resistant Ovarian Carcinoma
Klostergaard, Jim; Jul. 2004; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0726
Report No.(s): AD-A428544; No Copyright; Avail: CASI; A02, Hardcopy

Taxol resistance is an important issue in relapsing% ovarian cancer. Two approaches to address this resistance include the use of drug copolymers and drug targeting. In this proposal, paclitaxel covalently coupled to backbones of poly(L-glutamic) acid (non-targeted) or hyaluronic acid (CD44 targeted) as prodrugs will be evaluated in CD44 over-expressing human ovarian carcinoma i.p. (orthotopic) xenografts. We have now documented both the greatly reduced toxicity as well as the anti-tumor efficacy of a lead formulation of HA-TXL compared to Taxol in human ovarian tumor (NMP-1)-bearing nude mice. Additional studies will attempt to develop a superior HA-TXL formulation and compare its toxicity and efficacy to PGA-TXL, which is already in clinical trials.
DTIC
Cancer; Ovaries

20050051035 Massachusetts Univ., Amherst, MA USA

Intervention Study of Flaxseed in Postmenopausal Women: Effects on Hormonal Biomarkers of Breast Cancer Risk

Sturgeon, Susan R.; Jul. 2004; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0470

Report No.(s): AD-A428548; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this study is to determine if flaxseed supplementation to usual diet in postmenopausal women has a beneficial effect on important hormonal biomarkers of breast cancer risk. The specific aims of this study are to determine if (1) flaxseed intake lowers serum levels of estradiol and testosterone and increases serum levels of sex-hormone binding globulin; (2) flaxseed intake increases the urinary excretion ratio of 2/4-OHE1 and 2/16a-OHE1 and decreases the urinary excretion ratio of genotoxic estrogen metabolites to total estrogens (16a-OHE1 + 4-OHE2 + 4OHE1)/total estrogens; and (3) higher doses and longer duration of flaxseed intake results in greater changes to the aforementioned variables. Participants will receive 6 weeks of usual diet plus 12 grams per day of raw flaxseed, followed by 6 weeks of usual diet plus 24 grams per day of raw flaxseed. Serum and urinary levels of hormonal biomarkers of breast cancer risk will be assessed at baseline, 7 weeks, and 13 weeks.

DTIC

Biomarkers; Breast; Cancer; Estrogens; Hormones; Mammary Glands; Risk

20050051036 Indiana Univ., Indianapolis, IN USA

Translational Regulation of PTEN/MMAC1 Expression in Prostate Cancer

Zhang, Jian-Ting; May 2004; 13 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0073

Report No.(s): AD-A428550; No Copyright; Avail: CASI; A03, Hardcopy

In this project, we proposed to use a dicistronic expression system to determine whether the long 5'-UTR sequence of PTEN contains internal ribosome entry site (IRES) which can mediate cap-independent translation. In the first year of the study, we have accomplished the proposed work as planed. We found that the long 5'-UTR sequence of PTEN inhibits cap-dependent translation and that a region in the 5'-UTR sequence of PTEN has an activity to enhance the expression of the second cistron in a dicistronic assay. However, during the second year of studies when the 5'-UTR sequence of PTEN was cloned into the promoterless dicistronic vector and tested for its stimulatory activity for the expression of the second cistron, we found that the 5'-UTR of PTEN has a strong promoter instead of the previously proposed IRES. We have now mapped this promoter and it is likely responsible for Constitutive production of the PTEN mRNAs with shorter 5'-UTRs which would be compatible for cap-dependent translation initiation.

DTIC

Cancer; Prostate Gland

20050051037 British Columbia Univ., Vancouver, British Columbia Canada

A Phase I/II Study of Combination Neoadjuvant Hormone Therapy and Weekly OGX-011 Prior to Radical Prostatecomy in Patients With Localized Prostate Cancer

Chi, Kim N.; Aug. 2004; 14 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0226

Report No.(s): AD-A428552; No Copyright; Avail: CASI; A03, Hardcopy

The clusterin gene encodes a cytoprotective chaperone protein that promotes cell survival. Clusterin is expressed in a variety of cancers including prostate, increases in response to apoptotic stimuli, and in pre-clinical models confers a resistant phenotype. OGX-011-is a 2nd generation antisense complimentary to cluster in mRNA that inhibits expression of cluster in xenograft models and thereby increases sensitivity to therapy. To evaluate OGX-011 as a potential treatment in humans, we have undertaken this Phase I/II study to evaluate the clinical, pathologic and biologic effects of OGX-011, in combination with neoadjuvant hormone therapy (NHT) in patients with prostate cancer and high risk features prior to radical prostatectomy. The primary objective of the phase 1 study was to determine phase II dose based on target regulation effect in addition to standard toxicity parameters. The phase II component of this trial will assess the effects of combined NHT and OGX-011 on pathologic complete response. Progress: 25 patients were enrolled to 6 cohorts with doses of OGX-011 up to 640mg delivered. Toxicity was limited to grade 1/2, including fevers, rigors, fatigue and transient AST and ALT elevations. There were no dose-limiting toxicities. Plasma PK analysis showed linear increases in AUC and Cmax with a t1/2 of approximately 2h. Prostate tissue concentrations of OGX-011 increased with dose, and tissue concentrations associated with preclinical effect could be achieved. Dose dependent decreases in prostate cancer cell clusterin expression were observed by QRT-PCR and immunohistochemistry (IHC). At 640mg dosing, clusterin mRNA was decreased to a mean of 8% (SD=4%) compared with lower dose levels and

historical controls as assessed by QRT-PCR on laser captured microdissected cancer cells. By IHC, mean % cancer cells staining 0 intensity for clusterin protein at 640mg dosing was 54% (SD=24%) compared with 2-15% for lower dose levels and historical controls.
DTIC
Cancer; Hormones; Patients; Prostate Gland; Radicals; Therapy

20050051040 Georgetown Univ., Washington, DC USA
Role of GIF1 (GADD45 Interacting Factor 1) in Breast Cancer
Bae, Insoo; Jun. 2004; 70 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0525
Report No.(s): AD-A428560; No Copyright; Avail: CASI; A04, Hardcopy

Gadd45, a DNA damage inducible gene, plays role(s) in DNA repair and regulation of cell proliferation. Using yeast two hybrid system, we identified a novel gene whose products interact with GADD45 alpha and named it as GIF1 (Gadd45 alpha Interacting Factor 1). Alternative name of GIF1 is CRIF1 (=CR6 interacting factor 1, CR6=Gadd45 gamma). During the first year of finding period, we reported that a physical interaction of Gadd45 family proteins and GIF1 in mammalian cells using IP and GST pulldown assay. In the same paper, we also reported that GIF1 inhibits the cyclin-dependent kinases, Cdc2/cyclin Bl kinase and Cdk2/cyclin E, so it renders inhibition of the cell cycle progression at the G1/S phase and suppresses growth in serum stimulated NIH3T3 cells. In order to introduce GIF1 efficiently into breast cancer cells, we constructed rAd-GIF and confirmed that exogenous GIF expression in breast cancer cell lines. Infection of rAd-GIF1 increased cells in G1 phase in human cells. To extend our study we performed another round of yeast hybrid screening and found GIF interact with two other nuclear hormone receptor, NUR77 and Androgen receptor. We submitted a manuscript titled as 'CR6 Interacting Factor 1 (CRIF1) inhibits with Orphan Nuclear Receptor Nur77 and inhibits its transactivation'. Before initiating Task3 (role of GIF1 in response to cytotoxic agents), we examined whether GIF1 mRNA is inducible in response to stress such as X-ray, MMS, UVB, H2O2, ADR (adriamycin), Thapsigargin, Taxol, Camptothecin, Cis-Platinurn, TPA, Nacl, Heat shock, Arsenic in TK6 (p53wt), NH32 (p53 KO) and MCF-7 breast cancer cells. In this experiments we concluded that GIF1 is not a stress inducible gene.
DTIC
Breast; Cancer; Mammary Glands

20050051043 Georgetown Univ., Washington, DC USA
Examination of the Contribution of VEGF to the Metastatic Dissemination of c-Myc Overexpressing Breast Cancer Cells
Johnson, Michael; Jul. 2004; 22 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0255
Report No.(s): AD-A428564; No Copyright; Avail: CASI; A03, Hardcopy

Metastasis to the lung is a common occurrence accounting for approximately 60-70% of metastasis. We have developed a transgenic model of lung metastasis using a MMTV-c-myc/MMTV-VEGF bitransgenic mouse system. This system and fluorescent variants thereof have been used to examine the importance of VEGF to the metastatic behavior of these cells. We have shown that, surprisingly, the MMTV-c-myc model in fact exhibits much more metastatic potential than previously appreciated, but that c-myc/VEGF cells produce a dramatic stromal reaction in the lung of mice which results in considerable morbidity. The use of EGFP expressing mice as hosts for red-fluorescent tumor cells has greatly facilitated our ability to examine-the processes of extravasation and local tumor cell spread.
DTIC
Breast; Cancer; Mammary Glands; Metastasis

20050051046 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Monkeypox detection in rodents using real-time 3'minor groove binder Taqman assays on the Roche LightCycler, Laboratory Investigation 84:1200 - 1208
Kulesh, David A.; Loveless, Bonnie M.; Norwood, David; Garrison, Jeffrey; Whitehouse, Chris A.; Jun. 2004; 11 pp.; In English
Report No.(s): AD-A428570; RPP-04-279; No Copyright; Avail: Defense Technical Information Center (DTIC)

During the summer of 2003, an outbreak of human monkeypox occurred in the Midwest region of the USA. In all, 52 rodents suspected of being infected with monkeypox virus were collected from an exotic pet dealer and from private homes.

The rodents were euthanized and submitted for testing to the USA Army Medical Research Institute of Infectious Diseases by the Galesburg Animal Disease Laboratory, Illinois Department of Agriculture. The rodent tissue samples were appropriately processed and then tested by using an integrated approach involving real-time polymerase chain reaction (PCR) assays, an antigen-detection immunoassay, and virus culture. We designed and extensively tested two specific real-time PCR assays for rapidly detecting monkeypox virus DNA using the Vaccinia virus F3L and N3R genes as targets. The assays were validated against panels of orthopox viral and miscellaneous bacterial DNAs. A pan-orthopox electrochemiluminescence (ECL) assay was used to further confirm the presence of Orthopoxvirus infection of the rodents. Seven of 12 (58%) animals (seven of 52 (15%) of all animals) tested positive in both monkeypox-specific PCR assays and two additional pan-orthopox PCR assays (in at least one tissue). The ECL results showed varying degrees of agreement with PCR. One hamster and three gerbils were positive by both PCR and ECL for all tissues tested. In addition, we attempted to verify the presence of monkeypox virus by culture on multiple cell lines, by immunohistology, and by electron microscopy, with negative results. Sequencing the PCR products from the samples indicated 100% identity with monkeypox virus strain Zaire-96-I-16 (a human isolate from the Congo). These real-time PCR and ECL assays represent a significant addition to the battery of tests for the detection of various orthopoxviruses.
DTIC
Assaying; Binders (Materials); Grooves; Monkeys; Real Time Operation; Rodents; Viral Diseases; Viruses

20050051047 Howard Univ., Washington, DC USA
Chemomodulation of Doxorubicin Pharmacodynamics
Sridhar, Rajagopalan; Jul. 2004; 89 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8109
Report No.(s): AD-A428571; No Copyright; Avail: CASI; A05, Hardcopy

The project aims to develop;strategies for using doxorubicin in the treatment of multidrug resistant advanced breast cancer while simultaneously minimizing the risk of cardiotoxicity. The wild type MCF-7 breast cancer cells and the multidrug resistant cell line designated as MCF7/ADR were genetically unrelated. This slowed the progress of our research. However, genetically related MCF-7 wild type and its genetically related multidrug resistant variant were acquired and used successfully in our studies. We have found that in general, multidrug resistance reversing agents inhibit free radical mediated microsomal lipid peroxidation, but do not inhibit the conversion of doxorubicin to its semiquinone free radical. Several potent multidrug reversing agents have been identified. Several antiestrogens including tamoxifen sensitized drug resistant breast cancer cells to cyctoxicity of doxorubicin. The natural product tetrandrine and the anti diarrhea medicine loperamide were potent agents for reversing multidrug resistance. Both dipyridamole and raloxifene resembled tamoxifen in potentiating the cytotoxicity of doxorubicin towards MCF7/ADR cells, and inhibiting doxorubicin mediated microsomal lipid peroxidation. Raloxifene, dipyridamole and tamoxifen can inhibit protein kinase C, which is an attractive target for modulating multi drug resistance. Nicotine, which is cardiotoxic, can activate protein kinase C pathway. Raloxifene, tamoxifen and dipyridamole have basic amino groups in common, but unlike nicotine, they inhibit protein kinase C and sensitize multidrug resistant cells.
DTIC
Breast; Cancer; Mammary Glands

20050051048 University of Southern California, Los Angeles, CA USA
Breast Cancer Susceptibility Genes in High Risk Women
Hamilton, Ann S.; Jul. 2004; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0431
Report No.(s): AD-A428572; No Copyright; Avail: CASI; A03, Hardcopy

A positive family history, present in about 30% of breast cancer cases, has been shown to double a woman's risk of breast cancer(l), and this is true for postmenopausal as well as the premenopausal cases, among which the autosomal dominant, relatively high penetrant genes BRACA1 and BRCA2 are most prominent(2) . It has been hypothesized that susceptibility genes of lower penetrance are more prevalent than among the latter, and a likely group of such genes are those that regulate the production, intracellular transport, and metabolism of estrogen (3), the common factor underlying most known predictors of breast cancer risk (4) (5) (6). Recent reviews have identified several candidate genes (7) (8) (9). We have chosen to focus on those genes related to estrogen metabolism and carcinogen metabolism.
DTIC
Breast; Cancer; Females; Mammary Glands; Oncogenes; Risk

20050051049 Howard Univ., Washington, DC USA

A Training Program in Breast Cancer Research Using NMR Techniques

Wang, Paul C.; Jul. 2004; 53 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0291

Report No.(s): AD-A428574; No Copyright; Avail: CASI; A04, Hardcopy

This program has supported four predoctoral students (two students from the Electrical Engineering Department, one medical student and one MD/PhD student from Biochemistry) and three postdoctoral fellows. The new students have been introduced to the Biomedical NMR Laboratory and the Howard University Cancer Center. The trainees have continued to learn the theories and instrumentation behind nuclear MRI. The trainees have rotated through the mammography service in the Radiology Department to learn mammography procedures. Besides attending weekly seminars in the Cancer Center, the trainees also have attended a special seminar series on breast imaging sponsored by this grant Each trainee has actively participated in research projects. Based on the experimental findings, two papers were published and another one has been accepted for publication. Three abstracts have been presented and another two will be presented later this year in the national and international scientific meetings. Two predoctoral students received BS degrees and will attend graduate schools to continue biomedical imaging research. Two new research initiatives have been developed to do molecular imaging of breast cancer and to establish a breast cancer image database for computer-aided-diagnosis research. We have submitted four grant applications-two have received findings and the other two are pending.

DTIC

Breast; Cancer; Education; Mammary Glands; Nuclear Magnetic Resonance

20050051050 Cold Spring Harbor Lab., New York, NY USA

A New Pathway of Chemotherapy Induced Apoptosis in a Prostate Cancer Cell Line

Lazebnik, Yuri; Jun. 2004; 39 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0044

Report No.(s): AD-A428575; No Copyright; Avail: CASI; A03, Hardcopy

We have continued to systematically investigate several possibilities regarding the identity of caspase-P. Our systematic approach to chemotherapy induced apoptosis helped us to advance the understanding of this process and to develop new tools to analyze mechanisms of cell death in tumor cells.

DTIC

Apoptosis; Cancer; Chemotherapy; Prostate Gland

20050051051 Pittsburgh Univ., Pittsburgh, PA USA

Cell Motility in Tumor Invasion

Wells, Alan; Lauffenburger, Douglas A.; Turner, Timothy; Jul. 2004; 60 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0093

Report No.(s): AD-A428576; No Copyright; Avail: CASI; A04, Hardcopy

Our overall objective is to understand how dysregulation of cell migration contributes to tumor cell invasiveness in prostate cancer. A combination of correlative epidemiological studies and basic experimental investigations demonstrate a role for upregulated EGF receptor (EGFR) signaling of motility in tumor progression. EGFR-mediated cell motility has been demonstrated to be critical for tumor invasion. Our central premise is that prostate tumor cell invasiveness can be inhibited by interfering with the specific motility-associated calpain activation that governs the critical underlying biophysical process of de-adhesion. Prior work has shown that integrin/matrix binding and growth factor stimulation jointly regulate cell locomotion. These studies have identified cell/substratum adhesiveness, especially the ability of a cell to detach at its trailing edge, as a primary governor of cell locomotion. We have recently found that this tail detachment is regulated by calpain activation. We are employing a set of model prostate tumor cell lines including a panel of syngeneic androgen-independent DU-145 cells that vary in invasiveness. Our findings in the first year showed that disruption of calpain activation and de-adhesion can block tumor invasiveness in vitro. This has been extended in the second year to demonstrate that this also applies in animal models of tumor invasiveness.

DTIC

Cancer; Locomotion; Prostate Gland; Tumors

20050051052 MacCallum (Peter) Cancer Inst., Melbourne, Australia

Breast Tumor/Stromal Cell Interaction in Bone

Pouliot, Normand; Anderson, Robin L.; Jul. 2004; 41 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0371

Report No.(s): AD-A428577; No Copyright; Avail: CASI; A03, Hardcopy

Breast cancer is a leading cause of cancer mortality among western women. The high incidence of metastatic spread of breast tumors to bone in these women is, for the vast majority, associated with osteolytic lesions leading to significant clinical complications including osteoporosis, hypercalcemia, intractable pain, spinal cord compression and fracture of the long bones that invariably impair the quality of life of those affected (reviewed in (1)). Whilst the mechanisms leading to the preferential metastasis of breast cancer cells to bone remain poorly understood, recent findings from in vitro experiments using normal breast epithelial cells or tumor cells lines (2, 3) and the development of transgenic or xenograft animal models of breast cancer metastasis (reviewed in (4)) strongly support the critical role of the bone stromal microenvironment in the metastatic process and point to considerable cross-talk between bone cells and tumor cells leading to the establishment of secondary tumors in this organ. In particular, the use of an intracardiac injection model (5, 6) has been usefully in unravelling the mechanisms and factors affecting bone remodelling and late stage progression of breast tumor metastasis to bone. However, whilst informative, current models are limited by the low incidence of spontaneous bone metastases and/or only allow the study of specific stages of the metastatic cascade.

DTIC

Bones; Breast; Cancer; Cells (Biology); Mammary Glands; Neoplasms; Tumors

20050051053 New Jersey Medical School, New Brunswick, NJ USA

Interindividual Variation in the Metabolic Activation of Heterocyclic Amines and Susceptibility to Prostate Cancer

Hong, Jun-Yan; Jul. 2004; 25 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0250

Report No.(s): AD-A428578; No Copyright; Avail: CASI; A03, Hardcopy

The etiology of prostate cancer is not well understood. Exposure to carcinogenic heterocyclic amines such as PhIP, formed in high-temperature cooked meat has been implicated as an important risk factor. The Phase I metabolic pathway of PhIP is mainly catalyzed by the human cytochrome P450s 1A2, 1A1, and 1B1 to form 2-hydroxyamino-PhIP (N-hydroxy PhIP), the carcinogenic metabolite, and 4'-hydroxy PhIP (4'- hydroxy PhIP), the non-carcinogenic metabolite. Although epidemiological studies suggest that PhIP may play an important role in the etiology of human colon, breast, or prostate cancer, the capability of these human extrahepatic tissues in metabolizing PhIP has not been well studied. In the present study, metabolic activation of food borne heterocyclic amines in 31 different human prostate microsomes indicates that there is no significant N-hydroxylation of PhIP, IQ, MeIQ and MeIQx.

DTIC

Amines; Cancer; Heterocyclic Compounds; Metabolism; Prostate Gland

20050051054 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Comparative Analysis of the Schleicher and Schuell IsoCode Stix DNA isolation Device and the Qiagen QIAamp DNA Mini Kit

Coyne, Susan R.; Craw, Philip D.; Norwood, David A.; Ulrich, Melanie P.; Oct. 2004; 5 pp.; In English

Report No.(s): AD-A428579; USAMRIID-RPP-04-297; No Copyright; Avail: Defense Technical Information Center (DTIC)

Efficient, rapid, and reproducible procedures for isolating high-quality DNA before PCR gene amplification are essential for the diagnostic and molecular identification of pathogenic bacteria. This study evaluated the Qiagen QIAamp DNA Mini Kit and the Schleicher and Schuell IsoCode Stix DNA isolation device for isolating nucleic acid. Buffer, serum, and whole-blood samples were spiked with Bacillus anthracis Sterne vegetative cells and Yersinia pestis, while water was spiked with B. anthracis Sterne spores. Although minimal variations in limit of detection occurred among matrices, both the IsoCode Stix extraction method and the Qiagen procedure have comparable detection limits.

DTIC

Deoxyribonucleic Acid; Isolation; Kits; Microorganisms; Pathogens

20050051055 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Does the Need Exist to Change the Existing Medical Assemblage Lifecycle Management Process in Order to Successfully Operate in Full-Spectrum Operations

Bowers, Laura E.; Jun. 2004; 92 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428580; No Copyright; Avail: Defense Technical Information Center (DTIC)

Army Medical Department (AMEDD) after-action reviews emerging from healthcare professionals recently redeployed from Operations Enduring Freedom and Iraqi Freedom identified units deploying with insufficient or obsolete medical equipment in their assemblages. The contents of AMEDD sets, kits, and outfits were not optimal for full-spectrum operations. Medical materiel accommodation did not meet clinical demands resulting in upgrades on the fly often achieved by procurement and fielding outside traditional supply-procurement systems. A disparity exists between medical practices in full-spectrum operations and normally accepted standards of professional medical care. The rapid advance of medical science has caused a progressive shift of practice away from the static components held in AMEDD assemblages. This study answers the question: Does the need exist to change the existing medical assemblage lifecycle management process in order to successfully operate in full-spectrum operations? The study leads to the conclusion that the AMEDD must change its process, synchronize with commercial product lifecycles, and improve clinical acceptance. The current process, measured in terms of years, bears no relationship to the lifecycle of materiel. It is not agile, versatile or sustainable enough to keep pace with the ever-changing spectrum of operations and is not responsive to clinical demands, thus indicating diminished capability.
DTIC

Assemblies; Medical Equipment; Medical Services; Military Operations; Spectra

20050051056 Purdue Univ., West Lafayette, IN USA

Functional Analysis of the ErbB4 Receptor Tyrosine Kinase

Riese, David J., II; Jul. 2004; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0415

Report No.(s): AD-A428581; No Copyright; Avail: CASI; A04, Hardcopy

My laboratory studies the signaling network comprised of the epidermal growth factor (EGF) family of peptide hormones and the ErbB family of receptor tyrosine kinases. We are particularly interested in elucidating the roles that these hormones and receptors play in breast cancer and in developing reagents that target these hormones and receptor and may be use in diagnosing or treating breast cancer. In part due to the generous support of this career development award, we have made progress on four fronts. (1) We have identified and characterized novel small-molecule EGFR antagonists. Some of these hold promise as breast tumor imaging agents specific for tumors that overexpress EGFR. (2) We have used a set of constitutively active ErbB4 mutants to determine that ErbB4 signaling inhibits the proliferation of non-malignant and malignant human mammary cell lines. This suggests that ErbB4 may be a mammary-specific tumor suppressor. (3) We have characterized four novel EGF family hormones. (4) Moreover, we have made mutants of two EGF family hormones that have enabled us to identify residues critical for activation of ErbB4 signaling by these hormones. These data may lead to synthetic, specific ErbB4 agonists and antagonists that could be used to define the role of ErbB4 in breast cancer or could be used to prevent breast cancer.
DTIC

Breast; Cancer; Functional Analysis; Mammary Glands; Tyrosine

20050051057 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

DNA Vaccine for West Nile Virus Infection in Fish Crows (Corvus ossifragus)

Turell, Michael J.; Bunning, Michel; Ludwig, George V.; Ortman, Brian; Chang, Jeff; Sep. 2003; 6 pp.; In English

Report No.(s): AD-A428582; No Copyright; Avail: Defense Technical Information Center (DTIC)

A DNA vaccine for West Nile virus (WNV) was evaluated to determine whether its use could protect fish crows (Corvus ossifragus) from fatal WNV infection. Captured adult crows were given 0.5 mg of the DNA vaccine either orally or by intramuscular (IM) inoculation; control crows were inoculated or orally exposed to a placebo. After 6 weeks, crows were challenged subcutaneously with 105 plaque-forming units of WNV (New York 1999 strain). None of the placebo inoculated-placebo challenged birds died. While none of the 9 IM vaccine-inoculated birds died, 5 of 10 placebo-inoculated and 4 of 8 orally vaccinated birds died within 15 days after challenge. Peak viremia titers in birds with fatal WNV infection were substantially higher than those in birds that survived infection. Although oral administration of a single DNA vaccine dose failed to elicit an immune response or protect crows from WNV infection, IM administration of a single dose prevented death and was associated with reduced viremia.
DTIC

Deoxyribonucleic Acid; Fishes; Infectious Diseases; Vaccines; Viruses

20050051058 Health Research, Inc., Buffalo, NY USA
The Role of Stat3 Activation in Androgen Receptor Signaling and Prostate Cancer
Gao, Allen C.; Jul. 2004; 30 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0089
Report No.(s): AD-A428583; No Copyright; Avail: CASI; A03, Hardcopy

Most prostate cancer patients respond initially to androgen ablation and antiandrogen therapy. However, virtually all patients will relapse due to acquisition of the growth of the androgen-independent tumor cells. The molecular mechanism characterizing prostate cancer progression from androgen-dependence to androgen-independence is incompletely understood. We propose that Signal Transducers and Activators of Transcription 3 (Stat3) both regulates the expression of Stat3 target genes, and interacts with AR in prostate cancer cells. The experiments proposed in this application are based upon the hypothesis that stat3 activation alters androgen receptor signaling pathways, that in turn results in the loss of growth control in prostate cancer cells. We propose to determine the consequence of Stat3 activation in prostate cancer cell growth and to determine the molecular basis of Stat3 interactions with androgen receptor signaling.
DTIC
Cancer; Hormones; Males; Prostate Gland

20050051060 Duke Univ., Durham, NC USA
Functional Analysis of p53 Acetylation in Prostate Tumor Suppression
Yao, Tso-Pang; Jul. 2004; 59 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0054
Report No.(s): AD-A428585; No Copyright; Avail: CASI; A04, Hardcopy

The tumor suppressor p53 becomes acetylated upon its activation. We show that MDM2 can promote p53 deacetylation by recruiting a complex containing HDAC1. The HDAC1 complex binds MDM2 in a p53-independent manner and deacetylates p53 at all known acetylated lysines in vivo. Fibroblasts over-expressing a dominant negative HDAC1 mutant display enhanced DNA damage-induced p53 acetylation, increased levels of p53, and a more pronounced induction of p21 and MDM2. These results indicate that acetylation promotes p53 stability and function. As the acetylated p53 lysine residues overlap with those that are ubiquitinated, our results suggest that one major function of p53 acetylation is to promote p53 stability by preventing MDM2-dependent ubiquitination, while recruitment of HDAC1 by MDM2 promotes p53 degradation by removing these acetyl groups. We also found that acetylation regulates p53 subcellular localization by promoting p53 nuclear export. Thus, acetylation controls p53 function at several levels. Finally, we report that MDM2 is also subject to acetylation. We present evidence that acetylation-deficient MDM2 mutant is defective in promoting p53 deacetylation and degradation. Our studies reveal protein acetylation as an important mechanism in regulating the p53-MDM2 tumor suppressor network.
DTIC
Acetylation; Cancer; Functional Analysis; Prostate Gland; Tumors

20050051061 Medical Univ. of South Carolina, Charleston, SC USA
Regulation of Vitamin D Metabolism
Bell, Norman H.; Oct. 2004; 4 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0816
Report No.(s): AD-A428586; No Copyright; Avail: CASI; A01, Hardcopy

Compared to whites, blacks and Asian Indians have a reduction in serum 25-hydroxyvitamin D 25(OH)D as a consequence of increased skin pigment that causes a diminished rate of dermal production of vitamin D3 from 7-dehydrocholesterol and possibly of increased activity of 25(OH)D-24-hydroxylase, the rate-limiting enzyme for degradation of vitamin D metabolites, in cultured skin fibroblasts. Thus, production and degradation of 25(OH)D may be altered in these two racial groups. The purpose of this research is to determine the response to vitamin D in different racial groups, whites, blacks and Asian Indians. This will be accomplished by comparing the response of serum 25(OH)D to treatment with vitamin D. No results are available because the human subject restriction for this grant by the Army has not been removed.
DTIC
Calciferol; Metabolism

20050051062 Vanderbilt Univ., Nashville, TN USA
Portable Physical Activity Monitors for Measuring Energy Metabolism in ROTC Cadets
Chen, Kong Y.; Sep. 2004; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0716
Report No.(s): AD-A428587; No Copyright; Avail: CASI; A03, Hardcopy

The announcement of the Research Program in Technologies for Metabolic Monitoring (DAMD17-BAA-TMM02) called for 'new, novel and unconventional approaches to the field of metabolic monitoring'. Given the significance of physical activity and energy expenditure (EE) to health for both military and civilian populations, we proposed a feasibility study to achieve the following goals: 1) to develop and validate non-invasive portable techniques in monitoring detailed physical activity and accurately predict EE; and 2) to determine specific physical training related energy costs and physiological responses in ROTC cadets. The novel methodology we used for this study was an accelerometry array portable monitor we developed collaboratively with a small startup company (Minisun LLC). We designed a two-stage data collection periods, expanding one academic year (Fall-Spring). Despite several delays and problems encountered, we have completed the major components of the studies we had proposed. We demonstrated the accuracy of this instrument in predicting EE in the ROTC cadets in well-controlled laboratory environments while performing various exercises, suggesting its great potentials to be a tool for the detailed assessments of physical activity, energy metabolism, and physiological responses for various applications in the military and general populations. However, practical improvements, such as a developing a suit with build-in sensors and wires, and analytical prediction model optimizations should be our next steps to guide the future technical advancements. DTIC

Education; Metabolism; Monitors; Physical Fitness

20050051063 University of South Florida, Tampa, FL USA
Advanced Cancer Detection Center
Krischer, Jeffrey P.; Oct. 2004; 52 pp.; In English
Contract(s)/Grant(s): DAMD17-01-2-0056
Report No.(s): AD-A428588; No Copyright; Avail: CASI; A04, Hardcopy

The goals of the Advanced Cancer Detection Center include the discovery of molecular and genetic markers of cancer risk, the identification of individuals at high risk for cancer through screening and the testing of methods to prevent cancer. The projects included in this report are: Cad Vs. Human Accuracy in the Interpretation of Screening Mammograms: A Pilot Study Lung; Cancer Screening with Computed Tomography: Initial Results of Cohort Screening; Trial The Tampa Bay Ovarian Cancer Study Development of the Moffitt Cancer Network. DTIC

Cancer; Genetics

20050051064 California Univ., Los Angeles, CA USA
Non-Invasive Gene Therapy of Experimental Parkinson's Disease
Pardridge, William M.; Sep. 2004; 33 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0773
Report No.(s): AD-A428589; No Copyright; Avail: CASI; A03, Hardcopy

Neurotoxins can cause serious derangements in brain biochemistry that can compromise the cognitive and motor function of the individual. In the present studies an anima! model of neurotoxin exposure is used, wherein the neurotoxin, 6-hyrdoxydopamine, is injected into a specific region of the rat brain called the medial forebrain bundle, followed approximately 4 weeks later by a biochemical picture resembling Parkinson's disease (PD). On the side of the brain where the neurotoxin is injected, there is a 90% reduction in the level of a key enzyme, tyrosine hydroxylase (TH), which is a rate-limiting enzyme involved in dopamine production. Dopamine is the neurotransmitter that is deficient in PD. One way that brain TH levels can be restored in conditions such as PD is through gene therapy, wherein the TH gene is given to the individual afflicted with PD. However, with the conventional approach to gene therapy of the brain, there are two serious problems. First, virtually all present-day approaches use viral vectors to carry the gene to brain cells. However, these viral vectors are either highly inflammatory (such as adenovirus or herpes simplex virus) or stably alter the host genome in a random way (retrovirus, adeno-associated virus), which can lead to insertional mutagenesis and cancer. These viruses do not enter the brain from blood, because they do not cross the blood-brain barrier (BBB). This creates the second problem with present-day approaches to gene therapy, which is the viral vector is administered to the brain by craniotomy and drilling a hole in the head. However, this only distributes the virus to a tiny region of the brain at the tip of the injection needle. What is needed is a non-invasive, non-viral form of brain gene therapy wherein the therapeutic gene can be administered intravenously without

viral vectors followed by widespread expression of the exogenous gene throughout the brain. This is the goal of the present research.
DTIC
Diseases; Gene Therapy

20050051065 Fox Chase Cancer Center, Philadelphia, PA USA
Quality of Life After Prophylactic Oophorectomy
Daly, Mary B.; Sep. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0568
Report No.(s): AD-A428590; No Copyright; Avail: CASI; A02, Hardcopy

Risk reducing surgery remains an important option for women at risk for ovarian cancer, yet the quality of life implications of such surgery are vastly understudied. Our effort to prospectively study women who choose prophylactic surgery is providing much-needed feedback for other women who seek counseling regarding cancer risk reduction strategies. Further, comparing women undergoing surgery with a control group of those who opt not to pursue it provides a more rigorous scientific perspective to support clinical management. Pertinent findings from interim analysis presented here show statistically significant short term differences between groups with the surgery group experiencing more hot flashes, night sweats, decrease in physical and social functioning and decrease in sexual activity frequency and pleasure. There is no difference in self-concept between groups. The coming year will allow for completion of data collection and final comprehensive analysis to determine changes in quality of life over time and between the two groups. This study's outcomes will be directly translatable to the women who need this important information to develop coping strategies for increased risk of ovarian cancer.
DTIC
Cancer; Health; Ovaries

20050051066 Massachusetts Inst. of Tech., Cambridge, MA USA
Vascularized Tissue Sensors for Generic Toxin and Pathogen Detection
Griffith, Linda G.; Tannenbaum, S. R.; Wands, J.; Sherley, J.; Schaver, D.; Dec. 2004; 6 pp.; In English
Contract(s)/Grant(s): N00014-98-1-0760
Report No.(s): AD-A428591; No Copyright; Avail: CASI; A02, Hardcopy

We developed three iterative prototypes of a bioreactor system that facilitates micro-perfusion of tissue-like structures formed from primary liver cells, and showed that the bioreactor and detection system could be used in a field setting running on batteries. We demonstrated that the endogenous p450 metabolic capacity could be used as a sensor and that cells in the bioreactor were sensitive to toxins requiring liver metabolism.
DTIC
Detection; Liver; Metabolism; Pathogenesis; Pathogens; Toxins and Antitoxins

20050051077 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Towards a Vaccine Against Ebola Virus
Geisbert, Thomas W.; Jahrling, Peter B.; Jan. 2003; 14 pp.; In English
Report No.(s): AD-A428607; No Copyright; Avail: Defense Technical Information Center (DTIC)

Ebola virus infection causes hemorrhagic fever with high mortality rates in humans and nonhuman primates. Currently, there are no vaccines or therapies approved for human use. Outbreaks of Ebola virus have been infrequent, largely confined to remote locations in Africa and quarantine of sick patients has been effective in controlling epidemics. In the past, this small global market has generated little commercial interest for developing an Ebola virus vaccine. However, heightened awareness of bioterrorism advanced by the events surrounding September 11, 2001, concomitant with knowledge that the former Soviet Union was evaluating Ebola virus as a weapon, has dramatically changed perspectives regarding the need for a vaccine against Ebola virus. This review takes a brief historic look at attempts to develop an efficacious vaccine, provides an overview of current vaccine candidates and highlights strategies that have the greatest potential for commercial development.
DTIC
Vaccines; Viruses

20050051078 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Quorum Quenching: Enzymatic Disruption of N-Acylhomoserine Lactone-Mediated Bacterial Communication in Burkholderia thailandensis

Ulrich, Ricky L.; Oct. 2004; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428608; No Copyright; Avail: Defense Technical Information Center (DTIC)

Many species of gram-negative bacteria communicate by synthesizing, secreting, and responding to N-acylhomoserine lactones (AHLs), a mechanism termed quorum sensing. Several investigations have characterized numerous AHL-degrading enzymes (AiiA lactonases) encoded by environmental isolates of Bacillus spp. The Burkholderia thailandensis quorum system is comprised of at least three AHL synthases (AHSs) and five transcriptional regulators belonging to the LuxIR class of proteins. Expression of the Bacillus anthracis (Ames strain) AiiA lactonase in B. thailandensis completely abolished the accumulation of N-decanoylhomoserine lactone (C(10)-HSL) and N-octanoylhomoserine lactone (C(8)-HSL), reduced N-hexanoylhomoserine lactone (C(6)-HSL) levels, altered both swarming and twitching motility, caused a significant increase in generation time, and affected carbon metabolism. In contrast, heterologous expression of the Bacillus cereus strain A24 AiiA lactonase in B. thailandensis reduced the concentrations of C(6)-HSL, C(8)-HSL, and C(10)-HSL to nondetectable levels; altered both swarming and twitching motility; and caused fluctuations in carbon utilization. Individual disruption of the B. thailandensis AHSs, specifically disruption of the btaI1 and btaI3 genes, which encode the proteins that direct the synthesis of C(8)-HSL and C(6)-HSL, respectively, caused the hyper-beta-hemolysis of sheep erythrocytes on blood agar plates. In contrast, AHL cleavage in B. thailandensis by the Bacillus AiiA lactonases failed to enhance beta-hemolytic activity. The results of this study demonstrate that heterologous expression of Bacillus sp. AiiA lactonases in B. thailandensis reduced AHL accumulation, affected both swarming and twitching motility, increased generation time, altered substrate utilization, and prevented the beta-hemolysis of sheep erythrocytes.

DTIC

Anhydrides; Bacteria; Enzyme Activity; Infectious Diseases

20050051079 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Finding a New Vaccine in the Ricin Protein Fold

Olson, Mark A.; Carra, John H.; Roxas-Duncan, Virginia; Wannemacher, Robert W.; Smith, Leonard A.; Jun. 2004; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428611; RPP-04-255; No Copyright; Avail: Defense Technical Information Center (DTIC)

Previous attempts to produce a vaccine for ricin toxin have been hampered by safety concerns arising from residual toxicity, and the undesirable aggregation or precipitation caused by exposure of hydrophobic surfaces on the ricin A-chain (RTA) in the absence of its natural B-chain partner. We undertook a structure-based solution to this problem by reversing evolutionary selection on the 'ribosome inactivating protein' fold of RTA to arrive at a non-functional, compacted single-domain scaffold (sequence RTA1-198) for presentation of a specific protective epitope (RTA loop 95-110). An optimized protein based upon our modeling design (RTA1-33/44-198) showed greater resistance to thermal denaturation, less precipitation under physiological conditions, and a reduction in toxic activity of at least three orders of magnitude compared with RTA. Most importantly, RTA1-198 or RTA1-33/44-198 protected 100% of vaccinated animals against supra-lethal challenge with aerosolized ricin. We conclude that comparative protein analysis and engineering yielded a superior vaccine by exploiting a component of the toxin that is inherently more stable than is the parent RTA molecule.

DTIC

Proteins; Vaccines

20050051081 Texas Univ., San Antonio, TX USA

Electron Microscopy Analysis of Albumin Leakage Across Blood-Brain Barrier Following Microwave Exposure

Phelix, Clyde F.; Oct. 2004; 23 pp.; In English

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A428614; AFRL-HE-BR-TR-2004-0136; No Copyright; Avail: CASI; A03, Hardcopy

This effort was to develop the histological techniques required to process brain tissue from microwave exposed rats to identify the brain regions affected. Immunocytochemistry was utilized to detect endogenous albumin that had passed through the blood-brain barrier into the brain tissue surrounding the affected vessels. The four key objectives were met: 1) Test for ultrastructural preservation with new perfusion apparatus and when using the specialized fixative; 2) Test that the specialized fixative would allow for immunocytochemical staining with recommended, commercially available antibody to rat albumin, and especially that the albumin staining was equivalent when a gold labeled antibody was or was not included in the traditional indirect immunocytochemical procedure; 3) Test if gold-labeled immunocytochemical staining was detectable in the electron

microscopic samples; 4) Evaluate ultrastructure of brain blood vessels and blood brain barrier. The proposed novel histological approach to detect extravasated albumin in brain tissue at both the light and electron microscopic levels was successfully developed and implemented in positive control subjects.
DTIC
Albumins; Blood; Blood-Brain Barrier; Brain; Electron Microscopy; Exposure; Leakage; Microwaves

20050051082 Brigham and Women's Hospital, Boston, MA USA
Training Grant in Epidemiology and Prevention of Breast Cancer
Colditz, Graham; Jul. 2004; 66 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0165
Report No.(s): AD-A428615; No Copyright; Avail: CASI; A04, Hardcopy

We propose a training grant to recruit and train two postdoctoral students and three physicians, but have been able to extend that number to four postdoctoral students and four physician trainees. These trainees will acquire skills in the epidemiology and prevention of breast cancer. They will work closely with mentors who have a long track record of training epidemiologists. The funding will allow our research group to focus specific training opportunities on breast cancer. The ongoing epidemiologic studies and prevention trials offer a unique resource in which trainees can participate in cutting edge research and acquire skills that will establish them as future leaders. We have to date enrolled four doctoral students: Heather Baer, Heather Eliassen and Jeanne Marie Gaare-Eby, and Sonia Mathews; and four physicians: Ann Partridge, M.D. received her M.P.H. Larissa Nekhlyadov, M.D., M.P.H., this past year, has been pursuing several research projects in breast cancer prevention and early detection; Candice Aitken, M.D., received her--M.P.H. and Erica Mayer, M.D. will pursue her M.P.H. with the support of this grant. As a result of this award, we have also established the Advanced Cancer Epidemiology Seminar each spring in which allows specialized topics to be explored in depth.
DTIC
Breast; Cancer; Education; Epidemiology; Mammary Glands; Prevention

20050051083 Johns Hopkins Univ., Baltimore, MD USA
Proton MR Spectroscopic Imaging in NF-1
Barker, Peter B.; Jul. 2004; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0713
Report No.(s): AD-A428616; No Copyright; Avail: CASI; A03, Hardcopy

Neurofibromatosis Type 1 (NF-1) is the most common autosomal dominant genetic disorder, affecting the skin, central (CNS) and peripheral nervous systems. Children with NF-1 have an increased risk of developing significant learning disability (LD), cognitive impairment, and optic or brain stem gliomas. Cerebral magnetic resonance imaging (MRI) in NF-1 reveals regions of high signal intensity (often called 'unidentified bright objects', or UBOs). The pathophysiology of UBOs is poorly understood, and it is controversial to what extent they are involved in cognitive impairment. The aims of this proposal are to characterize the underlying metabolic abnormalities in NF-1 with proton MR spectroscopic imaging (MRSI). We have developed a rapid, quantitative MR spectroscopic imaging (MRSI) protocol for the evaluation of cerebral metabolite levels in NF-1. Metabolite levels will be determined both in UBOs and other brain regions, both in order to improve understanding of the etiology of UBOs, and to understand the relationship between regional brain metabolism and LD. 60 subjects with NF1 and 60 control subjects will be evaluated with proton MRSI and detailed neuropsychological testing. Ultimately, proton MRSI may be a useful test for identifying children with NF-1 at risk of developing LD, and also help in distinguishing UBOs from Other, malignant lesions which require therapeutic intervention.
DTIC
Fibrosis; Imaging Techniques; Magnetic Resonance; Neurophysiology; Protons; Spectroscopy

20050051088 Cancer Therapy and Research Foundation, San Antonio, TX USA
Enhancing Well-Being During Breast Cancer Recurrence
Coltman, Charles a., Jr; Jul. 2004; 69 pp.; In English
Contract(s)/Grant(s): DAMD17-96-1-6009
Report No.(s): AD-A428624; No Copyright; Avail: CASI; A04, Hardcopy

Significant numbers of breast cancer patients will experience a recurrence of their disease. Breast cancer recurrence is a time of enormous crisis, with significant distress, depression, and symptomatology, and few effective coping strategies. Targeted support services are currently unavailable. This study tests the hypothesis that patients experience greater well-being

by participating in an intervention designed for breast cancer patients experiencing a first recurrence. Following pilot study phase, 300 breast cancer patients will be enrolled within 6 weeks post-recurrence. All participants are Southwest Oncology Group (SWOG) institutions. The women will be randomly assigned to a control group or an intervention to be carried out by Y-Me, a national breast cancer support and advocacy organization. The intervention consists of 4 to 8 structures sessions providing information and peer support delivered by breast cancer survivors via telephone over a 4 week period. Endpoints are assessed at baseline and 3 and 6 months later through validated quality of life and depression questionnaires. This study provides information about improving well-being during a little studied portion of the breast cancer trajectory. The intervention is delivered by individuals who are well-qualified to provide support: women who themselves have experienced breast cancer recurrence. The project utilizes a cost-effective approach with the potential for widescale dissemination.
DTIC
Breast; Cancer; Mammary Glands

20050051090 New York Univ., New York, NY USA
Macromolecular Design
Seeman, Nadrian C.; Dec. 2004; 7 pp.; In English
Contract(s)/Grant(s): N00014-98-1-0093
Report No.(s): AD-A428626; No Copyright; Avail: CASI; A02, Hardcopy

We produce unusual DNA motifs from synthetic oligonucleotides. We use these molecules individually or in combinations to produce systems to implement DNA nanotechnology. Computer optimization of DNA sequences is used to select the molecules to synthesize. Structures are assembled in solution, and 1D or 2D arrays are deposited on mica for characterization by AFM. 3D arrays are analyzed by X-ray diffraction. During the current project period, we have built a robust DNA nanomechanical device and a nanorobot that walks on a sidewalk. We have built robust 2D arrays, and have made large strides towards the control of matter in 3D.
DTIC
Deoxyribonucleic Acid; Macromolecules; Oligomers

20050051092 British Columbia Univ., Vancouver, British Columbia Canada
Statistical Methods for Analysis of NF Clinical Data
Joe, Harry; Aug. 2004; 175 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0546
Report No.(s): AD-A428629; No Copyright; Avail: CASI; A08, Hardcopy

This project describes research in statistical methods that has been usefully for statistical modelling and analysis of clinical data from NF1 and NF2 subjects. The statistical methods are classified into the areas: (a) estimation of familial correlation for different types of data, b)assessment of multi-hit mutation models for incidence of tumors. Accomplishing the project required development of some new statistical theory, as well as non-trivial computer programming to implement the new and existing theory. One new statistical inference method for familial data is composite likelihood. This method is intended in general for situations in which a multivariate probability is too time consuming to compute because of numerical interactions; for the NF data, this situation occurred when the family size exceeded 4 to 6 (the lower bound on family size depends on the actual multivariate probability). Clinical data exist in many formats including binary, categorical, count, and continuous information. Also common are censored data (e.g., only a lower hound is known for some measurements). One goal of the project was the creation of a software package for familial data analysis for different types of data, such as binary, count, and right-censored survival data. The modules based on composite likelihood were the most recent additions to the package.
DTIC
Clinical Medicine; Computer Programs; Data Processing; Statistical Analysis

20050051093 RAND Corp., Santa Monica, CA USA
Understanding Potential Changes to the Veterans Equitable Resource Allocation (VERA) System
Wasserman, Jeffrey; Ringel, Jeanne; Ricci, Karen; Malkin, Jesse; Wynn, Barbara; Jan. 2004; 127 pp.; In English
Contract(s)/Grant(s): DASW01-01-C-0004
Report No.(s): AD-A428630; RAND/MG-163-DVA; No Copyright; Avail: CASI; A07, Hardcopy

The Veterans Equitable Resource Allocation (VERA) system was instituted by the Veterans Health Administration (VERA) in 1997 in a continuing effort to improve the allocation of congressionally appropriated health care funds to the 21

Veterans Integrated Service Net- works (VISNs).1 VERA was designed to ensure that funds are allocated in an equitable, comprehensible, and efficient manner and to address the complexities of providing health care to veterans with service-connected disabilities, low incomes, and special health care needs. In contrast to earlier VHA allocation systems, which were based largely on historical costs, VERA bases its allocation of finds primarily on the number of veterans served (work- load). However, the veteran population has been shifting dramatically from some geographic areas to others. As a result, since the implementation of VERA, allocations to the VISNs have undergone similar shifts, from areas with shrinking veteran populations to areas with increasing numbers of veterans. These funding shifts prompted concerns in Congress that VERA was not distributing resources equitably across the VISNs, which could affect health care delivery to some veterans. In legislation enacted in late 2000 (Public Law No. 106-377), Congress directed the Department of Veterans Affairs (VA) to determine 'whether VERA may lead to a distribution of finds that does not cover the special needs of some veterans. The VHA contracted with the RAND National Defense Research Institute to examine three specific areas of concern expressed by Congress: * The extent to which allocations cover costs associated with maintaining older-than- average medical facilities, caring for populations with complex case mixes, facilities undergoing major consolidation, and/or rural versus urban location. * Issues associated with maintaining affiliations between the VA medical centers and academic medical centers. The extent to which weather differences influence costs.

DTIC

Management Systems; Medical Services; Resource Allocation

20050051094 West Virginia Univ., Morgantown, WV USA

Novel Histone Deacetylase Inhibitors

Strobl, Jeannine S.; Jul. 2004; 54 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0500

Report No.(s): AD-A428631; No Copyright; Avail: CASI; A04, Hardcopy

Advanced breast cancer is not curable by existing treatment regimens. The purpose of this project is to discover new drugs to treat breast cancer that act to restore the differentiated and non-growing state of breast tumor cells by inhibition of histone deacetylase. We screened a series of antitumor antimalarial drugs as well as Structural analogs of antimalarials. Our work identified 5 novel quinolines that were more potent and efficacious than the antitumor antimalarial drugs in arresting the growth of human breast tumor cells in culture. These are NSC3852,NSc69603,Nsc8637l,NscloolO, and NSC305819. Of these 5 compounds, only NSC3852 was a direct inhibitor of histone deacetylase activity, an established mechanism for induction of differentiation in breast tumor cells. Further experimentation showed a second mechanism of action of NSC3852 that contributed importantly to inhibition of tumor cell growth inhibition. NSC3852 is a redox active Compound that %enerates superoxide radicals in tumor cells and causes DNA strand breakage. The %echanism of action of the other 4 compounds involves accumulation of pRb in its hypophosphorylated state and a down-regulation of %2F1 protein levels associated with blockade-of cell growth in GI phase of the cell cycle.

DTIC

Breast; Cancer; Inhibitors; Mammary Glands

20050051099 California Univ., San Diego, La Jolla, CA USA

Combinatorial Strategies and High Throughput Screening in Drug Discovery Targeted to Channel of Botulinum

Montel, Mauricio; Sep. 2004; 17 pp.; In English

Contract(s)/Grant(s): DAMD17-02-C-0106

Report No.(s): AD-A428643; No Copyright; Avail: CASI; A03, Hardcopy

This program examines innovative approaches and powerful new technologies to identify selective and potent agents directed to prevent or relieve the neuroparalytic toxic actions of botulinum toxin A (BoNTA)1. The focus is on the ion channel forming activity pf BoNTs as a validated target to screen for inhibitors of the translocation of the light chain into the cytosol and therefore to attenuate the BoNT neurotoxicity. The key of the program is based on our discovery that the heavy chain (HC) of BoNT acts as both a channel and a transmembrane chaperone for the light chain (LC) to ensure a trans location competent conformation during its transit from the acidic endosome into the cytosol - its site of action. This is an exciting time to focus on innovative technologies to uncover lead compounds that may represent a potential new generation of useful and safe antidotes for BoNTs.

DTIC

Clostridium Botulinum; Combinatorial Analysis; Drugs

20050051102 Air Force Occupational Measurement Center, Randolph AFB, TX USA
Occupational Survey Report. AFSC 4A2X1 Biomedical Equipment
Earles, James; May 2004; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428648; No Copyright; Avail: Defense Technical Information Center (DTIC)
Presentation of findings from Occupational Survey Report AFSC 4A2X1, Biomedical Equipment.
DTIC
Armed Forces (United States); Military Personnel; Personnel; Surveys; Tasks

20050051111 Texas Univ., Smithville, TX USA
The p202 Gene as a Tumor Suppressor in Prostate Cancer Cells
Hung, Mien-Chie; Jun. 2004; 139 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0071
Report No.(s): AD-A428674; No Copyright; Avail: CASI; A07, Hardcopy
During the funding period, we have completed the most Aims and subaims proposed in the proposal, i.e. to determine the anti-tumor and the proapoptotic activities of p202 in prostate cancer cells; to understand the molecular mechanisms underlying the p2O2-mediated anti-growth, anti-tumor, and potential proapoptosis activities in prostate cancer; and to test the anti-tumor activity of p202 in prostate cancer cells using preclincal gene therapy strategies and to determine the efficacy of a combined treatment with TN F-a in an orthotopic prostate cancer model. In an attempt to initiate a p202 clinical trial, we have communicated with the FDA and been informed that the human gene is preferable over murine one. Therefore, we have proceeded to clone a human counterpart of p202 gene, the AIM2 Labsent in melanoma). We have obtained encouraging results on AIM2 that has the similar effect of p202 in anti-growth activity in prostate cancer cells in cell culture, and exhibits an anti-tumor growth activity in animals bearing mammary tumors. To further extend the specificity for both androgen receptor-positive and -refractory prostate cancers, we have newly developed a broad spectrum of prostate cancer-specific promoter. We intend to test the therapeutic efficacy and specificity by using the broad spectrum of prostate cancer-specific promoter to drive the therapeutic gene, AIM2 in animals. In an attempt to discover more novel strategies to treat prostate cancer, we have found a natural compound, emodin, which has shown a promising killing effect on prostate cancer cells. To further pursue the potential application of AI2 gene for parastate cancer in a gene therapy setting, we have submitted a grant proposal entitled The AIM 2 Gene as a Tumor Suppressor in Prostate Cancer Cells' for the IDEA Award to the Department of Defense on February 10, 2004 deadline.
DTIC
Cancer; Cells (Biology); Genes; Neoplasms; Prostate Gland; Suppressors; Tumors

20050051112 Howard Univ., Washington, DC USA
Relationships Between IGF-1, IGF-Binding Proteins and Diet in African American and Caucasian Men
Agurs-Collins, Tanya; Jan. 2004; 29 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0024
Report No.(s): AD-A428675; No Copyright; Avail: CASI; A03, Hardcopy
The study aims to determine racial differences between insulin-like growth factor-l (IGF-1), insulin-like binding protein-1 (IGFBP-2), insulin-like binding preotein-3 (IGFBP-3), prostate specific antigen (PSA), testosterone, body mass index (BMI), and diets high in calories, protein and fat. Specifically, the primary objectives are to: * define raciai differences in serum levels of free and flal IGF-l, IGFBP-2, IGFBP-3, and testosterone * define how diet and BMI impact serum levels of IGF- 1, IGFBP-2, IGFBP-3, testosterone and PSA in African American and Caucasian men. * determine the associations between serum levels of free and total IGF-l, IGFBP-2, IGFBP-3, testoserone, PSA, BMI and specfic nutrients. Over 500 African American and Caucasian men were recruited. There were no racial differences found for serum levels of IGF-1. These analyses show that IGFBP-2 is significantly lower in African American than white men, while IGFBP-3 and testosterone are significantly higher. IGFBP-2 also exhibits a significant inverse association with BMI for both races, and a positive association with age for whites. African American men have higher consumption of calories, protein, total fat and nutrients than whites; all but the latter differences are significant. Finally, IGFBP-2 exhibits a significant univariate negative correlation with calories, protein and total fat, with a somewhat stronger association among white than African American men. Adjustment for age and BMI made all but the association with calories no longer significant, but it is possible that this represents over-adjustment of the model since age I not significantly correlated with nutrient intake in these men.
DTIC
Africa; Diets; Human Beings; Males; Proteins; Races (Anthropology)

20050051117 Office of the Under Secretary of Defense (Acquisitions and Technology), Washington, DC USA
Report of the Defense Science Board Task Force on Smallpox Vaccine Down Select Process Report Summary
May 2004; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428687; No Copyright; Avail: Defense Technical Information Center (DTIC)

In the 17th century, physicians in China blew powdered smallpox scabs into sinuses and prepared pills made from the fleas of cows. In India, physicians applied scabs to the scarified skin of the healthy. This technique migrated westward to Turkey where it was discovered by western physicians. Other early attempts to control smallpox included inoculation with material from smallpox lesions. This practice was known as variolation. In 1796, Edward Jenner noted that milkmaids were free of the facial scars that marked most of the population of that time. The observation that they 'cannot take smallpox' was attributed to the localized pox lesions that they developed in their hands. Jenner reasoned that infectious material from cowpox (caused by the vaccinia virus) lesions provided protection from smallpox (caused by the variola virus). He used it to vaccinate an 8-year-old boy. The boy later resisted infection, demonstrating the efficacy of the first vaccine.
DTIC
Immunology; Smallpox; Vaccines; Viruses

20050051120 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Vector Competence of Mexican and Honduran Mosquitoes (Diptera: Culicidae) for Enzootic (IE) and Epizooti (IC) Strains of Venezuelan Equine Encephalomyelitis Virus
Turell, Michael J.; O'Guinn, Monica L.; Navarro, Roberto; Romero, Guadeloupe; Estrada-Franco, Jose G.; May 2003; 7 pp.; In English
Report No.(s): AD-A428691; No Copyright; Avail: Defense Technical Information Center (DTIC)

Experimental studies were undertaken to evaluate the vector competence of Ochlerotatus taeniorynchus (Wiedemann), Culex cancer Theobald, Culex pseudes (Dyar and Knab), Culex taeniopus Dyar and Knab, and a Culex (Culex) species, probably Culex quinquefasciatus Say and Culex nigripalpus Theobald from Chiapas, Mexico, and Tocoa, Honduras, for epizootic (IC) and enzootic (IE) strains of Venezuelan equine encephalitis (VEE) virus. Culex pseudes was highly susceptible to infection with both the IC and IE strains of VEE virus (infection rates \g 78%). Patterns of susceptibility to VEE were similar for the Oc. taeniorynchus collected in Mexico and Honduras. Although Oc. taeniorynchus was highly susceptible to the epizootic IC strain (infection rates ≥ 95%, n = 191), this species was less susceptible to the enzootic IE strain (infection rates ≤ 30%, n = 311). The Culex (Culex) species were refractory to both subtypes of VEE virus, and none of 166 contained evidence of a disseminated infection. Virus-exposed Cx. pseudes that refed on susceptible hamsters readily transmitted virus, confirming that this species was an efficient vector of VEE virus. Although Oc. taeniorynchus that fed on hamsters infected with the epizootic IC strain transmitted VEE virus efficiently, only one of six of those with a disseminated infection with the enzootic IE virus that fed on hamsters transmitted virus by bite. These data indicate that Cx. pseudes is an efficient laboratory vector of both epizootic and enzootic strains of VEE virus and that Oc. taeniorynchus could be an important vector of epizootic subtypes of VEE.
DTIC
Infectious Diseases; Insects; Viruses

20050051141 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA
Readiness Estimate and Deployability Index for Air Force Nurse Anesthetists
Stevenson, Mark A.; Scholes, Robert B.; Sylvia, Barbara; Dremsa, Teresa; Austin, Paul N.; Dec. 2004; 20 pp.; In English
Report No.(s): AD-A428725; CI04-912; No Copyright; Avail: CASI; A03, Hardcopy

Air Force (AF) Certified Registered Nurse Anesthetists (CRNAs) play an important role in the support of the Global War on Terror. The purpose of the present investigation was to use an AF CRNA specific modification of the Readiness Estimate and Deployability Index revised for Air Force Nurses to assess readiness for deployment. Dimensions included (1) clinical competencies, (2) operational competencies, (3) soldier survival skills, (4) personal/ psychosocial/physical readiness, (5) leadership and administrative support, and (6) group integration/ identification. Readiness Skills Verifications for Air Force CRNAs were used to develop clinical competency questions. Two experts assessed validity, and reliability was evaluated using Cronbach's alpha. Available stateside AF CRNAs (N=105) were surveyed with a 60% response rate. Descriptive statistics described the sample and a mean score for each variable. Using a five point scale participants rated themselves an overall readiness score of 4.09, suggesting Air Force CRNAs perceive themselves ready to deploy.
DTIC
Anesthesiology; Maintainability; Medical Personnel

20050051148 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Improved Stability of a Protein Vaccine Through Elimination of a Partially Unfolded State

McHugh, Colleen A.; Tammariello, Ralph F.; Millard, Charles B.; Carra, John H.; Jan. 2004; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428734; No Copyright; Avail: Defense Technical Information Center (DTIC)

Ricin is a potent toxin presenting a threat as a biological weapon. The holotoxin consists of two disulfide-linked polypeptides: an enzymatically active A chain (RTA) and a galactose/N-acetylgalactosamine-binding B chain. Efforts to develop an inactivated version of the A chain as a vaccine have been hampered by limitations of stability and solubility. Previously, recombinant truncated versions of the 267-amino-acid A chain consisting of residues 1-33/44-198 or 1-198 were designed by protein engineering to overcome these limits and were shown to be effective and nontoxic as vaccines in mice. Herein we used CD, dynamic light scattering, fluorescence, and Fourier-transform infrared spectroscopy to examine the biophysical properties of these proteins. Although others have found that recombinant RTA (rRTA) adopts a partially unfolded, molten globule-like state at 45 degrees C, rRTA 1-33/44-198 and 1-198 are significantly more thermostable, remaining completely folded at temperatures up to 53 degrees C and 51 degrees C, respectively. Deleting both an exposed loop region (amino acids 34-43) and the C-terminal domain (199-267) contributed to increased thermostability. We found that chemically induced denaturation of rRTA, but not the truncated variants, proceeds through at least a three-state mechanism. The intermediate state in rRTA unfolding has a hydrophobic core accessible to ANS and an unfolded C-terminal domain. Removing the C-terminal domain changed the mechanism of rRTA unfolding, eliminating a tendency to adopt a partially unfolded state. Our results support the conclusion that these derivatives are superior candidates for development as vaccines against ricin and suggest an approach of reduction to minimum essential domains for design of more thermostable recombinant antigens.
DTIC

Proteins; Stability; Vaccines

20050051156 Civil Aeromedical Inst., Oklahoma City, OK USA

Isolation of RNA From Peripheral Blood Cells: A Validation Study for Molecular Diagnostics by Microarray and Kinetic RT-PCR Assays - Application in Aerospace Medicine

Vu, Nicole T.; Zhu, Hua; Owuor, Edward D.; Huggins, Mark E.; White, Vicky L.; Jan. 2004; 11 pp.; In English

Report No.(s): AD-A428748; DOT-FAA-AM-04-1; No Copyright; Avail: Defense Technical Information Center (DTIC)

Gene expression studies in clinical diagnostic settings involve a large number of samples collected at different time points requiring effective methods for collection, transportation, storage, and isolation of RNA to maintain the integrity of expression profiles. Human whole blood is a vital source of RNA for analysis of environmental exposure since blood constituents maintain homeostasis, effect immunity or inflammation, participate in stress signaling, and mediate cellular communication in vascular associated tissues including those of the central nervous system. Isolation strategies using whole blood should recognize the limited quantities of useful RNA that must be protected from the hostile leukocyte ribonucleases, in addition to the abundance of preformed mRNA in reticulocytes, high protein content, and transcriptional activation of cells during sample processing in vitro. This paper presents data showing how the collection, treatment, and storage of collected blood samples can affect subsequent RNA isolation and analysis. It is further demonstrated that total RNA isolated from human whole blood, using a modified and optimized procedure of PAXgene Blood RNA reagent kits, performed well in cDNA microarray hybridization and kinetic RT-PCR. Preservation of expression patterns was observed for 96% of the mRNAs after 24 h storage at 4 C by hybridization analysis of 100 mRNA targets. There were no detectable changes in expression levels of 2 housekeeping genes, b-actin and cyclophilin, for up to 10 days storage at 4 C by RT-PCR. This validated protocol was employed for isolation of RNA from blood samples collected in the study of acute ethanol effects on performance and characterization of ethanol inducible biomarkers related to performance impairment. The ultimate goal is to utilize gene expression analysis for aerospace accident investigation and prevention.
DTIC

Aerospace Medicine; Assaying; Blood; Diagnosis; Isolation; Ribonucleic Acids

20050051170 California Univ., Los Angeles, CA USA

Membrane Estrogen and HER-2 Receptors in Human Breast Cancer

Pietras, Richard J.; Jul. 2004; 86 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0177

Report No.(s): AD-A428764; No Copyright; Avail: CASI; A05, Hardcopy

Patients with breast cancers that express estrogen receptor (ER) commonly receive antiestrogen therapy. The efficacy of this treatment depends on tight regulation of breast growth by estrogen. However, as breast cancers progress, they often

become resistant to estrogens, and%most patients no longer respond to antiestrogen therapy. New antiestrogen treatment options are needed, and alternative therapies may derive from findings showing that some ER molecules occur in plasma membranes of breast cancer cells and interact with transmembrane HER-2 growth factor receptors. Expression of HER-2 receptors occurs in many breast cancers, and the protein kinase activity of HER-2 may modulate ligand-independent activation of ER. Active cross-communication between ER and HER-2 receptors occurs in breast tumors, leading to promotion of cancer growth. Thus, this axis may offer a new target for therapeutic intervention. We have partially purified a membrane-associated form of ER in breast cancer cells and have evidence that it promotes tumor growth. Using this novel signaling pathway as a target, we have assessed new treatments to prevent cancer progression in models of human breast cancer. Since HER-2 overexpression in breast cancer is associated with the failure of antiestrogen therapy, dual targeting of HER-2 and ER signaling may offer a new therapeutic strategy to assess in future clinical trials.
DTIC
Breast; Cancer; Estrogens; Mammary Glands; Membranes

20050051172 California Univ., Berkeley, CA USA
Inhibition of the TGF-Beta Tumor Suppression Pathway Through Repression of Smad Dependent Transcription
Pan, Deng; Luo, Kunxin; Jul. 2004; 27 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0307
Report No.(s): AD-A428766; No Copyright; Avail: CASI; A03, Hardcopy

Transforming growth factor-Beta (TGF Beta) inhibits the growth of normal mammary epithelial cells, but promotes invasiveness of malignant breast cancer cells. We have identified Ski and SnoN as negative regulators of TGF(3 signaling. The goal of this proposal is to understand the role of SnoN in breast carcinogenesis. The specific aims are: 1) To analyze the mechanism of Smad-induced degradation of SnoN. 2) To study the role of SnoN in breast carcinogenesis. We found that Smad3-induced degradation of SnoN requires the ubiquiflndependent proteasome and can be mediated by the anaphase promotmg complex (APC). Smad3 interacts with APC and SnoN, resulting in the recruitment of APC to SnoN and ubiquitination and degradation of SnoN. In breast cancer cells, this degradation pathway may be inactivated, leading to an elevated level of SnoN. When the small interference RNA was employed to reduce the expression of SnoN in malignant breast cancer cells, a restoration of responsiveness to TGF Beta-induced growth arrest and a marked decrease in the transforming activity of the breast cancer cells were observed. This suggests that an elevated level of SnoN indeed contributes to the malignant progression of breast cancer cells. Our studies have therefore identified an important factor affecting mammary carcinogenesis.
DTIC
Breast; Cancer; Mammary Glands; Neoplasms; Tumors

20050051219 Wayne State Univ., Detroit, MI USA
Analysis of Genes Differentially Expressed in a Human Ovarian Cancer Model
Lancaster, Wayne D.; Jul. 2004; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0735
Report No.(s): AD-A428851; No Copyright; Avail: CASI; A02, Hardcopy

The objectives of this study are to: (1) analyze gene expression in a model of human ovarian carcinogenesis from a benign to a malignant phenotype in organotypic culture and (2) to confirm gene expression patterns by RNA analysis. Sufficient RNA for microarray analysis has been isolated and purified and we changed from cDNA arrays to oligonucleotide arrays. All RNAs from one cell line (96.9.18) have queried the Affymetrix human U133 A and B chips in triplicate. All RNAs from the second cell line (1.24.96) have queried the Affymetrix U133A plus chip in triplicate. Data mining is underway by the Bioinformatics Core at Wayne State University. Analysis of the queries of the U133 A and B chips indicate that 231 genes are differentially expressed between benign and malignant cells when data transformation is done by ANOVA at p-\h0.1 with an expression level of \g1.2-fold change. Quantitative real time polymerase chain reaction validated the expression levels of all genes tested. About 60% of the genes we have identified have previously been shown to be dysregulated in cancer and about 50% of those have been shown to be dysregulated in ovarian cancer thus validating our model.
DTIC
Cancer; Genes; Ovaries; Tumors

20050051232 B and J Enterprises, Inc., Colorado Springs, CO USA

Differential Protein Expression in Explanted Human Retinal Pigment Epithelial Cells 24-Hours Post-Exposure 532 nm, 3.0 ns Pulsed Laser Light

Obringer, John W.; Johnson, Martin D.; Dec. 2004; 20 pp.; In English

Contract(s)/Grant(s): F05611-02-P-0471; FQ8671-01-0-0507

Report No.(s): AD-A428875; USAFA-TR-2005-01; No Copyright; Avail: CASI; A03, Hardcopy

The use of laser light for targeting devices and weapons has dramatically increased the likelihood that personnel will be exposed to laser energy during military operations. Expanded medical, research, and industrial laser use may lead to excessive risk of exposure to researchers and technicians and also during commercial applications. Further, the nature and importance of the biophysical mechanisms of photon-tissue interaction at such pulse widths and irradiances are not understood at the fundamental cell and molecular level. A human in vitro model for assessing laser-light damage to tissue at the cell and molecular level is desirable for scientific, political and fiduciary reasons. This research assesses the effects of sublethal pulsed laser-light treatment to a human cadaver donor retinal pigment epithelial (RPE) tissue using Western Array screening service with antibodies for 859 known human proteins involved in cell signaling, apoptosis, cell adhesion, kinase and GTPase activity as well as several other functions. Some of these functions have been shown to be important in biological processes that could lead to important biological sequelae such as loss of function, cancer or cell death. This research was done to gain insight into the state of cells at the level of protein expression after laser exposure. To our knowledge this is the first ever application of Western Array screening to laser-bioeffects research.

DTIC

Biological Effects; Exposure; Laser Damage; Laser Outputs; Light Beams; Pigments; Proteins; Pulsed Lasers; Retina

20050051233 Pennsylvania Univ., Philadelphia, PA USA

Selected Electromagnetic Problems in Electroencephalography (EEG) Fields in Complex Media and Small Radiating Elements in Dissipative Media

Engheta, Nader; Pugh, Edward N., Jr.; Nov. 2004; 25 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0438

Report No.(s): AD-A428876; AFRL-SR-AR-TR-05-0008; No Copyright; Avail: CASI; A03, Hardcopy

From the electromagnetic point of view we can think of the brain as an inhomogeneous, lossy dielectric body, with complex geometry. The electrical activity of the brain is represented by the currents flowing inside it that is caused by the neuronal activities. We are interested in the electromagnetic modeling and analysis of the effects of those currents on the potential that can be measured on the scalp by MEG sensors. In order to have a qualitative understanding it's possible to use simplified models either for the whole brain or of some specific part of it.

DTIC

Brain; Dissipation; Electrical Properties; Electroencephalography; Electromagnetic Properties

20050051638 NASA Marshall Space Flight Center, Huntsville, AL, USA

Health Monitoring System for Car Seat

Elrod, Susan Vinz, Inventor; Dabney, Richard W., Inventor; October 26, 2004; 9 pp.; In English

Patent Info.: Filed 18 Mar. 2003; US-Patent-6,809,643; US-Patent-Appl-SN-391487; NASA-Case-MFS-31714-1; No Copyright; Avail: CASI; A02, Hardcopy

A health monitoring system for use with a child car seat has sensors mounted in the seat to monitor one or more health conditions of the seat's occupant. A processor monitors the sensor's signals and generates status signals related to the monitored conditions. A transmitter wireless transmits the status signals to a remotely located receiver. A signaling device coupled to the receiver produces at least one sensory (e.g., visual, audible, tactile) output based on the status signals.

Official Gazette of the U.S. Patent and Trademark Office

Systems Health Monitoring; Children; Transport Vehicles

20050051655 Center for International Rehabilitation, Chicago, IL USA

International Rehabilitation Network

Smith, William K.; Wu, Yeongchi; Oct. 2004; 346 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0711

Report No.(s): AD-A428633; No Copyright; Avail: CASI; A15, Hardcopy

Improving the quality of services for landmine survivors and other-amputees in low-income Countries is the primary goal

of the International Rehabilitation network (IRN). This is being accomplished through the dissemination of educational programs and electronic services to professionals in the rehabilitation field. The innovative use of information and telecommunications technologies, as well as computer-based training, facilitates the dissemination process. Through the IRN, the CIR links its research Center and other centers of excellence in the rehabilitation field with rehabilitation Centers in under-served, post-conflict regions with large populations of landmine survivors. In year 4, the IRN developed expanded, culturally adapted and refined the multimedia training in Ischial Containment, Partial Foot Amputation, Knee, Hip and Shoulder Disarticulation, Lower and Upper Extremity Orthotics, Spinal Orthotics, CIR S-and Casting System, and CIR Whirlwind Ultralight Wheelchair. In addition, training Module Sets on Post-operative Care of Residual Limbs and Human Subject Assurance were developed. The QTR also created a network of researchers to collect and report data on the progress, problems, and barriers experienced by landmine survivors and other persons with disabilities.
DTIC
Human Beings; Leg (Anatomy); Joints (Anatomy); Disabilities

20050051892 NASA Glenn Research Center, Cleveland, OH, USA
Invariant Theory for Dispersed Transverse Isotropy: An Efficient Means for Modeling Fiber Splay
Freed, alan D.; Einstein, Daniel R.; Vesely, Ivan; [2004]; 29 pp.; In English; IUTAM Symposium on Mechanics of Biological Tissue, 27 Jun. - 2 Jul. 2004, Graz, Austria
Contract(s)/Grant(s): DAMD17-01-1-0673; 22-708-24-02-23-01; No Copyright; Avail: CASI; A03, Hardcopy

Most soft tissues possess an oriented architecture of collagen fiber bundles, conferring both anisotropy and nonlinearity to their elastic behavior. Transverse isotropy has often been assumed for a subset of these tissues that have a single macroscopically-identifiable preferred fiber direction. Micro-structural studies, however, suggest that, in some tissues, collagen fibers are approximately normally distributed about a mean preferred fiber direction. Structural constitutive equations that account for this dispersion of fibers have been shown to capture the mechanical complexity of these tissues quite well. Such descriptions, however, are computationally cumbersome for two-dimensional (2D) fiber distributions, let alone for fully three-dimensional (3D) fiber populations. In this paper, we develop a new constitutive law for such tissues, based on a novel invariant theory for dispersed transverse isotropy. The invariant theory is based on a novel closed-form splay invariant that can easily handle 3D fiber populations, and that only requires a single parameter in the 2D case. The model is polyconvex and fits biaxial data for aortic valve tissue as accurately as the standard structural model. Modification of the fiber stress-strain law requires no re-formulation of the constitutive tangent matrix, making the model flexible for different types of soft tissues. Most importantly, the model is computationally expedient in a finite-element analysis.
Author
Fiber Orientation; Isotropy; Mathematical Models; Dispersion; Tissues (Biology)

20050060685 NASA Glenn Research Center, Cleveland, OH, USA
VEGF165 Stimulates Vessel Density and Vessel Diameter Differently in Angiogenesis and Lymphangiogenesis
Parsons-Wingerter, Patricia; Radhakrishnan, Krishnan; DiCorleto, Paul E.; Leontiev, Dmitry; Anand-Apte, Bela; Albarran, Brian; Farr, Andrew G.; January 2005; 45 pp.; In English
Contract(s)/Grant(s): WBS 22-101-53-01; Copyright; Avail: CASI; A03, Hardcopy

Vascular endothelial growth factor-165 (VEGF(sub 165)) stimulated angiogenesis in the quail chorioallantoic membrane (CAM) by vessel expansion from the capillary network. However, lymphangiogenesis was stimulated by the filopodial guidance of tip cells located on blind-ended lymphatic sprouts. As quantified by fractal/generational branching analysis using the computer code VESGEN, vascular density increased maximally at low VEGF concentrations, and vascular diameter increased most at high VEGF concentrations. Increased vascular density and diameter were statistically independent events (r(sub s), -0.06). By fluorescence immunohistochemistry of VEGF receptors VEGFR-1 and VEGFR-2, alpha smooth muscle actin ((alpha) SMA) and a vascular/lymphatic marker, VEGF(sub 165) increased the density and diameter of sprouting lymphatic vessels guided by tip cells (accompanied by the dissociation of lymphatics from blood vessels). Isolated migratory cells expressing (alpha)SMA were recruited to blood vessels, whereas isolated cells expressing VEGFR-2 were recruited primarily to lymphatics. In conclusion, VEGF(sub 165) increased lymphatic vessel density by lymphatic sprouting, but increased blood vessel density by vascular expansion from the capillary network.
Author
Blood Vessels; Cardiovascular System; Smooth Muscle

20050061040 National Cheng Kung Univ., Tainan, Taiwan, Province of China
Transverse Elasticity of Rabbit Sciatic Nerves Tested by in vitro Compression
Ju, Ming-Shaung; Lin, Chou-Ching K.; Lin, Chang-Wei; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 965-970; In English; See also 20050061039
Contract(s)/Grant(s): NHRI-RX92-9017EP; Copyright; Avail: Other Sources

The Young's modulus of a rabbit sciatic nerve under stepwise in vitro linear compression test was estimated. Segments of rabbit sciatic nerves were compressed in the transverse direction with a custom-made parallel compression apparatus. Digital images of the cross-sectional face were taken simultaneously by using a camera mounted on a microscope. The applied force and the gap between the parallel plates of the compression apparatus were measured. Digitized images of the nerve cross- sections were used to construct two-dimensional models of the nerves. The parallel compression results showed that the mean Young's modulus of rabbit sciatic nerves was 41.6+/-5.0 kPa. By direct visual inspection and by comparing the finite element model simulation results and experimental data, we may suggest that the large fascicle is the main load-bearing component while the small fascicle and the loose connective tissues like the epineurium bear less load In the parallel compression process.
Author
Elastic Properties; Nerves; Compression Tests; Modulus of Elasticity; In Vitro Methods and Tests; Sciatic Region; Rabbits

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*.

20050041819 NASA Johnson Space Center, Houston, TX, USA
Gender and Decompression Sickness: A Critical Review and Analysis
October 2004; 60 pp.; In English
Contract(s)/Grant(s): NCC9-58
Report No.(s): NASA/TP-2004-213148; S-941; No Copyright; Avail: CASI; A04, Hardcopy

The author addressed the following questions: are women at greater risk of decompression sickness and venous gas emboli at certain times in their reproductive cycle, is risk modified by the use of birth control pills (BCP), and is there a difference in overall risk between men and women under the same decompression dose? The summary considers information from the few abstracts and reports that were available. Except for the observation of more Type II DCS in women, particularly in women who fly after diving, there was no compelling evidence of a difference in DCS risk between men and women SCUBA divers. Many women that presented with DCS symptoms seemed to be in or near menses, with statistically fewer cases reported as time increased from menses. There was no compelling evidence that the use of BCP in SCUBA divers increases the risk of DCS. There were insufficient data about VGE from SCUBA diving to make any conclusion about the incidence of VGE and gender. In contrast, there were ample data about VGE from research in altitude chambers. Women produced less VGE and less Grade IV VGE compared to men under the same decompression dose, certainly when resting oxygen prebreathe (PB) was performed prior to ascent to altitude. Dual-cycle ergometry exercise during PB tends to reduce the differences in VGE between men and women. There was no compelling evidence that the risk of altitude DCS was different between men and women. However, a large number of DCS cases were associated with menses, and the use of BCP did seem to put women at a slightly greater risk than those that did not use BCP. There were substantial observations that women comprised a larger number of difficult cases that required complicated medical management.
Author
Decompression Sickness; Females; Aeroembolism; Physiology; Reproduction (Biology)

20050051038 Advanced Information Engineering Services, Inc., Dayton, OH USA
Development and Use of the Biodynamics Data Bank and Its Web Interface
Cheng, Huaining; Mosher, Stephen E.; Buhrman, John R.; Aug. 2004; 57 pp.; In English
Contract(s)/Grant(s): F41624-97-D-6004; Proj-7184
Report No.(s): AD-A428553; AFRL-HE-WP-TR-2004-0148; No Copyright; Avail: CASI; A04, Hardcopy

The Air Force Research Laboratory's Biodynamics Data Bank (BDB) is the world's largest repository of human biodynamic response data. The contents include data from over 90 research efforts that include more than 10,000 impact

acceleration tests conducted with both human and instrumented manikin subjects. The tests were conducted on man-rated impact test facilities that include a Vertical Deceleration Tower (VDT), Horizontal Impulse Accelerator (HIA), Vertical Impact Device (VID), Body Positioning and Restraint Device (BPRD), Helmet Drop Tower (HDT), and Horizontal Decelerator (HD). Slow motion videos and documentation photographs of the tests provide enhanced analysis capability. The BDB also contains general information for each research effort such as test matrix, test conditions, type of test equipment, objective, and results. Anthropometry measurements for the human and manikin test subjects are also contained in the BDB. A web browser, along with search and plotting routines, has been incorporated to enhance the usability of the BDB.
DTIC
Biodynamics; Data Bases

20050051097 Air Force Research Lab., Wright-Patterson AFB, OH USA
Neck Muscle Response to Changes in Helmet Loading Under +Gz Acceleration -Gender Differences
Eveland, Edward S.; Goodyear, Chuck; Jun. 2001; 36 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A428640; AFRL-HE-WP-TR-2002-0211; No Copyright; Avail: CASI; A03, Hardcopy

Helmet-mounted devices (HMDs) can provide valuable assistance to the pilots of high performance aircraft. They allow operations to be accomplished in poor conditions and can improve effectiveness. However, each device changes the helmet configuration adding more weight and can change the center of gravity of the helmet. These factors are often implicated in reports of acute neck pain and cervical vertebral damage. Females, in particular, may be at risk for injury due to insufficient neck muscle strength to stabilize the neck under these loads. In this research, characteristics of the helmet configuration, along with +Gz acceleration, and task complexity are evaluated for their effect on human performance. Electromyography results showed that myoelectric activity of the neck muscles was most affected by the +Gz acceleration, whereas a helmet configuration effect was noticeable only for females. Other gender differences in myoelectric activity were also found. Females used as much as 80% of their maximal neck muscle capacity during performance of a task while males used 29% of their maximum. Approaching muscular limits might result in an inadequate muscular response to neck loading and the cervical area could be injured. In spite of this finding, tracking error of the females, although tending to be greater, was not significantly different from the error for males.
DTIC
Acceleration Tolerance; Helmet Mounted Displays; Helmets; Muscular Function; Pain

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20050051767
Testing the Possibility of Average-color Perception from Multi-colored Patterns
NTT Technical Review, Volume 3, No. 1; January 2005, pp. 50; In English; See also 20050051761; Copyright; Avail: Other Sources

To test the possibility that an average color is perceived from a multi-colored pattern, the appearance of colored mosaic patterns as a whole was measured by the method of adjustment. As the range of color distribution in a mosaic pattern became larger, subjects matches deviated more from the photometric averages of each pattern and the subjects perceived higher brightness from mosaic patterns. Since the saliency of element colors was different in an equiluminant mosaic pattern, two possible hypotheses for selecting a color which represents a mosaic pattern was examined by using brightness match results for each element color. The results show that the mosaic element with the highest-saturation strongly influences the choice of a color to represent a mosaic pattern.
Author
Color; Mosaics; Visual Perception; Perceptual Errors; Psychological Tests

20050051780 Nippon Telegraph and Telephone Public Corp., Japan
Aging Effect on Neural Basis of Controlled Attention in Working Memory
Otsuka, Y.; Kondo, H.; Morishita, M.; Osaka, N.; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 50; In English; International Conference on Working Memory, 2004; See also 20050051761; Copyright; Avail: Other Sources

Aging effect on the network of anterior cingulate cortex (ACC) and prefrontal cortex (PFC) was tested during working

memory task which requires controlled attention. ACC-PFC network is likely to play an critical role in higher cognition functions such as reading comprehension and general fluid intelligence. We found differences in brain activation between younger and older adults using fMRI when they engaged in controlled attention task. Ten younger and ten older normal adults performed reading span test (RST) whose performance was normalized across subjects. Subject was required to read a series of sentences with memorizing target words included in each sentence on RST condition while just to recognize the memorized words on Recognition condition. On RST condition in which controlled attention required, a significant activation was observed in ACC for younger while less activation was observed for older. Results suggested ACC-based neural network function underlying controlled attention declines by aging. Older adult seems less effective for controlled attention.
Author
Age Factor; Attention; Human Beings; Mental Performance; Psychological Tests; Reading

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*.

20050041807 Research and Technology Organization, Neuilly-sur-Seine, France
Decision Support to Combined Joint Task Force and Component Commanders
December 2004; 80 pp.; In English
Report No.(s): RTO-TR-SAS-044; AC/323(SAS-044)TP/46; Copyright; Avail: CASI; C01, CD-ROM; A05, Hardcopy

The aim of NATO Technical Team SAS 044 Decision Support to Combined Joint Task Force and Component Commanders has been to establish the current status of analysis in direct support of Commanders within NATO, and Nations. It has concentrated on the general principles for successful analytical support, rather than identification of specific tools and models. The guidance in this Code is intended to assist analysts and military staff in understanding the principles of providing decision support to Commanders. It is not intended to be prescriptive, nor exhaustive, and is based upon knowledge from experience gained on recent operations. This Code contains pertinent information aimed at helping prepare, deploy, integrate and support OA teams in the field. In addition to the COBP, the team has developed a short summary document (two pages in length), explaining the role of operational analysis in a form more accessible to those working under short time scales, such as senior military commanders. This summary document is an Annex in the Code.
Author
Command and Control; Decision Making; Information Systems; Multisensor Fusion

20050051844 Michigan Univ., Ann Arbor, MI
Mercury-Free HID Headlamps: Glare and Color Rendering
Sivak, M.; Schoettle, B.; Flannagan, M. J.; Nov. 2004; In English
Report No.(s): PB2005-100705; UMTRI-2004-37; No Copyright; Avail: National Technical Information Service (NTIS)

This study examined the potential effects of the spectral power distributions of mercury-free high-intensity discharge (HID) headlamps on discomfort glare for oncoming drivers and on color rendering of retro reflective traffic materials. In both cases, the effects of mercury-free HID light sources were compared to the changes in these properties that occurred when the tungsten-halogen light sources were replaced with traditional (mercury containing) HID light sources. Specifically, the effect on discomfort glare was estimated by comparing the chromaticity of 9 mercury-free headlamps with the chromaticity of 17 traditional HID headlamps. Analogously, the effects on color rendering were comparing the chromaticities of 46 retro reflective materials when illuminated by the mercury-free headlamps with the chromaticity of the same materials when illuminated by the traditional HID headlamps.
NTIS
Spectra; Halogens; Illuminating; Light Sources

20050060908 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Localization of Face-Seal Leak Sites
Geers, L. F. G.; Albers, J.; March 2004; 26 pp.; In Dutch
Contract(s)/Grant(s): A01/KL/441; TNO Proj. 014.12715
Report No.(s): TD-2004-0012; PML-2004-A12; Copyright; Avail: Other Sources

A number of methods are described for determining the position leaks in the facial seal of a gas mask, among which there

are: measuring the transport of sounds and light through leaks. measuring the deposition of aerosols on the face near leaks. and determining the amount of a gas that leaks into the mask at specific positions within the mask by means of samplers. The first three methods are complicated by the complex shape and the material properties of the mash and by possible health risks for the test persons. The last method is complicated by the airflow in the space between the mask and the face. This airflow can transport the test gas past samplers that are not in the neighborhood of the leak. However. if electronic sensors were used instead of samplers. the gas leakage test has potential. The disadvantages are the high cost and the potential leaks near the hole through which the cables attached to the sensors are lead out of the mask.
Author
Masks; Protective Clothing; Chemical Defense; Leakage; Performance Tests

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*.

20050042031 Stanford Linear Accelerator Center, Stanford, CA, USA
Whither Processing: An Incremental Approach to Archival Processing
Deken, J. M.; Sep. 2004; 16 pp.; In English
Report No.(s): DE2004-826766; SLAC-PUB-10135; No Copyright; Avail: Department of Energy Information Bridge

The struggle to accomplish processing is shared, to a greater or lesser extent, by most archival repositories regardless of their size or subject matter. Many archives also, I suspect, employ similar coping strategies in their efforts to preserve the identity and integrity of the records in their care, while at the same time arranging and describing them in order to facilitate research. Making progress on processing is one of the most difficult tasks we face in the Archives and History Office of the Stanford Linear Accelerator Center, and it is my hope that a discussion of our efforts in this area will prove useful to others both for the general issues it can illuminate and for the specific strategies it may suggest.
NTIS
Data Processing; Identities; Linear Accelerators

20050042041 Swedish Defence Research Establishment, Linkoeping
Implementation and Evaluation of a Method for Detection of Ground Targets in Aerial EO/IR Imagery
Karlholm, J.; Jun. 2004; 30 pp.; In English
Report No.(s): PB2005-100722; FOI-R-1267-SE; No Copyright; Avail: CASI; A03, Hardcopy

One way to increase the robustness and efficiency of unmanned aerial surveillance platforms is to introduce an autonomous data acquisition capability. In order to mimic a sensor operator's search pattern, combining wide area search with detailed study of detected regions of interest, the system must be able to produce target indications in real time. Rapid detection algorithms are also useful for cueing image analysts that process large amounts of air reconnaissance imagery, as well as in target seekers. The computational efficiency of a detector is affected by its structural design, the cost of feature extraction, and the discriminative power of the features. The use of a sequence (or cascade) of increasingly complex classifiers has by several authors been suggested as a means to achieve high processing rates at low false alarm and miss rates. The basic principle (applied recursively) is that much of the background can be rejected by a simple classifier before a more complex classifier is applied to the more difficult remaining image regions.
NTIS
Aerial Photography; Aerial Reconnaissance; Infrared Imagery; Evaluation; Target Recognition; Ground Tracks

20050042064 Raytheon Information Technology and Scientific Services, Lanham, MD, USA
Sea Surface Temperature. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1
Sikorski, R. J.; Miller, S. W.; Kealy, P. S.; May 2002; In English
Report No.(s): PB2005-102018; SBRS-Y2386; No Copyright; Avail: National Technical Information Service (NTIS)

This is the Algorithm Theoretical Basis Document (ATBD) for Sea Surface Temperature (SST) retrieval from Infrared (IR) signals received by the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Visible/Infrared Imager/Radiometer Suite (VIIRS). SST is an input variable for other VIIRS products such as net heat flux. The SST Unit will

produce the VIIRS SST Environmental Data Record (EDR). This document describes the theoretical basis of the SST algorithms, which have been developed by the NPOESS algorithm team.
NTIS
Sea Surface Temperature; Algorithms; Infrared Radiation; Heat Flux

20050050975 Naval Observatory, Washington, DC, USA
Estimating Frequency Stability and Cross-Correlations
Torcaso, F.; Ekstrom, C. R.; Burt, E. A.; Matsakis, D. N.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 69-81; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

We present a method for estimating the absolute frequency stability of N clocks separate from a reference. The method introduced is a modification of the one proposed by Tavella and Premoli (1993). After developing the theory we apply the method to atomic clock data gathered from the USNO.
Author
Frequency Stability; Cross Correlation; Estimating; Atomic Clocks

20050050998 Naval Observatory, Washington, DC, USA
New Ways to Visualize Time and Frequency Data
DeYoung, James A.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 377-391; In English; See also 20050050957; No Copyright; Avail: CASI; A03, Hardcopy

Some of the standards of numerical analysis in time and frequency are the formation of the various square roots of variances, such as Time Deviation (TDEV), Allan Deviation (ADEV), and Total Deviation (TotDev), among others. As time and frequency measurements and transfer become better and better, especially at smaller sampling intervals, transient disturbances from such things as environmental perturbations become more and more important to characterize, locate, and understand. While developing software tools to more fully analyze, visualize, and model time and frequency data, especially time transfer data, several 'new' ways of looking at the data were tested for usefulness. One new way of looking at time-series data was first reported in 1987 and is called visual recurrence plots or analysis (VRA). VRA, the auto-correlation function (ACF), power spectral density by the Barnes' Digital Spectrum Analyzer method (PSD), periodogram using phase dispersion-minimization techniques, phase plane visualization (PPV), time-frequency analysis (TFA), and even 1-D wavelet decomposition of a time-series signal are being tested. This paper will show some recent results that show that all these numerical tools are useful. Tests will be run on both real and synthetic data.
Author
Time Measurement; Frequencies; Numerical Analysis; Computer Programs

20050051776 Nippon Telegraph and Telephone Public Corp., Japan
A Quorum-based Extended Group Mutual Exclusion Algorithm without Unnecessary Blocking
Manabe, Y.; Park, J.; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 49; In English; See also 20050051761; Copyright; Avail: Other Sources

This paper presents a quorum-based distributed algorithm for the extended group mutual exclusion problem. In the group mutual exclusion problem, multiple processes can enter a critical section simultaneously if they belong to the same group. Processes in different groups cannot enter a critical section at the same time. In the extended group mutual exclusion, each process is a member of multiple groups at the same time. Each process can select which group it belongs at making a request. The algorithm for the group mutual exclusion cannot be applied for this extended problem, since there can be a case that two processes are prevented from entering a critical section simultaneously even when they are capable of doing so. We call the above situation unnecessary blocking. We present a quorum-based algorithm that prevents unnecessary blocking and show its correctness proof.
Author
Algorithms; Group Theory; Exclusion

20050051791 Stanford Linear Accelerator Center, Stanford, CA, USA
Centralized Authenitcation with Kerberos 5, Part 1
Wachsmann, A.; Jun. 2004; 16 pp.; In English
Report No.(s): DE2004-826992; SLAC-PUB-10466-Pt-1; No Copyright; Avail: Department of Energy Information Bridge

Account administration in a distributed Unix/Linux environment can become very complicated and messy if done by hand. Large sites use special tools to deal with this problem. I will describe how even very small installations like your three computer network at home can take advantage of the very same tools. The problem in a distributed environment is that password and shadow files need to be changed individually on each machine if an account change occurs. Account changes include: password change, addition/removal of accounts, name change of an account (UID/GID changes are a big problem in any case), additional or removed login privileges to a (group of) computer(s), etc. In this article, I will show how Kerberos 5 solves the authentication problem in a distributed computing environment. A second article will describe a solution for the authorization problem.
NTIS
Computer Information Security; Computer Networks; Unix (Operating System)

20050051792 Stanford Linear Accelerator Center, Stanford, CA, USA
Centralized Authorization Using a Direct Service, Part 2
Wachsmann, A.; Jun. 2004; 14 pp.; In English
Report No.(s): DE2004-826993; SLAC-PUB-10467-Pt-2; No Copyright; Avail: Department of Energy Information Bridge
Authorization is the process of deciding if entity X is allowed to have access to resource Y. Determining the identity of X is the job of the authentication process. One task of authorization in computer networks is to define and determine which user has access to which computers in the network. On Linux, the tendency exists to create a local account for each single user who should be allowed to logon to a computer. This is typically the case because a user not only needs login privileges to a computer but also additional resources like a home directory to actually do some work. Creating a local account on every computer takes care of all this. The problem with this approach is that these local accounts can be inconsistent with each other. The same user name could have a different user ID and/or group ID on different computers. Even more problematic is when two different accounts share the same user ID and group ID on different computers: User joe on computer1 could have user ID 1234 and group ID 56 and user jane on computer2 could have the same user ID 1234 and group ID 56. This is a big security risk in case shared resources like NFS are used. These two different accounts are the same for an NFS server so that these users can wipe out each other's files. The solution to this inconsistency problem is to have only one central, authoritative data source for this kind of information and a means of providing all your computers with access to this central source. This is what a ''Directory Service'' is. The two directory services most widely used for centralizing authorization data are the Network Information Service (NIS, formerly known as Yellow Pages or YP) and Lightweight Directory Access Protocol (LDAP).
NTIS
Directories; Unix (Operating System); Computer Information Security; Identities; Protocol (Computers)

20050051845 Swedish Defence Research Establishment, Linkoeping
Methods for Producing High Resolution Synthetic Environments/Environment Models for Sensor Simulation
Ahlberg, S.; Elmqvist, M.; Persson, A.; Soederman, U.; Dec. 2003; 84 pp.; In Swedish
Report No.(s): PB2005-100726; FOI-R-1110-SE; No Copyright; Avail: CASI; A05, Hardcopy
Models of the natural environment, environment models or Synthetic Natural Environments (SNE) have a central part in the M&S activities of the Swedish Armed Forces. They form the common 'playfield' where the simulated operations and interactions take place. Depending on the purpose, SNEs represent different environmental aspects for ground, sea and land operations (sometimes also space) across the whole spectrum of applications (armed combat, peace support operations, crisis management, etc).
NTIS
Environment Models; Management Methods; Simulation

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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*.

20050041989 NASA Langley Research Center, Hampton, VA, USA
Detecting Controller Malfunctions in Electromagnetic Environments, Part 2, Design and Analysis of the Detector
Belcastro, Celeste M.; [1999]; 7 pp.; In English; 1999 IEEE International Conference on Control Applications, 22-27 Aug. 1999, Kohala Coast, HI, USA; No Copyright; Avail: CASI; A02, Hardcopy

Verifying the integrity of control computers in adverse operating environments is a key issue in the development, validation, certification, and operation of critical control systems. Future commercial aircraft will necessitate flight-critical systems with high reliability requirements for stability augmentation, flutter suppression, and guidance and control. Operational integrity of such systems in adverse environments must be validated. This paper considers the problem of applying dynamic detection techniques to monitoring the integrity of fault tolerant control computers in critical applications. Specifically, this paper considers the detection of malfunctions in an aircraft flight control computer (FCC) that is subjected to electromagnetic environment (EME) disturbances during laboratory testing. A dynamic monitoring strategy is presented and demonstrated for the FCC from glideslope engaged until flare under clear air turbulence conditions using a detailed simulation of the B737 Autoland. The performance of the monitoring system is analyzed.
Author
Control Systems Design; Malfunctions; Airborne/Spaceborne Computers; Electromagnetic Interference; Fault Detection

20050051163 Mercury Computer Systems, Inc., Chelmsford, MA USA
Optimizing System Compute and Bandwidth Density for Deployed HPEC applications
Banton, Randy; Jaenicke, Richard; Aug. 2004; 20 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428756; No Copyright; Avail: Defense Technical Information Center (DTIC)

Many high-end deployed military and commercial applications share a common need to achieve high to very high compute and bandwidth density in the smallest possible volume. In addition, deployed military applications layer on additional environmental requirements, such as higher levels of shock, vibration, endurance vibration, temperature, and condensing humidity. Each of these requirements adds constraints on the solution space for maximizing compute and communication density. Not all HPEC applications can use the same solution due to varying limits on total size or weight and varying levels of ruggedness. For example, the size and weight requirements differ greatly for manned surveillance aircraft, large UAVs, and small UAVs. This presentation explores different options for high-density system designs while meeting the requirements for each of these applications, with an emphasis on thermal management and board real estate utilization. This presentation describes one technique for extracting greater thermal efficiency from an air-cooled design called 'finely managed air. ' In this approach, covers on the boards, heatsinks captive in these covers, and airflow shaping in the covers, slots, and chassis inlet areas are all designed together as a system to carefully direct all available air flow over the hottest components to extract the maximum thermal efficiency. While in conventional board and heat sink design the majority of the air wants to flow around the high-impedance heat sinks instead of through them, the new approach uses features in the cover that directs air through the heat sinks. Since high velocity flow tends to ride up the backplane and starve the front of the board, there is also a need to balance the airflow front to back within a slot to also maximize cooling efficiency. Sixteen briefing charts summarize the presentation. (2 figures)
DTIC
Bandwidth; Circuit Boards; Cooling; Data Processing Equipment; Deployment; Embedding; Printed Circuits; Temperature Control

20050051167 Sky Computers, Inc., Peabody, MA USA
The Decomposition of HPEC Applications Mapped to the Natural Decomposition of a Solution Architectures -- Another Way to Think about Solving HPEC Problems
Germann, Joe; Aug. 2004; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428760; No Copyright; Avail: Defense Technical Information Center (DTIC)

In the past, all large-scale computer architectures that were designed by so-called Digital Signal Processing (DSP) vendors were of the 'kitchen sink' approach. Each board unit incorporated all of the features that one could possibly want into a single unified design. Processors, I/O, memory, and interconnects were all available in one product, thereby increasing per slot functionality, but often at the burden of complexity, reliability, and overall cost. While this was convenient at the time, the user was required to support all of the key building blocks with solutions that were vendor unique and not always necessary for application success. An examination of high performance embedded computing (HPEC) applications shows that nearly all of them have a very distinctive and natural decomposition of the problem space such that there is a distinct I/O and data management portion and another distinct compute portion. Wrapped around both components is the need for global communications as well as system state and health management. In most instances the delivered solution was burdened with many facilities that were not of any value and that robbed the system of valuable real estate and/or reliability simplicities. This paper addresses an industry unique architectural approach to addressing the needs of HPEC applications through the use of distinctive, upgradeable, and naturally decomposed solution elements. This approach provides an application space with the freedom to address complex solutions without the burden of the kitchen sink approach. The paper's focus is on the adoption

of highly flexible data acquisition servers and highly focused compute servers, each of which addresses the unique needs of real-time signal and image processing. Advances in COTS components are integral to this capability. A comparison between traditional HPEC systems and Next Generation architectures also is presented. Twelve briefing charts summarize the presentation.
DTIC
Architecture (Computers); Circuit Boards; Client Server Systems; Data Management; Decomposition; Distributed Processing; Embedding

20050051168 Sky Computers, Inc., Peabody, MA USA
Health Maintenance System: An Application of Recovery Oriented Computing for HPEC Systems
Pocock, Gerry; Aug. 2004; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428761; No Copyright; Avail: Defense Technical Information Center (DTIC)

Until recently, the single aspect of HPEC systems that has been most critical has been 'performance,' in terms of processor speeds and I/O throughput. As processor speeds and I/O throughput have continued to increase, and as the capability to build larger and larger systems has improved, the need for raw performance is becoming less critical. Now, it is the ability to achieve a high level of application availability that is becoming as critical as performance. In this paper, the author presents a CORBA-based framework upon which highly available applications can be constructed. This framework, known as the Health Maintenance System, provides the application, system managers, and management tools that have the ability to 'manage' all resources within a system such that the 'health' of the system can be maintained. The management of these resources involves the ability to 'sense' the state of the resource, to control the resource, and to run tests on the resource to pro-actively detect any latent problems. The primary facet of the framework is the 'resource manager.' The resource manager provides local management support for all system resources. In addition, the resource manager provides management access to clients (e.g., the application). This access is provided via a set of 'client interface' modules that provide a wide variety of interfaces (e.g., APIs, agents, etc). It is this combination of resource managers and client interface modules that allow the framework to be easily configured for a specific HPEC system. Ten briefing charts summarize the presentation.
DTIC
Computers; Embedding; Health; Maintenance; Resources Management; Systems Management

20050051264 MathStar, Inc., Minneapolis, MN USA
Digital Signal Processing at 1GHz in a Field-Programmable Object Array
Helgemo, Dirk R.; Sep. 2003; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428966; No Copyright; Avail: Defense Technical Information Center (DTIC)

Autonomous MAC and ALU processors and register files (three types of Silicon Objects) are implemented with custom logic to achieve 1GHz fixed-point multiply and accumulate. Synchronous programmable interconnect and embedded storage reduces the need for difficult index calculation and the use of external memory for intermediate values. The flexibility of the objects and their interconnect allows the level of parallelism to be chosen freely based on performance requirements and resource constraints. Arraying hundreds of objects in parallel in a single chip enables incredible DSP performance from a flexible, in-circuit reprogrammable architecture. For example, a 1024-point FFT with (16+16)-bit complex samples can be completed every 160 clock cycles (i.e., every 160 nanoseconds) using 64 butterflies (128 MAC, 128 ALU, and 64 RF objects) assisted by 128 ALU and 64 RF objects for inter-stage data routing.
DTIC
Parallel Processing (Computers); Pulse Communication; Signal Processing; Silicon

20050051266 Sky Computers, Inc., Peabody, MA USA
The eXtreme Adaptive DSP Solution to Sensor Data Processing
Vorbach, Martin; Mirkin, Leo; Sep. 2003; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428968; No Copyright; Avail: Defense Technical Information Center (DTIC)

The new ISR mobile autonomous sensor platforms present a difficult challenge to the current generation of high-speed DSP solutions. The high-bandwidth data streams must be processed with minimal power and heat dissipation. The programmatic needs on the new SR platforms include a rapid pace of technology upgrades, a quick development cycle, and lower costs; especially reduction in the software development costs and risks. These goals conflict with high- cost and risk

of ASIC design, high-cost of FPGA development, and power-hungry but easy to program general-purpose CPU and DSP.
DTIC
Data Processing; Integrated Circuits; Signal Processing

20050051763 Nippon Telegraph and Telephone Public Corp., Atsugi, Japan
Sensor-based Hardware Technology Supporting Daily Activities
Mutoh, Shinichiro; Terada, Jun; Morisawa, Fumiharu; Sato, Yasuhiro; Kado, Yuichi; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 37-42; In English; See also 20050051761; Copyright; Avail: Other Sources

Services that provide remote sensing and remote control of home appliances connected to a home network are expected to make our daily lives safer, healthier, more convenient, and more comfortable. After reviewing the current state of sensor-based services, this article introduces technology for expanding the possibilities of home networks focusing on small adaptive sensors with communication functions (sensor nodes) that can respond flexibly to diversified and changing user needs.
Author
Remote Control; Remote Sensing; Broadband; User Requirements

20050051875 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Scaling Up Parallel Scientific Applications on the IBM SP
Skinner, D.; 2004; In English
Report No.(s): DE2004-826107; No Copyright; Avail: National Technical Information Service (NTIS)

This document provides a technical description of the IBM SP seaborg.nersc.gov with an emphasis on how the system performs as a production environment for large scale scientific applications. The overall goal is to provide developers with the information they need to write and run such applications. While some of the information presented here may be applicable in a larger context, the focus is on experiences and scaling techniques specific to seaborg.nersc.gov. In the first few sections we seek to determine how well the theoretical capabilities of this machine may be realized in practice. Most of the measured performance numbers come from small code microkernels or test codes rather than from real user codes. In a companion document several real applications are explored in detail. The microkernel approach described above has value to the user since the most widely quoted performance numbers often reflect the theoretical (peak) performance values rather than those realized in practice. Likewise anecdotes from full blown applications often involve mixed algorithms, hidden constraints or other specifics which make the results hard to generalize. Microkernels and test codes provide a middle ground which is a reasonable best case scenario for real user codes and provide the user with a small kernel of code can serve as a template for the writing or modification of more substantial codes.
NTIS
Scaling; Computer Systems Performance; Distributed Processing; IBM Computers

20050061071 Stanford Univ., Stanford, CA, USA
On Mass Conservation and Desingularization of the Level Set/Vortex Sheet Method
Herrmann, M.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 15-29; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

The level Set/Vortex Sheet (LSVS) method has been introduced by Herrmann. Its objective is to provide a framework for the derivation of the so called Large Surface Structure (LSS) model that describes the primary breakup of turbulent liquid jets and sheets. The advantage of the LSVS method as compared to other, more traditional approaches is the fact that it contains explicit local source terms for each individual physical process that occurs at the phase interface, thus making these directly accessible to modeling attempts of the LSS subgrid terms.
Derived from text
Vortex Sheets; Phase Transformations; Computational Grids

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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.

20050041804 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Theoretical Tools and Software for Modeling, Simulation and Control Design of Rocket Test Facilities
Richter, Hanz; July 30, 2004; 88 pp.; In English
Contract(s)/Grant(s): NASW-99027
Report No.(s): SSTI-8060-0001; No Copyright; Avail: CASI; A05, Hardcopy

A rocket test stand and associated subsystems are complex devices whose operation requires that certain preparatory calculations be carried out before a test. In addition, real-time control calculations must be performed during the test, and further calculations are carried out after a test is completed. The latter may be required in order to evaluate if a particular test conformed to specifications. These calculations are used to set valve positions, pressure setpoints, control gains and other operating parameters so that a desired system behavior is obtained and the test can be successfully carried out. Currently, calculations are made in an ad-hoc fashion and involve trial-and-error procedures that may involve activating the system with the sole purpose of finding the correct parameter settings. The goals of this project are to develop mathematical models, control methodologies and associated simulation environments to provide a systematic and comprehensive prediction and real-time control capability. The models and controller designs are expected to be useful in two respects: 1) As a design tool, a model is the only way to determine the effects of design choices without building a prototype, which is, in the context of rocket test stands, impracticable; 2) As a prediction and tuning tool, a good model allows to set system parameters off-line, so that the expected system response conforms to specifications. This includes the setting of physical parameters, such as valve positions, and the configuration and tuning of any feedback controllers in the loop.
Author (revised)
Rocket Test Facilities; Computerized Simulation; Control Systems Design

20050042012 NASA Langley Research Center, Hampton, VA, USA
Linear Static Structural and Vibration Analysis on High-Performance Computers
Baddourah, Majdi; Storaasli, Olaf O.; Bostic, Susan; International Jouranl of Computing Systems in Engineering; 1993; Volume 4, Nos. 4-6, pp. 41-49; In English; Parallel Computational Methods for Large-Scale Structural Analysis and Design, 24-25 Feb. 1993, Norfolk, VA, USA; No Copyright; Avail: CASI; A03, Hardcopy

Parallel computers offer the opportunity to significantly reduce the computation time necessary to analyze large-scale aerospace structures. This paper presents algorithms developed for and implemented on a massively-parallel computers hereafter referred to as Scalable High Performance Computers (SHPC) for the most computationally intensive tasks involved in structural analysis, namely, generation and assembly of system matrices, solution of systems of equations and calculation of the eigenvalues and eigenvectors. Results on SHPC are presented for large-scale structural problems (i.e. Models of high speed civil transport). The goal of this research is to develop new efficient technique which extend structural analysis to SHPC and make large-scale structural analyses tractable.
Author
Algorithms; Computer Programs; Computer Systems Performance; Finite Element Method; Parallel Processing (Computers); Structural Analysis; Structural Vibration

20050050962 Innovative Solutions International, Vienna, VA, USA
The Time Distribution System for the Wide Area Augmentation System (WAAS)
Klepczynski, William J.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 439-444; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes the functions, requirements, and objectives of the Time Distribution System (TDS). It should be pointed out that the WAAS TDS has not yet been developed because it is a component of the final phase of WAAS development. However, WAAS Phase I allows for the inclusion of the TDS into the WAAS if it is developed before the final phase of WAAS. The TDS will be located at the U.S. Naval Observatory (USNO). It will be used to provide the offset data between WAAS Network Time (WNT) and Coordinated Universal Time (UTC). The offset data will then be passed on to the

WAAS Master Station (WMS) for transfer to the Geostationary Uplink Station (GUS) and broadcast to users of precise time through the Waas Signals-in-Space.
Author
Computer Networks; Time Functions; Augmentation; Temporal Distribution

20050050965 Real Inst. y Observatorio de la Armada, San Fernando, Spain
The Synchronization of the Spanish R&D Network
Palacio, J.; Galindo, F. Javier; Lopez, T.; Batanero, L.; Tomas, C.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 423-432; In English; See also 20050050957
Contract(s)/Grant(s): MAR-97-1612-E; TEL-97-1887-E; No Copyright; Avail: CASI; A02, Hardcopy

RedIRIS is the spanish academic network for research and development funded by the National Plan for R&D and managed by the Centro de Communicsciones CSIC RedIRIS, which depends on the Scientific Research Council. Since September 1996 Real Instituto y Observatorio de la Armada (RAO) has been in charge of the synchronization of the RedIRIS network, using the NTP protocol. We have also been responsible for the installation of two Stratum I time servers, one at the network operational center in Madrid and the second at ROA in San Fernando. Some modifications on the software and the kernel have been made. In this paper we present an overview of the results of these modifications on the performance of the service and studies on its accuracy and accessibility.
Author
Protocol (Computers); Synchronism; Kernel Functions

20050051044 Ohio Univ., Athens, OH USA
Realtime Implementation of L1-Band Software Radios
Braasch, Michael S.; Dec. 2003; 3 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0284
Report No.(s): AD-A428567; AFRL-SR-AR-TR-04-0616; No Copyright; Avail: CASI; A01, Hardcopy

Efforts over the last two years have been directed towards characterization of quantization error effects in software radio interference mitigation algorithms. A high fidelity GPS software signal simulator was constructed during the 2001-2002 time frame. This simulator emulated the UPS signal-in-space and the receiver front-end-processing including the analog-to-digital (AID) conversion process. The simulator allowed one to control precisely the scenario under investigation. Efforts over the past year have been directed towards validation of the simulation against actual collected data with interference present.
DTIC
Computer Programs; Radio Equipment; Real Time Operation; Satellite Communication; Signal Processing

20050051075 Air Force Research Lab., Rome, NY USA
Defensive Planning for Combined Forces
Griffith, David A.; Mar. 2004; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428605; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Air Defense; Antimissile Defense; Computer Programs; Military Operations; Multisensor Fusion; Situational Awareness

20050051106 Lockheed Martin Advanced Technology Labs., Cherry Hill, NJ USA
Distributed Embedded Real-Time Agent Resource Management
Hein, C.; Rubin, A.; Aug. 2004; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428663; No Copyright; Avail: Defense Technical Information Center (DTIC)

This presentation describes an embedded intelligent agent architecture for distributing the real- time allocation and management of resources throughout networked systems. The solution is general purpose, and has been developed for several applications, including shared electronic systems and spectrum allocation. The agent architecture was derived from a combination of prior agent and resource management developments from Lockheed Martin ATL. To guide development and evaluate the distributed agent concept prior to detailed implementations, simulation models were constructed. A successful agent architecture was derived which relies on agent to agent negotiation for resolving allocation decisions in a distributed and parallel context. The simulations led to new methods for developing agents having sufficiently small program code and data structures consistent with embeddable implementations. Further developments led to highly scalable computing solutions. On DARPA's Next Generation Communications (XG-Comms) project, the agent technology was studied to leverage Software

Defined Radios (SDR) and related emerging wireless systems of the future, for improving total spectrum utilization, especially for the continuously changing heavy traffic on the battlefield. The XG-Comms program goals require re-using spectrum in time, space, frequency, and modulation, while minimizing interference to adjacent systems. The real-time distributed nature of the challenge was well suited to agent solutions. Results from the simulations of agents allocating spectrum will be shown. The simulations showed that the unique developments in the agent design enable the embedded agents to increase spectrum usage by more than 10x, while consuming less than 0.2% spectral overhead for control and negotiation under very high demanded loads.
DTIC
Architecture (Computers); Computer Programs; Embedding; Real Time Operation; Resources Management

20050051107 Mississippi State Univ., Mississippi State, MS USA
Evolution of the Milieu Approach for Software Development for the Polymorphous Computing Architecture Program
Dandass, Yoginder S.; Bapty, Theodore; Abbott, Ben; Skjellum, Anthony; Summey, Charles; Yuan, Hong; Aug. 2004; 40 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428664; No Copyright; Avail: Defense Technical Information Center (DTIC)

A key goal of the DARPA Polymorphous Computing Architectures (PCA) program is to develop reactive closed-loop systems that are capable of being dynamically reconfigured in order to respond to changing mission scenarios. This is in contrast to current systems that are fixed in nature and rely on architecture and software optimizations targeted for specific missions. In order to accomplish this objective, a number of 'malleable' processing elements, runtime support software, compilers, and application development tools are being developed by a variety of research teams. Application software development for PCA systems is expected to be particularly challenging because of the need to respond to rapid changes in the mission requirements and environment. The authors of this talk have formed a team that is focusing its effort on developing application modeling tools and middleware libraries that assist in managing the complexity of developing. deploying. and maintaining PCA applications. The four high-level research objectives of this effort are as follows: * Study. prototype and develop a modeling language for streaming and threaded resources and components. * Perform Design Space exploration to enable PCA scheduling (including use of AI techniques). * Achieve System Synthesis and Generation (including performance monitoring and feedback) to support, and * Accomplish Dynamic Reconfiguration study and support for PCA.
DTIC
Architecture (Computers); Computer Programming; Polymorphism; Software Engineering

20050051108 Georgia Inst. of Tech., Atlanta, GA USA
The Morphware Stable Interface: A Software Framework for Polymorphous Computing Architectures
Campbell, Daniel P.; Richards, Mark A.; Cottel, Dennis M.; Judd, Randall R.; McKensie, Kenneth M.; Aug. 2004; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428665; No Copyright; Avail: Defense Technical Information Center (DTIC)

Polymorphous Computing Architectures (PCAs) are computing devices that are capable of significant, rapid reconfiguration directed by software. Composed of several groups of computing elements, PCA devices can be configured to achieve high performance on a wide variety of problem types and processing demands. We describe an emerging concept called the Morphware Stable Interface (MSI), a portable, scalable software development framework to harness the power and complexity of PCAs, while allowing productive software development, and rapid adoption of PCA devices.
DTIC
Architecture (Computers); Computer Programs; Polymorphism

20050051109 Northeastern Univ., Boston, MA USA
Multimedia Macros for Portable Optimized Programs
Rojas, Juan C.; Leeser, Miriam; Aug. 2004; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428666; No Copyright; Avail: Defense Technical Information Center (DTIC)

Multimedia architectures can speed-up applications significantly when programmed manually. Optimized programs have been non-portable up to now, because of differences in instruction sets, register lengths, alignment requirements and programming styles. We solve all these problems by using a library of C pre-processor macros called MMM. We implemented three examples from video compression in MMM, and automatically translated them into optimized code for four distinct

multimedia processors. Their performance is comparable, and in several cases better, than equivalent examples optimized by the processor vendors.
DTIC
Multimedia; Portable Equipment

20050051153 Motorola, Inc., Phoenix, AZ USA
VXS, A High Speed Cu Switch Fabric Interconnect for VME
Wong, Henry; Fedder, James; Thompson, James; Aug. 2004; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428744; No Copyright; Avail: Defense Technical Information Center (DTIC)

VXS provides the VME architecture with an infusion of new technology and a roadmap for evolution while remaining backwards compatible. These seemingly opposing goals were achieved by careful planning and judicious selection of technologies. The platform level enhancements over the existing VME platform include improvements in mechanical packaging, 10 Gbs switch fabric interconnect technology, system management features, alignment and keying strategy, 2X power improvements, and cooling strategies. This work was done within the context of the VSO industry standards body to promote an eco-system of developers, vendors, and users. The focus of this paper is the 10 Gbs switch fabric interconnect technology. In the maximum configuration defined by the VXS standard, the interconnect technology allows up to eighteen payload and two switch boards to be topologically connected with redundant 4x LVDS (Low Voltage Differential Signaling) links in a dual star configuration that fits within a 19' rackmount chassis. The connector technology, MultiGig RT2, is based on a non-traditional PCB chicklets mounted on the plug-in daughter card that has carefully controlled impedance and optimized footprints. The backplane connector uses traditional beam contacts. Density and robustness of the connector exceed most conventional pin and socket interconnects.
DTIC
Architecture (Computers); Fabrics; High Speed; Switches

20050051154 Lockheed Martin Corp., Camden, NJ USA
High Performance Flexible DSP Infrastructure Based on MPI
McClean, Tom; Shank, Steve; Aug. 2004; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428746; No Copyright; Avail: Defense Technical Information Center (DTIC)

Lockheed Martin has developed a platform independent, scalable and reconfigurable Digital Processor (DP) infrastructure for use in multiprocessor environments. This infrastructure is in use within the Small System Processor (SSP) program. This infrastructure provides communication, data flow, processor/ algorithm scaling and configuration flexibility. All aspects of communication and processing are reconfigurable without the need to recompile. Pipeline, round robin, or hybrid processing architectures are supported, as well as modifying the number of processors without the need to recompile. This flexibility is provided by the use of test 'flow graph' files, which describe a static processor mapping. Multiple flow graphs are supported. A non-blocking multicast API is also provided. This is used to distribute the DP Stimulus messages to only the processors that are required to participate in processing. The communication infrastructure provides an efficient mechanism, which decouples algorithm development from the specific details of the data distribution. Algorithm data flow routines support redistributing from M to N processors with or without data overlap or minimum block sizes. Also provided are M to N corner turn and algorithm corner turn routines. Blocking and Non Blocking API's are provided.
DTIC
Signal Processing

20050051155 MPI Software Technology, Inc., Starkville, MS USA
DAFS Storage for High Performance Computing Using MPI-I/O: Design and Experience
Velusamy, Vijay; Skjellum, Anthony; Kanevsky, Arkady; Corbett, Peter; Aug. 2004; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428747; No Copyright; Avail: Defense Technical Information Center (DTIC)

A key goal of this effort is to demonstrate and develop heterogeneous and distributed computing technologies that are applicable to DoD and scientific communities, while maintaining and benefiting from industry standards that could be applied to high performance computing. High performance computing systems based on clusters of compute nodes, connected via a high speed interconnect, are becoming popular for large-scale parallel applications, forming a highly scalable infrastructure. Most large-scale scientific applications are highly I/ O-centric and have a tremendous need for a similarly scalable file I/O subsystem. DAFS is a well-defined highperformance protocol for file access across a network as well as set of APIs, uDAFS,

for user level OS-bypassing application programming, designed to take advantage of RDMA-based transports, such as Virtual Interface Architecture (VIA), InfiniBand Architecture1, and IWARP.
DTIC
Computer Storage Devices; Data Storage; Distributed Processing

20050051164 Black River Systems Co., Inc., Utica, NY USA
Parallelization of a Electromagnetic Analysis Tool
Benincasa, Milissa; Card, Chris; George, Alan; Aug. 2004; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428757; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper describes research work currently being conducted under the Common High Performance Software Support Initiative (CHSSI) sponsored by the DoD High Performance Computing Modernization Program (HPCMO). A scalable, portable, parallel electromagnetic modeling tool is being developed that will provide the capability to rapidly generate scenes of radiating and scattering structures (targets and their surrounding environment) in realistically complex electromagnetic environments. This tool allows users to accurately model targets embedded in their environment. It will be able to solve problems 10 to 100 times larger in liner dimension than previous models. The parallel electromagnetic modeling tool is providing exciting new design and research possibilities for electromagnetic analysis. The team assembled to conduct this research effort consists of the Air Force Research Laboratory, Naval Research Lab (NRL), U.S. Army Space & Missile Defense Command (USASMDC), Black River Systems Company, RADC, Syracuse University, University of Toronto, and SUNY Binghamton. Three briefing charts summarize the presentation.
DTIC
Computer Programs; Computerized Simulation; Detection; Electromagnetic Scattering; Electromagnetic Wave Transmission; Parallel Processing (Computers); Target Acquisition

20050051171 Massachusetts Inst. of Tech., Lexington, MA USA
Kernel Benchmarks and Metrics for Polymorphous Computer Architectures
Lebak, James; Hoffmann, Hank; McMahon, Janice; Rutledge, Eddie; Schrader, Glenn; Aug. 2004; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A428765; No Copyright; Avail: Defense Technical Information Center (DTIC)

Polymorphous computer architectures (PCA) are new computer architectures being developed under a DARPA/IPTO program to support mission agility for future high performance DoD embedded applications. These new architectures will have the ability to 'morph' into different modes of execution with the goal of delivering uniform, high performance across a large variety of different processing types and workload compositions. Examples of these architectures include the MIT RAW machine, the Stanford Smart memories project, and the University of Texas TRIPS machine.
DTIC
Architecture (Computers); Kernel Functions; Polymorphism

20050051174 Ohio State Univ., Columbus, OH USA
A Parallel Data Mining Toolbox Using MatlabMPI
Khot, Parna; Krishnamurthy, Ashok K.; Ahalt, Stanley C.; Nehrbass, John W.; Chaves, Juan C.; Aug. 2004; 44 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): GS04T01BFC0060
Report No.(s): AD-A428768; No Copyright; Avail: Defense Technical Information Center (DTIC)

The ready availability of vast quantities of data has driven the need for data mining algorithms that can discover patterns, correlations and changes in the data. The amount and high dimensionality of the data make data mining an important application for high performance computing Joshi, 2002. The mathematical and interactive nature of many of the data mining algorithm, makes it natural to use a language like MATLAB both to design algorithms and for post-processing of the results. Recently, Kepner 2002 has developed a system, called MatlabMPI, which implements the six basic functions of the Message Passing Interface (MPI) standard in MATLAB, and thus allows any Matlab program to exploit multiple processors. This has motivated us to develop a parallel data mining toolbox that is based on MatlabMPI. Implementations of a parallel clustering algorithm and a parallel classification algorithm have been completed, and other functions are currently under development.
DTIC
Data Mining; Information Retrieval; Message Processing; Parallel Processing (Computers)

20050051177 Naval Postgraduate School, Monterey, CA USA

Considerations for Algorithm Selection and C Programming Style for the SRC-6E Reconfigurable Computer

Duren, Russ; Fouts, Douglas; Aug. 2004; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428773; No Copyright; Avail: Defense Technical Information Center (DTIC)

The architecture and programming environment of the SRC-6E Reconfigurable Computer was presented in the 2002 MAPLD International Conference 1. That paper described how the programmer could trade off chip area for execution speed. In this paper we discuss additional aspects of programming the SRC-6E. In particular we examine classes of algorithms that best benefit from the SRC-6E's architecture. Additionally, we examine how the SRC-6E compiler interprets various C language constructs.

DTIC

Algorithms; Architecture (Computers); C (Programming Language); Computer Programming; Reconfigurable Hardware; Software Engineering

20050051179 Math Works, Inc., Natick, MA USA

Simulation and Real-Time Verification of Video Algorithms on the TI C6400 Using Simulink

Orofino, Donald P.; Aug. 2004; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428780; No Copyright; Avail: Defense Technical Information Center (DTIC)

This talk will show how the use of system-level design tools, such as MATLAB and Simulink, can greatly enhance an engineer's ability to quickly and effectively translate product-level and algorithm-level specifications into a working TI DSP-based prototype for the consumer electronics market. Specifically, we will show how to efficiently target typical video processing algorithms, with the high bandwidth and algorithmic efficiency they require, to the TI C6400 platform, and the value of utilizing simulation test-benches to verify real-time behavior of the final system using TI's High-speed RTDX capability. Both the TI C6416 DSK and the XDS-560 Emulator are demonstrated.

DTIC

Algorithms; Computerized Simulation; Real Time Operation; Simulation; Video Signals

20050051185 Carnegie-Mellon Univ., Pittsburgh, PA USA

Development of the StratWar Wargame Software

Halloran, Timothy J.; Feb. 2004; 34 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428794; CI04-134; No Copyright; Avail: Defense Technical Information Center (DTIC)

StratWar, a computerized strategic nuclear wargame, developed for the Air Command and Staff College, faced serious political and technical challenges during its development. It survived to become a success that was voted the 'Highlight of the Academic Year' by 500 Air Command and Staff College students and faculty who played the game in its debut at the Air Force Wargaming Center in spring of 1990. This is an account, including a narrative and a critical analysis, of the 18-month development of the wargame written by a member of its programming team.

DTIC

Computer Programming; Education; Project Management; Software Engineering; War Games

20050051189 CodeSourcery, LLC, Granite Bay, CA USA

VSIPL++: Serial and Parallel Performance

Mitchell, Mark; Oldham, Jeffrey; Sidwell, Nathan; Aug. 2004; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428799; No Copyright; Avail: Defense Technical Information Center (DTIC)

The VSIPL (the Vector, Signal, and Image Processing Library) specification defines a portable, C programming language interface to use in linear algebra and signal-processing applications. The VSIPL standard has been implemented by a variety of vendors. VSIPL's portable interface provides developers the ability to write code once and reuse it in multiple environments. At HPEC 2002, the authors presented an overview of VSIPL++, a C++ specification designed to perform the same types of computations as VSIPL. The primary goals for VSIPL++ are improved serial performance relative to VSIPL, support for multi-processor systems, extensibility, and simpler syntax. The serial VSIPL++ specification is virtually complete. By HPEC 2003, they expect to have a successful implementation of the specification. They anticipate that the performance of the VSIPL++ reference implementation will be superior to that of VSIPL for some applications. By HPEC 2003, the reference implementation of VSIPL++ will contain preliminary support for parallel systems. Their presentation will compare the performance of VSIPL++ with VSIPL, and demonstrate the VSIPL++ support for parallel computation. They also will discuss VSIPL++ implementation strategies, including the use of an existing VSIPL implementation, a native C++

implementation using expression templates, and a hybrid approach that allows an implementor to incrementally reimplement portions of VSIPL++ to achieve higher performance. Fourteen briefing charts summarize the presentation.
DTIC
C (Programming Language); C++ (Programming Language); Image Processing; Parallel Processing (Computers); Signal Processing

20050051195 Mercury Computer Systems, Inc., Chelmsford, MA USA
Data Reorganization Interface
Cain, Kenneth, Jr.; Aug. 2004; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428821; No Copyright; Avail: Defense Technical Information Center (DTIC)

This presentation will update the HPEC community on the latest status of the standard Data Reorganization Interface (DRI). DRI is a software interface for performing data-parallel distribution and reorganization operations (e.g., transpose, reshape) that are frequently required in scalable HPEC applications. DRI provides increased ease of use compared to point-to-point middleware by providing abstractions for multi-dimensional datasets, partitioning and distribution methods (e.g., block, block-cyclic, overlapped elements), and a high-level interface that frees applications from having to orchestrate the multitude of individual transfers required in a single data reorganization. A planned transfer approach in DRI enables high performance data transfers, and its multi-buffering semantics enable (with hardware support) time overlap of an application s communication and computation operations. DRI is designed to enhance existing standard and proprietary middleware by adding a standard, easy to use interface without compromising high performance.
DTIC
Computer Programs

20050051206 California Univ., Davis, CA USA
Towards a Theory for Combining Information From Related Experiments
Samaniego, Francisco J.; Nov. 2002; 6 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-1082
Report No.(s): AD-A428833; 004; No Copyright; Avail: Defense Technical Information Center (DTIC)

A detailed description is given of the Principal Tnvestigator's research accomplishments during the three year period (5/99 - 4/02) over which the PT's research was supported through the above named contract. Work in the areas of a) combining infomation from disparate sources, b) network reliability, c) software reliability, d) modeling and inference in reliability and e) general statistical research is featured. Twenty-five research papers related to this period are specifically listed in the report.
DTIC
Information Retrieval; Software Reliability

20050051209 Ohio State Univ., Columbus, OH USA
A Java-based Web Interface to Matlab
Samsi, Siddharth; Krishnamurthy, Ashok; Ahalt, Stanley; Nehrbass, John; Pierce, Marlon; Sep. 2003; 46 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428836; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper discusses the development of an alternative method for deploying Matlab applications over the Web. The system developed here aims at overcoming many of the limitations of the Matlab Web Server, resulting in a more interactive online Matlab experience. Using the MATLAB-Java interface available in the recent releases of MATLAB, our system provides the web interface through the use of Java Servlets and custom Java classes. As shown in Fig. 1, a multithreaded socket is used to start a new Matlab process for every user that logs into the system. Once the Matlab process for a user has been started, all communication between the user and Matlab process is facilitated by the servlet and the Java socket opened by Matlab. This allows each user to have a workspace that is preserved until his/her Matlab process exits. This also has the advantage that no additional server-side programming is needed specifically to save user data and have a unique identifier to associate it with the user.
DTIC
Computer Programming; Display Devices; Graphical User Interface; Internets; Java (Programming Language); Mathematical Programming; Programming Languages

20050051211 Ohio State Univ., Columbus, OH USA

Parallel Performance of Pure MATLAB 'M-files' versus 'C-code' as Applied to Formation of Wide-Bandwidth and Wide-Beamwidth SAR Imagery

Nehrbass, John; Soumekh, Mehrdad; Ahalt, Stan; Krishnamurthy, Ashok; Chaves, Juan C.; Sep. 2003; 51 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428838; No Copyright; Avail: Defense Technical Information Center (DTIC)

To the extent that tools can allow rapid prototyping, increased value is achieved. For scientists in the area of Signal and Image processing, MATLAB is often the tool of choice. MATLAB allows extremely rapid prototyping and debugging of complicated studies with a minimal of computer science expertise. Frequently an idea is implemented in MATLAB code and tested on small data sets. These small data sets provide outputs in sufficient time such that performance studies can be conducted. However, as the studies progress and the same codes are used on much larger real data sets, run times may grow to unrealistic lengths. This may force the research scientist to use another implementation language, such as C and MPI, and implement the code on parallel architectures. This code conversion is undesirable, time consuming, and error prone. An alternative and convenient way to accomplish run time reduction is to use the MatlabMPI suite written by Jeremy Kepner of MIT. This suite of pure MATLAB code allows one to simulate many of the MPI functions within MATLAB. It accomplishes inter-processor communication via disk I/O and a common disk drive.

DTIC

Bandwidth; Beams (Radiation); Computer Programming; Image Processing; Mathematical Programming; Messages; Parallel Processing (Computers); Programming Languages; Radar Imagery; Rapid Prototyping; Synthetic Aperture Radar

20050051212 Massachusetts Inst. of Tech., Lexington, MA USA

Parallel Matlab: The Next Generation

Kepner, Jeremy; Travinin, Nadya; Sep. 2003; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A428839; No Copyright; Avail: Defense Technical Information Center (DTIC)

The true costs of high performance computing are currently dominated by software. Addressing these costs requires shifting to high productivity languages such as Matlab. The development of MatlabMPI (www.ll.mit.edu/ MatlabMPI) was an important first step that has brought parallel messaging capabilities to the Matlab environment, and is now widely used in the community. The ultimate goal is to move beyond basic messaging (and its inherent programming complexity) towards higher level parallel data structures and functions. The pMatlab Parallel Toolbox provides these capabilities, and allows any Matlab user to parallelize their program by simply changing a few characters in their program. The performance has been tested on both shared and distributed memory parallel computers (e.g., Sun, SGI, HP, IBM, Linux and MacOXS) on a variety of applications.

DTIC

Computer Programming; Interprocessor Communication; Mathematical Programming; Messages; Parallel Processing (Computers); Programming Languages

20050051236 Silicon Graphics, Inc., Mountain View, CA USA

Low Overhead Real-Time Computing With General Purpose Operating Systems

Raymond, Michael A.; Aug. 2004; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428881; No Copyright; Avail: Defense Technical Information Center (DTIC)

Much embedded real-time computing is done with operating systems crafted from the ground up specifically for the task. In larger systems and more recently, general-purpose operating systems such as SGI IRIX and Linux are used for new projects because they already have multiprocessor and device driver support as well a large user base. Work can and has been done to improve their real-time capabilities, for example IRIX has been improved over the years to offer a number of hard real-time response time guarantees ranging from 1ms to 50us. Since general-purpose operating systems must meet the needs of a wide variety of users they are very complex which can interfere with and cause variability in the most demanding of real-time applications. My presentation deals with one method of improving the performance of these operating systems, which is by adding special low overhead interfaces to common facilities, which may be accessed entirely in user space. I will describe a number of these features including low overhead priority inversion avoiding locking methods and device I/O as well as provide performance comparisons.

DTIC

Real Time Operation

20050051237 Delaware Univ., Newark, DE USA
SMARTMolding Update
Heider, D.; Jul. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-081
Report No.(s): AD-A428885; No Copyright; Avail: Defense Technical Information Center (DTIC)
Briefing charts only.
DTIC
Computer Programs

20050051255 State Univ. of New York, Albany, NY USA
Building the Support for Radar Processing across Memory Hierarchies: On the Development of an Array Class with Shapes using Expression Templates in C++*
Mullin, Lenore R.; Luo, Xingmin; Bush, Lawrence A.; Aug. 2004; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428924; No Copyright; Avail: Defense Technical Information Center (DTIC)
'Embedded software processing requirements for DSP, especially for radar, are expected to exceed 1 x 10 (exp 12) operations per second within five years 3.' Therefore, the efficient use of memory at all levels of the hierarchy is essential. These array based computations involve the composition of linear and multi-linear operators. Previous work illustrated how a general array algebra (MoA), and a 'suitably rich compatible index calculus 3' (Psi-Calculus), could be used to develop software for radar and other DSP applications. This software needs to be tuned to use the levels of memory hierarchies efficiently without the materialization of array valued temporaries 3. Monolithic compiler experiments presented in 4 illustrated how these theories could be mechanized using expression templates in C++. The present work continues these investigations by defining an N-dimensional array class with shape in order to support the mechanization of linear transformations in the Psi-Calculus (Psi -Calculus). We show that this class extends the support for array operations in the Portable Expression Template Engine ?\hPETE\g! while offering performance that is competitive with hand coded C. Such extensions are needed to support the dimension lifting which maps arrays to all levels of a memory/processor hierarchy.
DTIC
C (Programming Language); Computer Storage Devices; Shapes; Signal Processing; Templates

20050051267 Objective Interface Systems, Inc., Herndon, VA USA
An Update on CORBA Performance for HPEC Algorithms
Beckwith, Bill; Aug. 2004; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428976; No Copyright; Avail: Defense Technical Information Center (DTIC)
CORBA technology today surrounds HPEC-oriented subsystems. In recent years CORBA is getting used inside those subsystems, but mostly to facilitate communication with nodes outside the subsystem. It is now possible to implement CORBA ORBs that have the performance characteristics required by HPEC applications. This talk will describe the effort to modify the OMG CORBA specification to accommodate HPEC requirements, one HPEC ORB implementation, and preliminary measured performance data. CORBA provides a standards-based middleware architecture for building flexible distributed systems. The time-to-market and engineering life-cycle benefits of using CORBA in enterprise, server, and desktop systems are well documented. At the very least, embedding CORBA in very high-performance and parallel computing environments offers seamless connectivity to external environments such as Java virtual machines, web-integrated application agents, etc. Beyond the basic value, potential exists for building time-critical, data-intensive applications with the more flexible CORBA programming paradigm where communication is handled by a highly specialized Object Request Broker (ORB). The determinate of this potential is the performance impact of using ORB technology on these time-critical, data-intensive applications. With the historical performance of desktop ORBs we often expect the CORBA GIOP protocol, and thus ORBs by nature, must add significant overhead to simple communications.
DTIC
Algorithms; Embedding; Parallel Processing (Computers); Systems Engineering

20050051561 Department of the Navy, Washington, DC USA
Status Display Tool
Bussiere, Gregory A., Inventor; May 2004; 29 pp.; In English
Report No.(s): AD-D020174; No Copyright; Avail: CASI; A03, Hardcopy
In a distributed computing environment utilizing Common Object Request Broker Architecture (CORBA), this patent

application discloses a software status display tool that provides a graphical representation of the current operational status of all of the data sources in a computer network. The display tool accesses the CORBA Name Server and obtains all available references for object implementations and their CORBA Interface Definition Language (IDL) interface. The references and interfaces map directly to all of the data suppliers and servers and their respective interfaces. The display tool then interfaces with each and every supplier and server as if it were a corresponding client or consumer. Based upon the data it is able to obtain, it makes a determination of the state of that particular supplier or server. The display tool then logs the results of its determinations and presents a fundamental color-coded, system-wide display of its determinations on a video device. (5 figures)
DTIC
Computer Graphics; Display Devices; Distributed Processing; Graphical User Interface; Patent Applications

20050051563 Department of the Navy, Washington, DC USA
Universal Client and Consumer
Bussiere, Gregory A., Inventor; Sep. 2002; 42 pp.; In English
Report No.(s): AD-D020176; No Copyright; Avail: CASI; A03, Hardcopy

In a network computing environment with a distributed software system utilizing Common Object Request Broker Architecture (CORBA), the patent application discloses a Universal Client and Consumer tool that creates Client and Consumer implementations for use in interacting with any existing Servers and/or Suppliers in the system. The tool displays the data resulting from the interactions for the purpose of validating the operation, functionality, and performance of the Servers and Suppliers. The tool creates a graphical user interface for the user to select Servers or Suppliers to evaluate. The tool identifies the Server's or Supplier's IDL interface, and then creates either a Client or Consumer Implementation that uses the same corresponding IDL interface. The tool then attempts to connect to the Server or Supplier and, where appropriate, allows the user to invoke methods. Data received from the Servers and/or Suppliers is displayed in a video device and logged for later analysis. (9 figures)
DTIC
Computer Graphics; Consumers; Display Devices; Distributed Processing; Graphical User Interface; Patent Applications

20050051634 NASA Lewis Research Center, Cleveland, OH, USA
Software for System for Controlling a Magnetically Levitated Rotor
Morrison, Carlos R., Inventor; October 26, 2004; 17 pp.; In English
Patent Info.: Filed 4 Dec. 2003; US-Patent-6,809,450; US-Patent-Appl-SN-729589; NASA-Case-LEW-17293-2; No Copyright; Avail: CASI; A03, Hardcopy

In a rotor assembly having a rotor supported for rotation by magnetic bearings, a processor controlled by software or firmware controls the generation of force vectors that position the rotor relative to its bearings in a 'bounce' mode in which the rotor axis is displaced from the principal axis defined between the bearings and a 'tilt' mode in which the rotor axis is tilted or inclined relative to the principal axis. Waveform driven perturbations are introduced to generate force vectors that excite the rotor in either the 'bounce' or 'tilt' modes.
Official Gazette of the U.S. Patent and Trademark Office
Computer Programs; Rotors; Magnetic Suspension; Electronic Control; Magnetic Bearings; Automatic Control

20050051651 Defence Research and Development Canada, Dartmouth, Nova Scotia Canada
A Review of Submarine Out-of-Plane Normal Force and Pitching Moment
Mackay, M.; Aug. 2004; 46 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428802; TM-2004-135; No Copyright; Avail: Defense Technical Information Center (DTIC)

The normal force and pitching moment experienced by a submarine in a turn, or at an angle of drift, are called out-of-plane because they are loads induced in the vertical plane by a maneuver in the horizontal plane. They arise from the interaction of flow circulation generated by the sail with cross flow on the hull aft of the sail, i.e., the Magnus Effect. Smaller than the corresponding in-plane loads, side force, and yawing moment, the out-of-plane loads are nevertheless significant for good maneuverability and safety. Left uncorrected, they would result in a bow-up attitude and decrease in depth, but are generally not a significant problem for closed-loop control. However, while this response may assist recovery from a plane jam-to-dive, it could hinder covert recovery from a jam-to-rise. It is necessary to model out-of-plane loads in a numerical simulation. Experiments with a number of submarine configurations validate the previously proposed linear circulation distribution model, or a simple modification of it, for estimating the out-of-plane normal force and pitching moment arising from both drift and

yaw rate. The effect of the tail does not appear to be greatly significant. Pitching moment may be underpredicted for submarines with a relatively small sail. A numerical circulation distribution model will be implemented in the DSSP21 maneuvering simulation code for estimating out-of-plane loads. In the longer term, the effect of full-scale Reynolds numbers should be investigated so that proper scaling can be applied to results from experimental and numerical models. (13 figures, 12 refs.)
DTIC
Computerized Simulation; Loads (Forces); Magnus Effect; Pitching Moments; Submarines

20050051652 Massachusetts Inst. of Tech., Lexington, MA USA
High Performance Embedded Computing Software Initiative (HPEC-SI)
Kepner, Jeremy; Aug. 2004; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A428798; No Copyright; Avail: Defense Technical Information Center (DTIC)

The High Performance Embedded Computing Software Initiative is addressing the military's need to advance the state of embedded software development tools, libraries, and methodologies to retain the nation's military technology advantage in increasingly software-based systems. Key accomplishments include the completion of the first demonstration and the development of the Parallel VSIPL++ standard. Currently, the HPEC-SI effort is on track towards its goal of changing the state-of-the-practice in programming DoD HPEC SIP systems. This paper gives a brief overview of the HPEC-SI program objectives, technical objectives and program plans. The HPEC-SI program is organized around demonstrations, standards development, and applied research. Each of these activities is overseen by a Working Group. The demonstrations team Prime contractors with FFRDC or academic partners to use currently defined standards, evaluate their performance, and report on how well their needs are being met. The first demonstration was with the Common Imagery Processor (CIP) and successfully showed the use of MPI communication standard and the VSIPL computation standard to achieve portability (while preserving performance) across shared servers and distributed memory embedded systems. The Development Working Group is extending the VSIPL standard to include parallel object-oriented software practices already prototyped by the research community. This effort is tightly coupled with military demonstrations; it provides the next generation of standards with direct feedback from the military user base. The Applied Research Working Group is also taking a longer term view to assess the potential impact of a variety of emerging technologies, such as fault tolerance and dynamic scheduling, self-optimization, and next generation, high productivity languages. Thirty-one briefing charts summarize the presentation.
DTIC
Computer Programming; Computer Programs; Embedding; Image Processing; Object-Oriented Programming; Parallel Processing (Computers); Signal Processing; Software Engineering

20050051773 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Scalable Video Software Codec Enabling Realtime Processing of Standard-TV-Quality Video
NTT Technical Review, Volume 3, No. 1; January 2005, pp. 48; In English; See also 20050051761; Copyright; Avail: Other Sources

NTT has developed a scalable video software codec that enables realtime processing of video at standard TV quality (VGA*) at 30 frames per second. A scalable video bitstream can provide multiple video qualities, so video can be viewed at an appropriate quality level according to the network bandwidth and terminal performance. This codec can process images at a resolution about four times that of ones using existing scalable codec techniques without having to employ expensive dedicated hardware. Using this codec, NTT has also developed a multi-point videoconferencing system based on the server-client system. Besides allowing video to be viewed at a quality level appropriate to the network bandwidth and terminal performance, this system can also raise the quality of a small portion of the picture called the region of interest (ROI) on a client-by-client basis. It does this by lowering the quality of the rest of the picture and retrieving the data encoding the high-resolution details for that portion at high speed. This function lets a user make a portion of the screen clear and detailed for easier viewing. The system can also process network-bandwidth and ROI requests from multiple clients at high speed, enabling several dozen users to be simultaneously connected to one server. While existing multipoint videoconferencing systems support only a single bandwidth in video viewing, this codec can meet the network-bandwidth and ROI needs of each and every user. It has the potential to be used in a wide variety of fields such as remote education and remote monitoring where multiple users with various different communication bandwidth environments share the same video bitstream. In the future, NTT plans to provide video-communication services that can deal flexibly with network and terminal performance over a mature IP (Internet protocol) network by incorporating this codec as a platform technology. And with an eye to further enhancements, NTT will study the implementation of a scalable codec using the H.264/MPEG-4 AVC (advanced video

coding) standard that provides higher compression efficiency than MPEG-4 ASP (advanced simple profile).
Author
Video Communication; Coders; Bandwidth; Real Time Operation; Telecommunication

20050060975 NASA Langley Research Center, Hampton, VA, USA
Efficient Construction of Discrete Adjoint Operators on Unstructured Grids Using Complex Variables
Nielsen, Eric J.; Kleb, William L.; January 31, 2005; 15 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 23-762-45-CA
Report No.(s): AIAA Paper 2004-0324; No Copyright; Avail: CASI; A03, Hardcopy

A methodology is developed and implemented to mitigate the lengthy software development cycle typically associated with constructing a discrete adjoint solver for aerodynamic simulations. The approach is based on a complex-variable formulation that enables straightforward differentiation of complicated real-valued functions. An automated scripting process is used to create the complex-variable form of the set of discrete equations. An efficient method for assembling the residual and cost function linearizations is developed. The accuracy of the implementation is verified through comparisons with a discrete direct method as well as a previously developed handcoded discrete adjoint approach. Comparisons are also shown for a large-scale configuration to establish the computational efficiency of the present scheme. To ultimately demonstrate the power of the approach, the implementation is extended to high temperature gas flows in chemical nonequilibrium. Finally, several fruitful research and development avenues enabled by the current work are suggested.
Author
Unstructured Grids (Mathematics); Computerized Simulation; Computer Programming; Complex Variables

20050060976 NASA Langley Research Center, Hampton, VA, USA
Using an Adjoint Approach to Eliminate Mesh Sensitivities in Computational Design
Nielsen, Eric J.; Park, Michael A.; [2005]; 10 pp.; In English; 43rd AIAA Aerospace Sciences Meeting, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 23-762-45-CA
Report No.(s): AIAA Paper 2005-0491; No Copyright; Avail: CASI; A02, Hardcopy

An algorithm for efficiently incorporating the effects of mesh sensitivities in a computational design framework is introduced. The method is based on an adjoint approach and eliminates the need for explicit linearizations of the mesh movement scheme with respect to the geometric parameterization variables, an expense that has hindered practical large-scale design optimization using discrete adjoint methods. The effects of the mesh sensitivities can be accounted for through the solution of an adjoint problem equivalent in cost to a single mesh movement computation, followed by an explicit matrix-vector product scaling with the number of design variables and the resolution of the parameterized surface grid. The accuracy of the implementation is established and dramatic computational savings obtained using the new approach are demonstrated using several test cases. Sample design optimizations are also shown.
Author
Computational Grids; Algorithms; Computerized Simulation; Computational Fluid Dynamics

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20050050937 Defence Science and Technology Organisation, Edinburgh, Australia
XQuery Engine Prototype: Coalition Theatre Logistics (CTL), Advanced Concept Technology Demonstrator (ACTD)
Kuster, Egon; Roff, Andrew; October 2004; 37 pp.; In English
Report No.(s): DSTO-TN-0577; DODA-AR-013-071; Copyright; Avail: Other Sources

During the architectural design of the Coalition Theatre Logistics (CTL) Advanced Concept Technology Demonstrator (ACTD) it was identified that a data query capability that could operate over XML-based web services was required. This document outlines how a new technology called XQuery could provide this XML-based query capability over web service oriented communication Also outlined is a possible solution along with a discussion of its limitations and capabilities. A

successful implementation of the XQuery engine was developed with performance metrics and architectural designs of the implemented system included within.
Author
Document Markup Languages; Information Systems; World Wide Web; Information Retrieval; Logistics Management

20050051045 Army Research Lab., Adelphi, MD USA
Implementing a Virtual Private Network for a Mobile LAN Using DIRECWAY and OpenSSH
Luu, Brian B.; Gopaul, Richard D.; Dec. 2004; 18 pp.; In English
Report No.(s): AD-A428568; ARL-TR-3389; No Copyright; Avail: Defense Technical Information Center (DTIC)

Mobile Internet Protocol (IP) Local Area Network (LAN) is a technique, developed by the U.S. Army Research Laboratory, that allows a LAN to be IP mobile when attaching to a foreign IP-based network and using this network as a means to retain connectivity to its home network. This technique is a form of virtual private networking which enables a LAN to roam on the Internet. In this paper, we describe an enhanced version of Mobile IP LAN where a personal computer (termed a pass-through system) equipped with Hughes Network Systems (HNS) DIRECWAY (an upstream/downstream Internet service via satellite communications) and Secure Shell (SSH) software allows a LAN to be mobile in the USA. The pass-through system does no network routing (layer 3) but instead serves as a transparent (secure) bridge at layer 4 (transport layer) to link the mobile LAN and its home network. This bridging technique implemented on the pass-through system can be adapted to any system equipped with a network interface card, SSH software, and Internet access as a means to provide a VPN for a mobile LAN to its home network.
DTIC
Local Area Networks

20050051115 Northern Telecom Technologies, McLean, VA USA
National Transparent Optical Network Consortium (NTONC)
Daspit, Paul; Oct. 2004; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-98-2-0194; Proj-G152
Report No.(s): AD-A428684; AFRL-IF-RS-TR-2004-303; No Copyright; Avail: Defense Technical Information Center (DTIC)

This final report describes the National Transparent Optical Network Consortium (NTONC) efforts in dense wavelength division multiplexing (DWDM) transport, switching technologies and control strategies required to develop, deploy and operate the terabit per second optical networks needed to meet requirements of Next Generation Internet applications. The report also describes NTONC's 'Flat Network Architecture' research for very high capacity networks. The objective of this work was to devise a network to serve as the Next-Generation Internet (NGI) with minimum inner-to-outer capacity ratio, linear capacity expansion, low incremental delay, no data loss, ease of access, automatic new user registration, ease of network engineering, fast recovery from failure conditions, and self-governance. The report concludes with a summary of work performed in the areas of ActiveNets/Openet research, sensor deployment and networking research and proof of concept, MEMs CAD networking research, SuperNet Analysis and fiber expansion in the Washington DC area.
DTIC
Internets; Organizations; Transparence

20050051762 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Home Network Service Management Technologies
Ogawara, Masanori; Kobayashi, Eiji; Yoda, Ikuo; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 17-21; In English; See also 20050051761; Copyright; Avail: Other Sources

The next generation of home networks will offer flexible service configurations by linking multiple devices on a home network. This article introduces the architecture of Home Service Harmony, a platform for next-generation home network services. It achieves user-oriented service control by fully managing multiple services and devices.
Author
Local Area Networks; Video Communication; Architecture (Computers); User Requirements

20050051770 Nippon Telegraph and Telephone Public Corp., Tsukuba Science City, Japan
An Operation Service Composition Method for Home Network Operation Support
Nishiyama, Nobuhide; Nishikawa, Kenichi; Nakamura, Yoshihiro; Ito, Fumihiko; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 22-26; In English; See also 20050051761; Copyright; Avail: Other Sources

To help users operate their home networks, which are becoming increasingly complex, we are studying a method of composing home network operation services based on descriptions provided in semantic languages on the Web. This approach will provide users with practical interfaces for operating home networks.
Author
Protocol (Computers); Semantics; Programming Languages

20050051771 Nippon Telegraph and Telephone Public Corp., Tsukuba Science City, Japan
Abstract Interface Technique for Home Network Management
Tsuchikawa, Kimio; Katayama, Kazunori; Ito, Fumihiko; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 27-30; In English; See also 20050051761; Copyright; Avail: Other Sources

Many kinds of home appliances that can be operated via networks are going to appear on the market, but when they are connected to home networks, users will find them complicated to manage and operate. To overcome this problem, we are developing an easier method of operating home appliances that lets users operate appliances via abstract concepts that are comprehensible to humans such as 'make the room cooler'. Moreover, in the step of converting the abstract request from a user into real actions, the optimum means can be chosen dynamically, taking into consideration the user and the location and state of home appliances.
Author
Protocol (Computers); Position (Location); Visual Aids

20050051772 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan
Technologies for Next-generation Wireless LANs
Kagami, Osamu; Toyoda, Ichihiko; Umehira, Masahiro; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 31-36; In English; See also 20050051761; Copyright; Avail: Other Sources

This article reviews wireless local area networks (WLANS) as the most appropriate method to implement the home network services described in the previous articles. After surveying the trends for WLANs, we describe next-generation WLAN technologies including MIMO (multiple input multiple output) transmission, which uses multiple transmitting and receiving antennas. MIMO is the most attractive candidate for high-data-rate transmission and large communication capacity without expanding the signal bandwidth. We also describe various approaches to next-generation WLANs.
Author
Local Area Networks; MIMO (Control Systems); Rates (Per Time); Bandwidth

20050060747 NASA Langley Research Center, Hampton, VA, USA
Performance Comparison of Mainframe, Workstations, Clusters, and Desktop Computers
Farley, Douglas L.; January 2005; 26 pp.; In English
Contract(s)/Grant(s): 23-728-30-11
Report No.(s): NASA/TM-2005-213505; L-18392; No Copyright; Avail: CASI; A03, Hardcopy

A performance evaluation of a variety of computers frequently found in a scientific or engineering research environment was conducted using a synthetic and application program benchmarks. From a performance perspective, emerging commodity processors have superior performance relative to legacy mainframe computers. In many cases, the PC clusters exhibited comparable performance with traditional mainframe hardware when 8-12 processors were used. The main advantage of the PC clusters was related to their cost. Regardless of whether the clusters were built from new computers or whether they were created from retired computers their performance to cost ratio was superior to the legacy mainframe computers. Finally, the typical annual maintenance cost of legacy mainframe computers is several times the cost of new equipment such as multiprocessor PC workstations. The savings from eliminating the annual maintenance fee on legacy hardware can result in a yearly increase in total computational capability for an organization.
Author
Performance Tests; Workstations; Personal Computers; Central Processing Units; Multiprocessing (Computers)

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*.

20050041814 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Experimental Test-Bed for Intelligent Passive Array Research
Solano, Wanda M.; Torres, Miguel; David, Sunil; Isom, Adam; Cotto, Jose; Sharaiha, Samer; September 17, 2004; 4 pp.; In English
Report No.(s): SSTI-1300-001; Copyright; Avail: CASI; A01, Hardcopy

This document describes the test-bed designed for the investigation of passive direction finding, recognition, and classification of speech and sound sources using sensor arrays. The test-bed forms the experimental basis of the Intelligent Small-Scale Spatial Direction Finder (ISS-SDF) project, aimed at furthering digital signal processing and intelligent sensor capabilities of sensor array technology in applications such as rocket engine diagnostics, sensor health prognostics, and structural anomaly detection. This form of intelligent sensor technology has potential for significant impact on NASA exploration, earth science and propulsion test capabilities. The test-bed consists of microphone arrays, power and signal distribution modules, web-based data acquisition, wireless Ethernet, modeling, simulation and visualization software tools. The Acoustic Sensor Array Modeler I (ASAM I) is used for studying steering capabilities of acoustic arrays and testing DSP techniques. Spatial sound distribution visualization is modeled using the Acoustic Sphere Analysis and Visualization (ASAV-I) tool.
Author
Artificial Intelligence; Multisensor Applications; Arrays

20050041869 Vanderbilt Univ., Nashville, TN, USA
Acquisition of Basic Behaviors through Teleoperation using Robonaut
Campbell, Christina; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NAG9-1537; No Copyright; Avail: CASI; A01, Hardcopy

My area of research is in artificial intelligence and robotics. The major platform of this research is NASA's Robonaut. This humanoid robot is located at the Johnson Space Center. Prior to receiving this grant, I was able to spend two summers in Houston working with the Robonaut team, which is headed by Rob Ambrose. My work centered on teaching Robonaut to grasp a wrench based on data gathered as a human teleoperated the robot. I tried to make the procedure as general as possible so that many different motions could be taught using this method.
Author
Artificial Intelligence; Robotics; Teleoperators

20050042024 NASA Langley Research Center, Hampton, VA, USA
Target Recognition Using Neural Networks for Model Deformation Measurements
Ross, Richard W.; Hibler, David L.; [1999]; 4 pp.; In English; 1999 International Joint Conference on Neural Networks, 10-16 Jul. 1999, Washington, DC, USA; Copyright; Avail: CASI; A01, Hardcopy

Optical measurements provide a non-invasive method for measuring deformation of wind tunnel models. Model deformation systems use targets mounted or painted on the surface of the model to identify known positions, and photogrammetric methods are used to calculate 3-D positions of the targets on the model from digital 2-D images. Under ideal conditions, the reflective targets are placed against a dark background and provide high-contrast images, aiding in target recognition. However, glints of light reflecting from the model surface, or reduced contrast caused by light source or model smoothness constraints, can compromise accurate target determination using current algorithmic methods. This paper describes a technique using a neural network and image processing technologies which increases the reliability of target recognition systems. Unlike algorithmic methods, the neural network can be trained to identify the characteristic patterns that distinguish targets from other objects of similar size and appearance and can adapt to changes in lighting and environmental conditions.
Author
Mathematical Models; Target Recognition; Image Contrast; Light Sources; Neural Nets; Optical Measurement; Wind Tunnel Models; Wind Tunnel Tests

20050042060 Louisiana State Univ., Baton Rouge, LA, USA
Louisiana Traffic Sign Inventory and Management System
Wolshon, B.; Sep. 2003; 62 pp.; In English
Report No.(s): PB2005-101494; No Copyright; Avail: CASI; A04, Hardcopy

The Louisiana Department of Transportation and Development (DOTD), like many state highway agencies in the USA, lacks a comprehensive system for inventorying and maintaining records of traffic signs. To address this problem, state highway departments around the country have, or are beginning to develop, computerbased sign inventory systems that allow highway department personnel to count, locate, and monitor the maintenance and condition of their sign inventories. This project involved the initial step in creating a statewide traffic sign inventory system in Louisiana.
NTIS
Traffic Control; Inventory Management; Management Systems; Transportation

20050050936 Defence Science and Technology Organisation, Edinburgh, Australia
Modelling Intention Recognition for Intelligent Agent Systems
Heinze, Clint; November 2004; 231 pp.; In English
Report No.(s): DSTO-RR-0286; AR-013-251; Copyright; Avail: Other Sources

Mainstream visual psychology presents a 'sense then infer' account of vision that is analogous to the 'sense then infer' processing that characterizes the agent intention recognition literature. From ecological psychology comes Gibson's theory of visual perception that highlights the importance of the environment in explaining the nature of vision and recognition and claims that higher order structures are directly accessible. This theory can be used as the stepping-off point for an account of intention recognition and the means by which it might be modelled. Furthermore, the capacity for virtual environments to be designed 'agent friendly' provides yet another dimension of design freedom. When accompanied by an explicit model of perception the intention recognition problem can be cast as a software design problem. The resulting design patterns provide useful options for modelling intention recognition in intelligent agent systems.
Author
Recognition; Artificial Intelligence; Psychology; Models; Design Analysis

20050051110 Pennsylvania Univ., Philadelphia, PA USA
Coordinated Control of Vehicle Groups
Kumar, Vijay; Leonard, Naomi E.; Oct. 2004; 11 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0382
Report No.(s): AD-A428673; 537415; AFRL-SR-AR-TR-04-0642; No Copyright; Avail: CASI; A03, Hardcopy

This project focuses on cooperation in the context of coordinated control of distributed, autonomous agents and the collection and fusion of the sensor information that they retrieve. Central is the synthesis and analysis of high-performance, group-level properties from simple control laws at the individual agent-level. There are three main objectives: (1) to develop a theoretical paradigm for formalizing the concepts of a group, a team, and control of groups, with specified tasks such as exploring, mapping, searching, and transporting objects; (2) to develop new algorithms for the organization, reconfiguration, and control of vehicles that will scale to different types of vehicles, larger numbers, and different tasks; and (3) to develop practical tools that can be used to develop solutions to practical problems and as proofs-of-concept for testing and generating new prototypes. These practical tools include a new simulation environment and software for testing new controllers and estimators, and experimental test beds for the validation of algorithms. The paper concludes with a list of 6 papers on this subject that were presented at various symposia, 39 related publications, and 7 honors/awards.
DTIC
Collision Avoidance; Drone Vehicles; Robotics; Underwater Vehicles

20050051137 Massachusetts Inst. of Tech., Lexington, MA USA
The Emergence and Impact of Intelligent Machines
Kurzweil, Ray; Sep. 2003; 71 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428714; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Challenge from Software: We're making exponential gains in hardware, but not software. However, we are making exponential gains in software, although the doubling time is indeed longer. 1) There has been increased productivity from new languages, class libraries, software development tools; 2) Software complexity required to emulate the human brain is manageable; 3) We have a specific game plan to reverse engineer the human brain; 4) We will not program human-level

intelligence link by link (e.g., the expert system 'cyc'). The Challenge from Ethics: 1) There is far less ethical resistance to the development of nonbiological intelligence (including intimate connection with our bodies and brains) than to biological tinkering; 2) In any event, ethical concerns end up as stones in a stream: the economic and moral imperatives are too strong; 3) There ultimately will be grave dangers, but the biological downsides are more apparent today.
DTIC
Artificial Intelligence; Expert Systems; Microminiaturization; Nanotechnology; Virtual Reality

20050051243 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Consistency Results for the ROC Curves of Fused Classifiers
Bjerkaas, Kristopher S.; Dec. 2004; 63 pp.; In English
Report No.(s): AD-A428891; AFIT/GAM/ENC/05-01; No Copyright; Avail: Defense Technical Information Center (DTIC)
The U.S. Air Force is researching the fusion of multiple classifiers. Given a finite collection of classifiers to be fused, one seeks a new classifier with improved performance. An established performance quantifier is the Receiver Operating Characteristic (ROC) curve, which allows one to view the probability of detection versus the probability of false alarm in one graph. Previous research shows that one does not have to perform tests to determine the ROC curve of this new fused classifier. If the ROC curve for each individual classifier has been determined, then formulas for the ROC curve of the fused classifier exist for certain fusion rules. This will be an enormous saving in time and money since the performance of many fused classifiers can be determined analytically. In reality only finite data is available so only an estimated ROC curve can be constructed. It has been proven that estimated ROC curves will converge to the true ROC curve in probability. This research examines if convergence is preserved when these estimated ROC curves are fused. It provides a general result for fusion rules that are governed by a Lipschitz continuous ROC fusion function and establishes a metric that can be used to prove this convergence.
DTIC
Classifiers; Consistency; Multisensor Fusion

20050061057 NASA Langley Research Center, Hampton, VA, USA
Mobius: An Omnidirectional Robot Utilizing Mecanum Wheels and Fuzzy Logic Control
Bradley, Arthur T.; Miller, Samuel A.; Creary, Garfield A.; Miller, Nathanael A.; Begley, Matthew D.; Misch, Noah J.; [2004]; 15 pp.; In English; 27th Annual AAS Guidance and Control Conference, 4-8 Feb. 2004, Breckenbridge, CO, USA
Report No.(s): AAS-05-027; No Copyright; Avail: CASI; A03, Hardcopy
In this paper, we present the results of an unmanned ground vehicle robot development effort completed at NASA LaRC's Robotics and Intelligent Machines Lab. The low-cost robot, named Mobius, was developed as part of an investigation into novel omnidirectional locomotion technologies. The vehicle is equipped with lightweight Mecanum (a.k.a. Swedish) wheels. Operator input is provided using a commercial joystick and wireless link. Directional commands are converted to a 45-degree rotated coordinate system, leading to a simple and intuitive mathematical solution for teleoperable Mecanum-wheel-based platforms. A high-level processor running Linux serves to input user commands, output sensor data, and perform translation on incoming direction values. Sensors include dual pan-and-tilt color cameras providing real-time mono and stereoscopic video feedback. At the microcontroller level, a simple fuzzy logic algorithm has been implemented for wheel speed control. The robot platform is capable of performing complete 360-degree translation, bi-directional rotation, and simultaneous translation with rotation.
Author
Fuzzy Systems; Robotics; Unmanned Ground Vehicles; Wheels; Locomotion

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NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20050041911 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Modified Coulomb-Dipole Theory for 2e Photoionization
January 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only
In the light of recent experiment on 2e photoionization of Li near threshold, we have considered a modification of the Coulomb-dipole theory, retaining the basic assumption that the threshold is dominated by asymmetric events in phase space [implies r(sub 1), k(sub 1)) greater than or equal to 2(r(sub 2), k(sub)]. In this region [in a collinear model, 2/r(sub 12)

approached + 2/(r(sub 1)+r(sub 2)] the interaction reduces to V(rIsub 1) is greater than or equal to 2r(sub 2) is identically equal to [(-Z/r(sub 2)-(A-1)/r(sub 1)] + [(-2r(sub 2)/r(sub 1 exp 2)] is identically equal to V(sub c)+[V(sub d)]. For two electron emission Z = 2, thus both electrons see a Coulomb potential (V(sub c)) asymptotically, albeit each seeing a different charge. The residual potential (V(sub d)) is dipole in character. Writing the total psi = psi (sub c) + psi(sub d) = delta psi, and noting that. (T+V(sub c)-E)psy(sub c) = 0 and (T+V(sub c))psi(sub d) = 0 can be solved exactly, we find, substituting psi into the complete Schrod. Eq., that delta psi = -(H-E)(exp -1)(V(sub d) psi(sub 0)+V(sub c psi (sub 1). Using the fact that the absolute value of V(sub c) is much more than the absolute value of V(sub d) in almost all of configuration space, we can replace H by H(sub 0) in 9H-E)(exp -1) to obtain an improved approximation psi (improved) = psi(sub c) + psi(sub d) -(H(sub 0)-E)(exp -1) (V(sub c) psi (sub 0) + V(sub c) psi(sub 1). Here's the Green's function (H(sub 0)-E)(exp -1), can be exhibited explicitly, but the last term in psi (improved) is small, compared to the first two terms. Inserting them into the transition matrix element, which one handles in the usual way, we obtain in the limit E approaches 0, the threshold law: Q(E) alpha E + M(E)E(exp 5/4) + higher order (Eq. 1a). The modulation function, M(E), is a well-defined (but very non-trivial integral, but it is expected to be well approximated by a sinusoidal function containing a dipole phase term (M(E) = c sin[alpha log (E) + micron] (Eq. 1b). Experimental results show definite modulations, and are well fitted by Eqs (1).
Author
Coulomb Potential; Matrices (Mathematics); Photoionization

20050051067 University of Central Florida, Orlando, FL USA
Arrays to Support Spatial Solitons. DoD - MURI Fellowship, April 2, 2000 to April 1, 2004
Stegeman, George; Salamo, Greg; Nov. 2004; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-00-1-0476
Report No.(s): AD-A428593; ARO-41505.1-PH-MUR; No Copyright; Avail: Defense Technical Information Center (DTIC)

The focus of this work is to demonstrate discrete solitons in arrays of coupled nonlinear waveguides or the controlled switching of optical information from one line to another. Results have been the successful creation of a linear array of over one hundred soliton waveguides. The array is necessary to demonstrate transfer of energy across the soliton array. The significance or impact is that this project is the first step to achieve photonic networks using discrete solitons-all-optical routers. It is possible to use the discrete soliton arrays to switch optical information from one channel to another, using only optical beams. For this reason, the results demonstrate discrete solitons and their potential use in optical communication systems.
DTIC
Nonlinear Systems

20050051146 Army Research Lab., Aberdeen Proving Ground, MD USA
Implementation of Schoenfield-Wright Failure Criterion into a Three-Dimensional Adiabatic Shear Band Model in CTH
Fermen-Coker, Muge; Sep. 2004; 44 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428732; ARL-TR-3284; No Copyright; Avail: Defense Technical Information Center (DTIC)

A failure criterion based on material response and scaling laws is implemented into a three-dimensional shear band nucleation and propagation model being developed in CTH, a Eulerian wave propagation code. Numerical simulations of plastic localization in Ti-6Al-4V armor plates due to steel fragment impact are carried out, before and after the implementation of the failure criterion. Adiabatic shearing is depicted as the impact speed approaches the ballistic limit velocity, confirming experimental observations. The capacity to calculate Grady-Kipp and Wright-Ockendon length scales are added to CTH to be used in conjunction with shear band model. Computational aspects of shear band spacing effects are discussed.
DTIC
Adiabatic Conditions; Criteria; Failure; Three Dimensional Models

20050051169 Naval Observatory, Washington, DC USA
Geometric Ray Tracing of a Paraxial Lens
Murison, Marc A.; Jan. 2004; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428762; AA-2004-01; FTS-2004-01; No Copyright; Avail: Defense Technical Information Center (DTIC)

The AESOP computer algebra ray tracing package has been updated to include geometric tracing of a paraxial lens. This document describes ray direction and optical path changes upon traversal of the ideal optical element known as a paraxial lens.

This is simply an infinitely thin, aberration-free lens in the paraxial approximation.
DTIC
Algebra; Lenses; Ray Tracing

20050051182 GIRD Systems, Inc., Cincinnati, OH USA
Wavelet Packets in Wideband Multiuser Communications
Fan, Howard; Nov. 2004; 120 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0086; Proj-4519
Report No.(s): AD-A428785; AFRL-IF-RS-TR-2004-305; No Copyright; Avail: Defense Technical Information Center (DTIC)

Throughout the entire duration of this contract, the contractor has accomplished a number of tasks. First, we modeled communications channels using wavelet packets, for both time-invariant and time-varying channels. We then developed doubly orthogonal CDMA user spreading waveforms based on wavelet packets. We have also developed and evaluated a wavelet packet based multicarrier CDMA wireless communication system. In this system design a set of wavelet packets are used as the modulation waveforms in a multicarrier CDMA system. The need for cyclic prefix is eliminated in the system design due to the good orthogonality and time-frequency localization properties of the wavelet packets. Two new detection algorithms are developed to work in either time domain or wavelet packet domain to combat multiuser and inter symbol interferences. Compared with the existing DFT based multicarrier CDMA systems, better performance is achieved with the wavelet packet based system by utilizing the saved cyclic prefix overhead for error correction coding. Theoretical analyses as well as computer simulations are performed to support these claims.
DTIC
Broadband; Intelligence; Wavelet Analysis; Wideband Communication

20050051183 Mercury Computer Systems, Inc., Chelmsford, MA USA
Partitioning of a Signal Detection Algorithm to a Heterogeneous Multicomputing Platform
Vinskus, Michael; Sep. 2003; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428792; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper explores the tradeoffs involved in mapping a signals intelligence algorithm to general-purpose processor and field programmable gate array (FPGA) based technology. Specifically, a prototypical signal detection algorithm is described. This algorithm consists of a Fourier transform based frequency channelizer followed by a statistical signal detector.
DTIC
Algorithms; Detection; Heterogeneity; Signal Detection; Signal Processing

20050051186 Carnegie-Mellon Univ., Pittsburgh, PA USA
Custom Reduction of Arithmetic in Linear DSP Transforms
Misra, Smarahara; Zelinski, A.; Hoe, James C.; Pueschel, Markus; Sep. 2003; 31 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DABT63-98-1-0004
Report No.(s): AD-A428795; No Copyright; Avail: Defense Technical Information Center (DTIC)

In multiplier-less hardware implementations of DSP transforms, multiplication-by-constants are implemented as a network of (wire-)shifts and additions. The number of additions required can be reduced by approximating the multiplicative constants using lower precision fixed-point representations, but the loss of precision increases the numerical error in the implementation. This trade-off can be leveraged to reduce the hardware area, critical path and power/ energy while maintaining the perceptible quality of a signal processing application (e.g., MPEG-4). This paper describes an automatic approach to minimize the number of additions subject to a given quality measure, or, vice-versa, to maximize the quality subject to a given number of available additions. Our automatic approach can handle linear DSP transforms in general and includes optimizations over the space of algorithm design. A Verilog backend generates synthesizable descriptions of the final variable-width fixed-point implementations.
DTIC
Algorithms; Arithmetic; Discrete Functions; Fourier Transformation; Linear Systems; Linear Transformations; Signal Processing

20050051187 Alternative System Concepts, Inc., Windham, OH USA

Precision Modeling and Bit-width Optimization of Floating-Point Applications

Zhao, Zhihong; Leeser, Miriam; Sep. 2003; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428796; No Copyright; Avail: Defense Technical Information Center (DTIC)

We present a floating-point precision modeling methodology that can be used to develop application adaptive arithmetic precision models for variable bit-width floating-point computing. We also developed optimization algorithms that minimize the total bit-width for the application such that the output accuracy meets user-defined requirements. The methodology supports different bit-widths for different variables in the datapath.

DTIC

Algorithms; Floating Point Arithmetic; Mathematical Models

20050051253 Boeing Phantom Works, Seattle, WA USA

Survivability Extensions for Dynamic Ultralog Environments

Brittan, Marc; Dec. 2004; 220 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MDA972-02-C-0025; DARPA ORDER-N047

Report No.(s): AD-A428910; No Copyright; Avail: Defense Technical Information Center (DTIC)

This final report describes the status of work performed during the contract period of performance from March 2002 to December 2004 on the DARPA project titled 'Survivability Extensions for Dynamic UltraLog Environments'. The objective of the effort was to: 1. Research and demonstrate new algorithms for improving metrics of performance and risk of a distributed agent system. This is done by building a mathematical model of the system, and using optimization techniques to improve the performance and risk profiles. 2. Integrate these algorithms into the fully operational Ultralog agent society. The tools for managing the state of the distributed agent system should themselves fit seamlessly into the existing Ultralog architecture.

DTIC

Algorithms

20050051257 Drexel Univ., Philadelphia, PA USA

High-Performance Linear Algebra Processor using FPGA

Johnson, J. R.; Nagvajara, P.; Nwankpa, C.; Aug. 2004; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): ER63384

Report No.(s): AD-A428934; No Copyright; Avail: Defense Technical Information Center (DTIC)

With recent advances in FPGA (Field Programmable Gate Array) technology it is now feasible to use these devices to build special purpose processors for floating point intensive applications that arise in scientific computing. FPGA provides programmable hardware that can be used to design custom hardware without the high-cost of traditional hardware design. In this talk we discuss two multi-processor designs using FPGA for basic linear algebra computations such as matrix multiplication and LU factorization. The first design is a purely hardware solution for dense matrix computations, and the second design uses a hardware/software solution for sparse matrix computations. The hardware solution uses the regular structure available in dense linear algebra computations to design custom processors with hard-wired communication patterns. The hardware/ software solution uses embedded processors with the flexibility to program the irregular communication patterns required by sparse matrix computations. The dense matrix processor utilizes a distributed memory architecture connected in a ring topology, with hardwired control for communication. Each processing element consists of pipelined multiply-accumulate hardware, and local memory to store part of the input and output matrices. Extra buffers are available to provide overlapped communication and computation so that while a computation is being performed the next inputs can be downloaded from the host computer. This allows the FPGA to be used as a hardware accelerator as part of a larger matrix computation using various block algorithms.

DTIC

Algebra; Computer Programming; Field-Programmable Gate Arrays

20050051265 Dillon Engineering, Inc., Edina, MN USA

Efficient Split Radix FFTs in FPGAs

Dillon, Tom; Sep. 2003; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428967; No Copyright; Avail: Defense Technical Information Center (DTIC)

This presentation outlines methods for split radix FFTs implemented in FPGAs. Analysis of various algorithms with

regards to performance, cost and power consumption are presented. FPGAs are rapidly finding their way into high performance DSP applications, specifically real time signal processing applications. Large FPGAs offer a significant cost, size, and power advantage over other alternatives for many front end real time processing operations. FPGAs offer the advantage of short and flexible design cycles, high performance and relatively low NRE. The FFT is at the heart of many real time signal processing applications, including radar, communication, and image processing. Logic for high speed FFTs can account for up to 90% of the cost and power of a given application, making efficient resource usage critical.
DTIC
Algorithms; Fast Fourier Transformations; Signal Processing

20050051558 Department of the Navy, Washington, DC USA
Inverse Method for Estimating the Wave Propagation Parameters of Two Dissimilar Wave Types
Hull, Andrew J., Inventor; Aug. 2004; 39 pp.; In English
Report No.(s): AD-D020171; No Copyright; Avail: CASI; A03, Hardcopy

A method is provided to distinguish two blended but different waves in a structure, such as compression and shear waves, by measuring their corresponding wave numbers and wave speeds. Other characteristics of the two waves may also be measured, such as the propagation coefficients of both waves. All measurements can be calculated at every frequency for which a transfer function measurement is made. The measurements do not depend on the resonance frequencies of the structure and do not require curve fitting to the transfer functions. The present invention relates generally to determining wave propagation parameters and, more particularly, to determining wave propagation parameters of two dissimilar wave types that have been blended together. Measuring the wave propagation parameters of structures is important because these parameters significantly contribute to the static and dynamic response of the structures. Because most measurement methods are designed to isolate and measure one specific wave, they fail to correctly analyze dual wave propagation. The present method preferably uses seven transfer functions that are obtained by vibrating the structure in a method that excites two different types of wave motion. Measurements may be made of either strain, displacement, velocity, or acceleration of the structure. Once this is accomplished, the seven measurements are combined to yield a closed form solution of both wave numbers and wave speeds. The four corresponding wave propagation coefficients also are estimated with a closed form solution during this process. Once these six parameters are known, the system response can be correctly characterized. (16 figures)
DTIC
Estimates; Estimating; Patent Applications; Transfer Functions; Vibration; Wave Propagation

20050051560 Department of the Navy, Washington, DC USA
A Method for Estimating the Properties of a Solid Material Subjected to Compressional Forces
Hull, Andrew J., Inventor; Feb. 2004; 31 pp.; In English
Report No.(s): AD-D020173; No Copyright; Avail: CASI; A03, Hardcopy

This patent application discloses a method to measure the complex frequency-dependent dilatational and shear wave numbers of a material under a static compressional force. The material is first vibrated in both vertical and horizontal directions while transfer functions are obtained in each direction. The two transfer functions are combined with a theoretical model to estimate a dilatational wave number and a shear wave number. The wave numbers can be utilized to give the complex dilatational wave speed, complex shear wave speed, complex Lame constants, complex Young's modulus, complex shear modulus, and complex Poisson's ratio.
DTIC
Compression Waves; Estimating; Modulus of Elasticity; Patent Applications; Shear Properties; Static Pressure; Transfer Functions; Wave Propagation

20050051965 Italian Aerospace Research Center, Capua, Italy
Synthetic Jet Modeling for U-RANS
Capizzano, F.; Iaccarino, G.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 183-194; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

This work focuses on different approaches for the numerical simulation of a Synthetic Jet device via RANS codes. The objective is to explore possible RANS techniques to utilize a more general design loop with flow control purposes. A turbulent flow over a hump model with a contoured slot in three different working conditions (no-flow control, steady suction and oscillatory control) is considered for our validation tests.The device itself is not simulated but its effects are modeled using

specially designed boundary conditions (BC). Comparisons of numerical results obtained with various BC formulations and experimental data are carried out. In the second part of the paper a preliminary study of a lumped model in which the time averaged flow field is resolved using a steady state approach is presented. A source term is added in the momentum equation to account for the unsteadiness generated by the pulsating jet. The source term is related to a scalar quantity whose field is governed by a classical convection-diffusion type transport equation.
Author
Flow Distribution; Turbulent Flow; Oscillations; Boundary Conditions

20050051966 Stanford Univ., Stanford, CA, USA, Sydney Univ., Australia
Direct Numerical Simulation of Turbulent Premixed Flames with a Marker Field and Application to RANS and LES
Bilger, R. W.; Martin, S. M.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 255-267; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

Direct numerical simulations of turbulent premixed combustion in isotropic homogeneous turbulence have been carried out. The simulations incorporate solutions for the marker field produced for a scalar having a simple source term proportional to the mean density. The mapping of the reaction progress field from this marker field is investigated at low to moderate Damkohler number and the results suggest that this could be a feasible way for closing the progress variable field in RANS and LES. Preliminary results for RANS calculations for a combustor with a backward-facing step are presented.
Author
Direct Numerical Simulation; Premixed Flames; Turbulent Combustion; Homogeneous Turbulence; Combustion Chambers

20050051967 Pohang Univ. of Science and Technology, Pohang, Korea, Republic of
Validation of an Asymptotic Zone Conditional Expression for Turbulent Burning Velocity Against DNS Database
Huh, K. Y.; Kim, S. H.; Kim, S.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 269-282; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

Zone conditional formulations for the Reynolds averaged reaction progress variable are used to derive an asymptotic expression for the turbulent burning velocity. New DNS runs are performed for validation in a statistically one dimensional steady state configuration. A parametric study is performed with respect to turbulent intensity, integral length scale, density ratio and laminar flame speed. Results show good agreement between DNS results and the asymptotic expression in terms of measured maximum flame surface density and estimated turbulent diffusivity in unburned gas.
Author
Direct Numerical Simulation; Asymptotic Series; Laminar Flow; Turbulence; Reynolds Averaging; Combustion; Estimating

20050051977 NASA Ames Research Center, Moffett Field, CA, USA
Sampling Versus Filtering in Large-Eddy Simulations
Debliquy, O.; Knaepen, B.; Carati, D.; Wray, A. A.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 133-144; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

A LES formalism in which the filter operator is replaced by a sampling operator is proposed. The unknown quantities that appear in the LES equations originate only from inadequate resolution (Discretization errors). The resulting viewpoint seems to make a link between finite difference approaches and finite element methods. Sampling operators are shown to commute with nonlinearities and to be purely projective. Moreover, their use allows an unambiguous definition of the LES numerical grid. The price to pay is that sampling never commutes with spatial derivatives and the commutation errors must be modeled. It is shown that models for the discretization errors may be treated using the dynamic procedure. Preliminary results, using the Smagorinsky model, are very encouraging.
Author
Large Eddy Simulation; Sampling; Finite Difference Theory; Finite Element Method; Derivation

20050051978 Cyprus Univ., Nicosia, Cyprus
Combining Eddy-Viscosity Models and the Algebraic Structure-Based Reynolds Stress Closure
Kalitzin, G.; Iaccarino, G.; Langer, C. A.; Kassinos, S. C.; Studying Turbulence Using Numerical Simulation Databases - X

Proceedings of the 2004 Summer Program; December 2004, pp. 171-182; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

Two linear eddy-viscosity models, the v(sup 2)-f and k-omega models , have been combined with an algebraic structure-based algorithm for the evaluation of the Reynolds stresses. This closure was originally designed as an integral part of the algebraic structure-based model (ASBM) to capture the turbulent anisotropy occurring in rotating wall bounded flows. It is shown that the algebraic structure-based evaluation of Reynolds stresses can be used directly with conventional turbulence models sensitizing them to rotation. Significant improvement in the prediction of anisotropic turbulent flow can be achieved without an additional tuning of the closure coefficients. The models are evaluated for spanwise rotating channel flow. The sensitivity to the Reynolds and Rossby numbers is investigated. The results are compared with DNS data.
Author

K-Omega Turbulence Model; Reynolds Stress; Turbulent Flow; Mathematical Models; Algebra; Eddy Viscosity

20050051980 Imperial Coll. of Science, Technology and Medicine, London, UK

Nonlinear Evolution of Velocity Fluctuations in a Laminar Boundary Layer Excited by Free-Stream Vortical Disturbances

Ricco, P.; Durbin, P. A.; Zaki, T.; Wu, X.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 223-240; In English; See also 20050051959
Contract(s)/Grant(s): EPSRC-GR/S59635/01; No Copyright; Avail: CASI; A03, Hardcopy

The response of an incompressible laminar boundary layer to vortical disturbances in the free-stream is investigated. For sufficiently long-wavelength components, the unsteady boundary-regio equations are employed at a streamwise location where the boundary-layer thickness becomes of the order of the inverse of the transverse fundamental wavenumber. The equations account for the transverse ellipticity and the pressure gradient induced by the displacement effect produced by the developing boundary layer. The free-stream turbulence is modeled by one vortical mode and the nonlinear generation of modes of higher frequency within the boundary layer is considered. This study confirms that low-frequency disturbances penetrate into the viscous region and induce laminar streamwise-elongated streaks, whereas high-frequency disturbances are confined in the outer edge layer. Results show that the streamwise and vertical wavenumbers have opposite effects on the penetration of modes into the boundary layer and that there is consistency between the linear boundary-region solution and the continuous spectrum of the Orr-Sommerfield equation. Nonlinear effects are more intense for lower values of streamwise wavenumber for a fixed level of turbulence intensity.
Author

Incompressible Boundary Layer; Free Flow; Vortices; Pressure Gradients; Boundary Layer Stability; Ellipticity

20050051988 Kobe Univ., Japan

Filtering and LES of flow over irregular rough boundary

Street, R. L.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 145-156; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

Formal explicit filtering defined by the convolution integral over a flow region has been applied to derive fundamental equations of Large Eddy Simulation (LES) for turbulent flows over complex boundaries with small-scale roughness which is not resolved in full. It allows smoothing of the boundary at the same level of filtering as for the flow. It indicates that extra stress-like terms appear in the equations due to the smoothing. DNS data for a flow over a doubly wavy boundary are analyzed to examine the distributions of these terms and other quantities that need modeling. It is found that these stress terms are due to the pressure drag acting on smoothed-out roughness. Preliminary LES calculations have also been made to examine a model for these terms. It is suggested that the modeling of the boundary resistance terms must be done with appropriate modeling of the boundary conditions. A dynamic procedure to determine model constants is proposed.
Author

Filtration; Large Eddy Simulation; Convolution Integrals; Turbulent Flow; Surface Roughness; Boundary Conditions

20050051989 Institut Francais de Petrole, Toulouse, France

Commutation Errors in Large Eddy Simulation on Moving Grids: Application to Piston Engine Flows

Moureau, V. R.; Vasilyev, O. V.; Angelberger, C.; Poinsot, T. J.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 157-168; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

A theoretical framework is developed to evaluate Temporal Commutation Errors (TCE) in piston-engine flows. These

errors occur when the Large Eddy Simulation (LES) filter is a function of time, implying for the temporal partial derivative not to commute with filtering. TCE are derived from structured and unstructured grids, highlighting the contributions of width and shape variations. Finally they are evaluated on LES simulations of a square-piston experiment and the influence of the crank speed and the compression ratio are studied. It is found that the TCE may be neglected to first order if the flow field and mesh deformation are generated by the same boundary movement.
Author
Large Eddy Simulation; Structured Grids (Mathematics); Unstructured Grids (Mathematics); Piston Engines; Commutation; Derivation; Flow Distribution; Errors

20050051990 Valeo Motors and Actuators, France
Numerical Simulation of a Low Speed Fan Blade
Moreau, Stephane; Iaccarino, G.; Kang, S.; Khalighi, Y.; Wang, M.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 195-207; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

The feasibility of using unsteady turbulence models for the prediction of the wall pressure fluctuations or self-noise sources on a Controlled Diffusion airfoil is evaluated. The aim is to find a possible alternative to a classical body-fitted Large Eddy Simulation for a complex automotive engine cooling fan blade. These unsteady simulations have been compared to wall pressure and wake velocity profiles measured in the large anechoic chamber of Ecole Centrale de Lyon, and to a reference body-fitted Large Eddy Simulation using the dynamic subgrid scale model previously achieved at CTR.
Author
Fan Blades; Large Eddy Simulation; Pressure Distribution; Turbulence Models; Wall Pressure; Dynamic Models

20050061041 Chulalongkorn Univ., Bangkok, Thailand
Flux-Difference Splitting Scheme with Modified Multidimensional Dissipation on Unstructured Meshes
Phongthanapanich, Sutthisak; Dechaumphai, Pramote; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 981-992; In English; See also 20050061039; Copyright; Avail: Other Sources

A flux-difference splitting scheme with a modified multidimensional dissipation for high-speed compressible flow analysis on unstructured meshes is presented. The scheme eliminates unphysical flow behaviors such as a spurious bump of the carbuncle phenomenon that occurs on the bow shock from flow over a blunt body, and the expansion shock generated from flow over a forward facing step. The switching function suggested by Quirk is implemented as a choice to detect the vicinity of strong shock. The proposed scheme is further extended to obtain higher-order spatial and temporal solution accuracy. The scheme is. in addition. combined with an adaptive meshing technique that generates unstructured triangular meshes to resemble the flow phenomena for reducing computational effort. The entire procedure is evaluated by solving several benchmarks as well as steady-state and transient high-speed compressible flow problems. Key Words: shock instabilities. carbuncle phenomenon. Roe's FDS. entropy fix. H-correction.
Author
Compressible Flow; Unstructured Grids (Mathematics); Unsteady Flow; Flux Difference Splitting; Difference Equations; Shock Waves

20050061043 Hwa Hsia Inst. of Tech., Taipei, Taiwan
Robust H(sup infinity) Output Feedback Control for General Nonlinear Systems with Structured Uncertainty
Wu, Jenq-Lang; Lee, Tsu-Tian; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1069-1075; In English; See also 20050061039
Contract(s)/Grant(s): NSC-89-2213-E-146-008; Copyright; Avail: Other Sources

In this paper, the robust H(sup infinity) output feedback control problem for general nonlinear systems with L(sub 2)-norm-bounded structured uncertainties is considered. Sufficient conditions for the solvability of robust performance synthesis problems are represented in terms of two Hamilton-Jacobi inequalities with n independent variables. Based on these conditions. a state space characterization of a robust H(sup infinity) output feedback controller solving the considered problem is proposed. An example is provided for illustration.
Author
Nonlinear Systems; Robustness (Mathematics); Hamilton-Jacobi Equation; Feedback Control

20050061047 National Taiwan Ocean Univ., Keelung, Taiwan, Province of China

Internal Symmetry Groups for Perfect Elastoplasticity Under Axial-Torsional Loadings

Liu, Chein-Shan; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 993-1002; In English; See also 20050061039

Contract(s)/Grant(s): NSC92-2212-E-019-006; Copyright; Avail: Other Sources

In the material modeling of experimental axial-torsional strain control tests, the hoop and radial strains are always unknown, a priori, and hence can not be viewed as inputs. This greatly complicates constitutive model analyses because the resulting differential equations become highly nonlinear. To tackle this problem, we demonstrate two new formulations. By using the two-integrating factors idea we derive two LIE type systems. The LIE algebra is a direct sum, and correspondingly the symmetry group is a direct product. Then. by using the one-integrating factor idea we convert the nonlinear constitutive equations to a Lie type system. The underlying space is a cone in the pseudo-Riemann manifold. Consistent numerical methods are also developed according to these Lie symmetries.

Author

Elastoplasticity; Torsion; Axial Strain; Riemann Manifold; Symmetry; Differential Equations; Constitutive Equations

20050061048 National Taiwan Univ. Hospital, Taipei, Taiwan, Province of China

Kinematic Chain Study of the Adjustability of a Monolateral External Fixator

Hou, Sheng-Mou; Wang, Jaw-Lin; Soong, Chang-Yaw; Lin, Tsung-Hung; Lin, Jinn; Journal of The Chinese Institute of Engineers, Volume 27, No. 7; November 2004, pp. 1003-1011; In English; See also 20050061039; Copyright; Avail: Other Sources

Adjustability of the external fixator reflects two important features; the range of allowable locations of pins and the ease of frame application, In this study. multilink open chain kinematic equations were developed to examine this adjustability of a monolateral external fixator. The entire bone-fixator system was simulated by a manipulator with four rigid links. two spherical joints, and one prismatic joint. Each of the links and joints was described by a 4x4 homogenous transformational matrix with either X-Y-Z or Z-X-Z Euler angle representation. The transformation equations were developed by concatenating these transformational matrices. Then the kinematic equations were solved by the least squares optimization method. and the numerical solutions were validated by geometrical solutions and mechanical experiments. The results showed solutions using Z-X-Z Euler angle representations were more reliable in predicting the reducibility of the malalignment and could be more conveniently used for direct kinematic study. Increasing the length of the central body. the offset of the telescoping joint, and the rotational range of ball joints and decreasing the pin length increased the adjustability. The adjustability reached its maximum as the initial offset of the telescoping joint reached a critical level. In conclusion. the adjustability of the external fixators was closely related to their designs. This study may assist manufacturers in the design of external fixators and help surgeons better understand the restraints of fixators and hence use such equipment more effectively.

Author

Kinematic Equations; Euler Equations of Motion; Manipulators; Joints (Junctions); Angles (Geometry)

20050061074 NASA Ames Research Center, Moffett Field, CA, USA

Topography Modeling in Atmospheric Flows Using the Immersed Boundary Method

Ackerman, A. S.; Senocak, I.; Mansour, N. N.; Stevens, D. E.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 331-341; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

Numerical simulation of flow over complex geometry needs accurate and efficient computational methods. Different techniques are available to handle complex geometry. The unstructured grid and multi-block body-fitted grid techniques have been widely adopted for complex geometry in engineering applications. In atmospheric applications, terrain fitted single grid techniques have found common use. Although these are very effective techniques, their implementation, coupling with the flow algorithm, and efficient parallelization of the complete method are more involved than a Cartesian grid method. The grid generation can be tedious and one needs to pay special attention in numerics to handle skewed cells for conservation purposes. Researchers have long sought for alternative methods to ease the effort involved in simulating flow over complex geometry.

Author

Grid Generation (Mathematics); Unstructured Grids (Mathematics); Cartesian Coordinates; Flow Geometry

20050061076 Stanford Univ., Stanford, CA, USA

Accurate and Efficient Immersed-Boundary Interpolations for Viscous Flows

Kang, S.; Iaccarino, G.; Moin, P.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 31-43; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

The objective of the present study is to further develop an IB method based on forcing which has sufficient accuracy for Large Eddy Simulations (LES) at high Reynolds numbers with minimal increase on computational cost with respect to the simple, underlying Cartesian grid solver. The starting point for the present IB method is the interpolation method described in Fadlun et al. (2000). In addition to its simplicity, it has several advantages. The velocity boundary condition is enforced with implicit forcing, there is no severe limit on the time step. and the velocity components from the regions across the immersed boundary are decoupled. In the present study, revisions to this approach are introduced with the objective of increasing the accuracy and consistency of this method. In addition we analyze the practical importance of strict mass conservation.
Author
Viscous Flow; Large Eddy Simulation; Interpolation; Boundary Conditions; High Reynolds Number; Cartesian Coordinates

20050061083 Uppsala Univ., Uppsala, Sweden
Stability for the Wall-Pierce-Moin Implicit Scheme
Gustafsson, B.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 87-93; In English; See also 20050061070; No Copyright; Avail: CASI; A02, Hardcopy

Explicit schemes are not well suited for simulation of low Mach number flow, due to the severe restriction on the time-step. Implicit schemes on the other hand, give rise to large non-linear systems coupling all dependent variables. Iterative methods have to be used for solving these systems, but iteration to full convergence in each time-step may be time consuming. One way to reduce the work, is to limit the number of iterations, such that the system is not fully solved, but still has a reasonable accuracy. Sometime such method is called semi-implicit. The purpose of this paper is to generalize the stability analysis for the fully implicit scheme in two ways. The first generalization is that we allow for nonzero advective velocity. The second one is that we start from the full non-linear difference scheme, and linearize from there. We will assume constant coefficients, and use Fourier analysis to prove unconditional stability and energy conservation even in this case.
Author
Stability Tests; Iterative Solution; Nonlinearity

20050061089 Stanford Univ., Stanford, CA, USA
Energy Conservation in Collocated Discretization Schemes on Unstructured Meshes
Ham, F.; Iaccarino, G.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 3-14; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

Recently, Mahesh et.al. proposed a control-volume-based collocated fractional step method for the incompressible Navier-Stokes equations suitable for large-eddy simulation (LES) and direct numerical simulation (DNS) on hybrid unstructured grids. Their approach emphasizes kinetic energy conservation for the convection and pressure terms. A significant contribution of their work is a novel last-squares pressure gradient reconstruction, which attempts to minimize the non-conservation of the pressure terms in the context of a collocated discretization. They report that this least squares reconstruction was found imperative to obtain robust, accurate solutions in the presence of highly skewed elements; unstable solutions were obtained in its absence. The present report describes our efforts to develop an alternative reconstruction for pressure by considering consistency in the presence of mesh skewness as an additional constraint to that of the minimization of any non-conservation of kinetic energy.
Author
Energy Conservation; Computational Grids; Navier-Stokes Equation; Unstructured Grids (Mathematics); Large Eddy Simulation; Direct Numerical Simulation

20050061095 Stanford Univ., Stanford, CA, USA
A Formulation of Incompressible Navier-stokes Equations in a Quasi-Generalized Coordinate System
You, D.; Wang, M.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 95-105; In English; See also 20050061070
Contract(s)/Grant(s): N00014-99-1-0389; No Copyright; Avail: CASI; A03, Hardcopy

In large-eddy simulation (LES) of flows in complex geometries, the generation of a high quality mesh and the large memory requirement for the metric quantities of coordinate transformation are often major obstacles, when a three-dimensional structured, body-fitted mesh is employed. The problem is particularly severe for flow solvers employing the staggered mesh arrangement, which is strongly preferred in non-dissipative LES codes for stability and discrete energy conservation (e.g.Mittal & Moin 1997; Nagarajan, Lele & Ferziger 2003). For instance, at least 80 (8 positions with 10 variables (metric coefficients plus Jacobian) per mesh element) three-dimensional arrays are required, compared to 10

three-dimensional arrays for collocated meshes. This makes LES impractical on large grids. In addition, the increase of partial derivative terms in the transformed governing equations cause a significant increase in computational cost. On the other hand, many geometries in engineering and scientific applications can be handled using a two-dimensional curvilinear mesh with mild variations along the remaining third direction. Frequently observed variations are shift, rotation, magnification/contraction, and skewing of the curvilinear plane along a perpendicular direction to that plane. The airplane wing is an example of the shift and contraction of the airfoil section, and the axial compressor or turbine blades are observed to be twisted along the radial direction maintaining the blade section profile. The objective of this study is to exploit these geometric simplification in the design of a numerical method, which is applicable to a wide class of problems while minimizing the memory requirement and computational cost. To this end, a formulation of incompressible Navier-Stokes equations based on a quasi-generalized coordinate system which consists of two-dimensional generalized curvilinear coordinates and a reasonably smooth variation along the perpendicular remaining direction is proposed. Using such an approach, one can efficiently treat geometric difficulties, and, at the same time, alleviate problems associated with a fully generalized coordinate transformation.
Author
Large Eddy Simulation; Incompressible Flow; Energy Conservation; Structured Grids (Mathematics)

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20050050993 Observatoire de Besancon, France
A Bayesian Method for Oscillator Characterization
Vernotte, F.; Zalamansky, G.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 99-107; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

The power spectral density of frequency fluctuations of an oscillator is generally modeled as a sum of power laws with integer exponents (from -2 to +2). However, a power law with a fractional exponent may exist. We propose a method for measuring such a noise level and determining the probability density of the exponent. This yields a criterion for compatibility with an integer exponent. This method is based upon a Bayesian approach called the reference analysis of Bernardo-Berger. The application to a sequence of frequency measurement from a quartz oscillator illustrates this paper.
Author
Bayes Theorem; Noise Intensity; Frequency Measurement; Oscillators; Probability Theory

20050051204 Florida State Univ., Tallahassee, FL USA
Bayesian Automated Target Recognition: Models and Algorithms
Srivastava, Anuj; Liu, Xiuwen; Mar. 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-1-0267
Report No.(s): AD-A428831; ARO-40074.17-MA; No Copyright; Avail: Defense Technical Information Center (DTIC)

The primary goal of this research was to develop representations, models, and algorithms for use in Bayesian automated recognition of objects from their images. Despite focused efforts in the area of image understanding in recent years, a fresh look was needed to highlight the progress and the limitations. Our research was focused along the following three broad themes: (i) development of efficient representations of the objects of interest (or their images) using nonlinear manifolds, (ii) development of parametric probability models for capturing object and clutter variability, and (iii) development of algorithms for solving inference problems on nonlinear manifolds that arise in object recognition.
DTIC
Algorithms; Bayes Theorem; Target Recognition; Targets

20050051555 Department of the Navy, Washington, DC USA
Enhanced Randomness Assessment Method for Three-Dimensions
O'Brien, Francis J., Inventor; Jul. 2004; 39 pp.; In English
Report No.(s): AD-D020168; No Copyright; Avail: CASI; A03, Hardcopy

This patent application discloses a multi-stage method for automatically characterizing data sets containing data points that are each defined by measurements of three variables as either random or non-random. A three-dimensional Cartesian volume which is sized to contain all of a total number N of data points in the data set which is to be characterized. The Cartesian volume is partitioned into equal-sized cubes, wherein each cube may or may not contain a data point. A

predetermined route is defined that goes through every cube one time and scores each cube as a one or a zero, thereby producing a stream of ones and zeros. The number of runs is counted and utilized to provide a Runs Test that predicts if the N data points in any data set are random or nonrandom. Additional tests are used in conjunction with the Runs Test to increase the accuracy of characterization of each data set as random or nonrandom. (3 figures)
DTIC
Cartesian Coordinates; Classifications; Patent Applications; Signal Processing; Sonar; Statistical Analysis

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20050041956 NASA Ames Research Center, Moffett Field, CA, USA
Evolvable Hardware for Space Applications
Lohn, Jason; Globus, Al; Hornby, Gregory; Larchev, Gregory; Kraus, William; [2004]; 13 pp.; In English; AIAA Intelligent Systems Conference; No Copyright; Avail: CASI; A03, Hardcopy

This article surveys the research of the Evolvable Systems Group at NASA Ames Research Center. Over the past few years, our group has developed the ability to use evolutionary algorithms in a variety of NASA applications ranging from spacecraft antenna design, fault tolerance for programmable logic chips, atomic force field parameter fitting, analog circuit design, and earth observing satellite scheduling. In some of these applications, evolutionary algorithms match or improve on human performance.
Author
Evolvable Hardware; Design Optimization; Aerospace Engineering

20050050960 Naval Observatory, Schriever AFB, CO, USA
Bridging the Gap Between Designs and Use of PTTI System: An Operations Perspective
Hutsell, Steven T.; Bollwerk, William V.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 61-68; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

Factors such as the unbounded growth in technology, as well as the desire for better, faster, and cheaper products, will always increase the pressure for advancing time transfer systems in the foreseeable future. Timing users will continually need systems with more features than before, improved robustness over previous systems, and better timing precision, stability, and accuracy than ever. Often lost in the pursuit of timing system advancements is the perspective of the operator (user) of the system. This paper addresses elements of operations that are essential to the cohesiveness between a system and its operator. These often forgotten elements include system training, system continuity, operational simplicity, operator responsibility, and common sense in implementation.
Author
Time Measurement; Robustness (Mathematics); Education; Accuracy

20050051013 Defence Science and Technology Organisation, Salisbury, Australia
Understanding Soft Operations Research: The Methods, their Application and its Future in the Defence Setting
Heyer, Rebecca; Oct. 2004; 50 pp.; In English
Report No.(s): AD-A428464; DSTO-GD-0411; DODA-AR-013-184; No Copyright; Avail: CASI; A03, Hardcopy

This paper seeks to understand soft operations research (OR) - the distinctions between it and hard OR, its methods and their application, particularly in the Defence setting. To achieve this a detailed examination of selected soft OR methods is presented, followed by a literature review documenting applications of these methodologies in the Defence setting, and the development of a preliminary framework to guide application of the methods. The paper concludes with an examination of the way forward for soft OR in the Defence setting, recommending support for soft OR's use in future projects, either singularly or in combination with hard OR methods; and the development of a framework for incorporating soft OR in% current military operations research.
DTIC
Operations Research

20050051114 Altarum Inst., Ann Arbor, MI USA

Agents Overcoming Resource Independent Scaling Threats (AORIST)

Van Dyke Parunak, H.; Brueckner, Sven; Sauter, John A.; Savit, Robert; Oct. 2004; 74 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-C-0134; DARPA ORDER-K275; Proj-ANTS

Report No.(s): AD-A428683; AFRL-IF-RS-TR-2004-306; No Copyright; Avail: Defense Technical Information Center (DTIC)

This project uses abstract simulation models of resource allocation and mathematical techniques inspired by statistical physics to study the nonlinear emergent dynamics of distributed decentralized resource allocation. Our techniques seek to characterize the dynamics that may be anticipated in real systems, to predict pathological dynamics such as peaks in required computational effort and catastrophic breakdown in performance, and to develop control methods based on this understanding. Our general approach begins with a set of abstract Resource Allocation Games (RAG). These games are derived from the Minority Game, a simple model of competition for scarce re-sources that captures essential features of interactions among agents that are heterogeneous, autonomous, boundedly rational, adaptable, parallel, co-situated, and experienced. Our research explores and generally confirms two hypotheses concerning the dynamics of resource allocation. The Generality Hypothesis asserts that a generic RAG exhibits dynamics that are intrinsic to resource allocation in-dependent of mechanism. The Specificity Hypothesis asserts that a RAG can be developed to resemble a specific re-source allocation mechanism and study its (idiosyncratic) dynamics.

DTIC

Game Theory

20050051241 Delaware Univ., Newark, DE USA

2D Distributed Sensing Via TDR

Dominauskas, A.; Heider, D.; Gillespie Jr, J. W.; Jul. 2003; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0811

Report No.(s): AD-A428889; No Copyright; Avail: Defense Technical Information Center (DTIC)

Briefing charts only.

DTIC

Detection; Reflectometers

20050051768 Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan

Resource Management Technologies for Home Network Services

Yamazaki, Hirofumi; Zhang, Zhi; Yoda, Ikuo; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 12-16; In English; See also 20050051761; Copyright; Avail: Other Sources

Recently the number of resources, such as home appliances, connected to home networks has been increasing. If they can cooperate, they will be able to provide a lot of services, and home life will be much more convenient and comfortable. However, there are several resource standards and situations; this obstructs resource cooperation. This article describes our resource management techniques for facilitating cooperation among different resource standards and our techniques for detecting the location of resources. Our resource manager converts the different types of resource information into a uniform style and manages it to reduce the processing load. Network management technologies are utilized for location detection to reduce maintenance work.

Author

Resources Management; Computer Techniques; Resource Allocation; Management Methods; Maintenance

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20050050932 Michigan Univ., Ann Arbor, MI, USA

Mathematical Description of Dendrimer Structure

Majoros, Istvan J.; Mehta, Chandan B.; Baker, James R., Jr.; Journal of Computational and Theoretical Nanoscience; June 2004; ISSN 1546-1955; Volume 1, No. 2, pp. 193-198; In English

Contract(s)/Grant(s): NAS2-02069; NO1-CM-97065-32; Copyright; Avail: Other Sources

Characteristics of starburst dendrimers can be easily attributed to the multiplicity of the monomers used to synthesize them. The molecular weight, degree of polymerization, number of terminal groups and branch points for each generation of a dendrimer can be calculated using mathematical formulas incorporating these variables. Mathematical models for the calculation of degree of polymerization, molecular weight, and number of terminal groups and branching groups previously published were revised and elaborated on for poly(amidoamine) (PAMAM) dendrimers, and introduced for poly(propyleneimine) (POPAM) dendrimers and the novel POPAM-PAMAM hybrid, which we call the POMAM dendrimer. Experimental verification of the relationship between theoretical and actual structure for the PAMAM dendrimer was also established.
Author
Dendrimers; Molecular Weight; Polymerization; Macromolecules

20050051180 Norwegian Defence Research Establishment, Kjeller, Norway
Set Classification of Military Targets
Korsnes, Reinert; Hansen, Bjorn J.; Mar. 2004; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428782; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Classifications; Targets

20050051229 Boston Univ., Boston, MA USA
Threats Networks and Threatened Networks
Stanley, H. E.; Nov. 2004; 6 pp.; In English
Contract(s)/Grant(s): N00014-02-1-1033
Report No.(s): AD-A428870; No Copyright; Avail: CASI; A02, Hardcopy
A.Network robustness. The goal of this work is to determine network design guidelines which maximize the robustness of networks to both random failure and intentional attack while keeping the cost of the network constant. We find optimal parameters for: (i) scale free networks having degree distributions with a single power-law regime, (ii) networks having degree distributions with two power-law regimes, and (iii) networks described by degree distributions containing two peaks. B. Resilience of Networks: An attack on a network is aimed at interrupting the flow of information in the network. The efficiency of the network in transmitting information between two nodes depends on the length of the optimal path of least cost between them. Our previous work had shown that when the loads on the links are distributed over several orders of magnitude, the average optimal path length scales as a power of the network size N. In such a case the network is said to be in the regime of 'strong disorder'. This situation is detrimental to the efficient flow of information on the network. In our work we focused on quantifying the point at which the network starts experiencing strong disorder and therefore starts losing its functionality. C. Dynamics of flow in complex networks: Understanding flow in complex networks is important if we are to understand how information, disease, resources, etc flow in the real world. in particular it is important to understand the nature of flow in the presence of disorder. Our work has focused on determining if there is a relationship between the scaling of flow variables and the scaling of other previously studied quantities such as the optimal path. Our preliminary finding is that current flow in a random resistor lattice has the same scaling as the optimal path under conditions of both strong and weak disorder.
DTIC
Network Analysis

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*.

20050041898 Florida State Univ., Tallahassee, FL, USA
Measurement of the Recoil Polarization of Electroproduced Lambda(1116)
McAleer, S. B.; 2004; In English
Report No.(s): DE2004-824912; No Copyright; Avail: National Technical Information Service (NTIS)
The CEBAF Large Acceptance Spectrometer at the Thomas Jefferson National Laboratory was used to study the reaction e+ p(yields) e(prime)+ K(sup+)+(Lambda)(1116) for events where(Lambda)(1116) subsequently decayed via the

channel(Lambda)(1116)(yields) p+(pi)(sup -). Data were taken at incident electron beam energies of 2.5, 4. 0, and 4.2 GeV during the 1999 E1C run period. They hyperon production spectra span the Q(sup 2) range from 0.5 to 2.8 GeV(sup 2) and nearly the entire range in the center of mass angles. The proton angular distribution in the(Lambda)(1116) rest frame is used to deduce the recoil polarization of the hyperon, and the W and cos(theta)(sub cm)(sup K+) dependence of the recoil polarization will be presented. The data show sizeable negative polarizations for the(Lambda)(1116) as a function of both cos(theta)(sub cm)(sup K+) and W.
NTIS
Spectrometers; Linear Accelerators; Electrons; Polarization (Waves)

20050041899 Ripon Coll., WI, USA, George Washington Univ., Washington, DC, USA
Resonance Production Through the Two Neutral-Pion Channel
Philips, S. A.; Jan. 30, 2002; In English
Report No.(s): DE2004-824914; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Pions; Cross Sections; Neutral Particles

20050041900 Virginia Univ., Charlottesville, VA, USA
Spin Structure of the Proton in the Resonance Region
Fatemi, R. H.; Jan. 2002; In English
Report No.(s): DE2004-824911; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Proton Resonance; Asymmetry; Spin

20050041904 Fermi National Accelerator Lab., Batavia, IL, USA
Prospects in CP Violation Measurements at the Tevatron Collider
Tonelli, D.; Jun. 2004; In English
Report No.(s): DE2004-825242; FERMILAB-CONF-04/086-E; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
CP Violation; Particle Accelerators; Particle Production; Detectors

20050041905 Florida Univ., Gainesville, FL, USA
Search for Higgs, Leptoquarks, and Exotics at Tevatron
Wong, S. M.; May 27, 2004; In English
Report No.(s): DE2004-825247; FERMILAB-CONF-04/085-E; No Copyright; Avail: National Technical Information Service (NTIS)
This paper reviews some of the most recent results from the CDF and D0 experiments on the searches for Standard Model and Non-Standard Model Higgs bosons, and other new phenomena at the Tevatron. Both experiments examine data from proton anti-proton collision at(radical)s= 1. 96 TeV, of integrated luminosity(approx) 200 pb(sup -1) (per experiment), to search for Higgs predicted in the Standard Model and beyond Standard Model, supersymmetric particles in the Gauge Mediated Symmetry Breaking scenario, leptoquarks, and excited electrons. No signal was observed, and limits on the signatures and models are derived.
NTIS
Leptons; Quarks; Higgs Bosons; Standard Model (Particle Physics)

20050041907 Colombo Univ., Colombo, Sri Lanka, Old Dominion Univ., Norfolk, VA, USA
Spin Structure Functions of the Deuteron Measured with Clas in and Above the Resonance Region
Vipuli, K. G.; Dharmawardane, G.; May 2004; In English
Report No.(s): DE2004-824941; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Deuterons; Spin Resonance

20050041909 Yildiz Technical Univ., Istanbul, Turkey, Old Dominion Univ., Norfolk, VA, USA
Measurement of the Double Spin Asymmetry in pi(sup -) Electroproduction with CLAS
Bektasoglu, M.; Dec. 01, 2002; In English
Report No.(s): DE2004-824918; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Electron Beams; Asymmetry; Electron Spin; Particle Production

20050041910 Catholic Univ. of America, Washington, DC, USA
Strangeness Photoproduction in the gamma p(yields) K(sup 0)Sigma(sup+) Reaction
Carnahan, B.; 2003; In English
Report No.(s): DE2004-824935; No Copyright; Avail: National Technical Information Service (NTIS)
The photoproduction reaction(gamma)p(yields) K(sup 0)(Sigma)(sup+) was analyzed in the photon energy range from 1.15 to 2.35 GeV. This thesis contains the first high-statistics analysis of K(sup 0) photoproduction. Data were taken in Hall B at Jefferson Lab using tagged photons incident on a liquid hydrogen target, with all outgoing charged particles in the final states ((pi)(sup+)(pi)(sup -))(p(pi)(sup 0)) and ((pi)(sup+)(pi)(sup -))(n(pi)(sup+)) detected by the CLAS spectrometer. As the reaction(gamma)p(yields) K(sup 0)(Sigma)(sup+) is a rare process, most of the detected events are due to unwanted background reactions. Careful data fits and cross checks are required to identify the reaction being studied. To determine the acceptance for the desired reaction and the possible contamination by background processes, a detailed Monte Carlo simulation of all of these processes is performed. Data sets at beam energies of 2.445 and 3.115 GeV were studied separately and then averaged into a single data set, with much better statistical precision than previous measurements. Our cross sections are smaller than previous experimental data and theoretical predictions based on those data, especially in the forward angular region, but are similar in shape in the total cross section.
NTIS
Photoproduction; Strangeness; Reaction Kinetics

20050041942 Arizona State Univ., Tempe, AZ
Eta (547) and Eta (958) Meson Photoproduction on the Proton
Dugger, M.; Dec. 2001; In English
Report No.(s): DE2004-824908; No Copyright; Avail: National Technical Information Service (NTIS)
Photoproduction of(eta) and(eta)(prime) mesons has been studied at the Continuous Electron Beam Accelerator Facility (CEBAF) Large Acceptance Spectrometer (CLAS) using a tagged photon beam incident on a hydrogen target with photon energies from the respective production thresholds up to 2.4 GeV. The photoproduced mesons were identified via missing mass reconstruction using recoil proton momentum and time of flight information. Data were obtained in a range of(radical)s from threshold to 2.2 GeV for each meson. In this study, differential cross-section measurements for the(gamma)p(yields) p(eta) and(gamma)p(yields) p(eta)(prime) reactions are presented, and the results compared to recent data. An isobar analysis of the differential cross-sections is performed. The predicted differential cross-sections from the isobar analysis are used to predict behavior in unmeasured regions of phase space, and to infer total cross sections. For the(gamma)p(yields) p(eta) reaction, a value of the S(sub 11)(1535) proton helicity amplitude also was extracted and compared to recent analyses. The data presented greatly extends the energy and angle coverage for differential cross-sections of(eta) photoproduction, and significantly improves the accuracy with which(eta)(prime) cross sections are known.
NTIS
Photoproduction; Photons; Photon Beams; Eta-Mesons

20050041943 Carnegie-Mellon Univ., Pittsburgh, PA
Photoproduction of (Lambda) and (Sigma)(sup 0) Hyperons off Protons in the Nucleon Resonance Region using CLAS at Jefferson Lab
McNabb, J. W. C.; Dec. 05, 2002; In English
Report No.(s): DE2004-824902; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Hyperons; Photoproduction; Protons

20050041946 Brookhaven National Lab., Upton, NY, USA
Proposal for a Silicon Vertex Tracker (VTX) for the PHENIX Experiment
Akiba, Y.; 2004; In English
Report No.(s): DE2004-15007383; BNL-72204-2004; No Copyright; Avail: National Technical Information Service (NTIS)

We propose the construction of a Silicon Vertex Tracker (VTX) for the PHENIX experiment at RHIC. The VTX will substantially enhance the physics capabilities of the PHENIX central arm spectrometers. Our prime motivation is to provide precision measurements of heavy-quark production (charm and beauty) in A+A, p(d)+A, and polarized p+p collisions. These are key measurements for the future RHIC program, both for the heavy ion program as it moves from the discovery phase towards detailed investigation of the properties of the dense nuclear medium created in heavy ion collisions, and for the exploration of the nucleon spin-structure functions. In addition, the VTX will also considerably improve other measurements with PHENIX. The main physics topics addressed by the VTX are: (1) Hot and dense strongly interacting matter--Potential enhancement of charm production; Open beauty production; Flavor dependence of jet quenching and QCD energy loss; Accurate charm reference for quarkonium; Thermal dilepton radiation; High p(sub T) phenomena with light flavors above 10-15 GeV/c in p(sub T); and Upsilon spectroscopy in the e(sup+)e(sup -) decay channel. (2) Gluon spin structure of the nucleon-(Delta)G/G with charm;(Delta)G/G with beauty; and x dependence of(Delta)G/G with(gamma)-jet correlations. (3) Nucleon structure in nuclei--Gluon shadowing over broad x-range.
NTIS
Silicon; Ionic Collisions; Energy Dissipation

20050041953 Fermi National Accelerator Lab., Batavia, IL, USA
Top Physics at CDF
Thom, J.; Jun. 2004; In English
Report No.(s): DE2004-825282; FERMILAB-CONF-04/089-E; No Copyright; Avail: National Technical Information Service (NTIS)

Precision studies of top quark properties are a primary goal of the Run II physics program at the Fermilab Tevatron. Marking the first stages of this program, the CDF collaboration presents recent results on top pair production cross section, single top physics and top mass, using between 109 and 200 pb(sup -1) of Run II data.
NTIS
Pair Production; Quarks

20050041958 Carnegie-Mellon Univ., Pittsburgh, PA, USA
Measurement of the Unpolarized K(sup +)(Lambda) and K (sup +)(Sigma)(sup 0) Electroproduction Cross Sections and Interference Terms from the Proton with the CLAS Detector
Feierbach, R. J.; Dec. 2002; In English
Report No.(s): DE2004-824916; No Copyright; Avail: National Technical Information Service (NTIS)

Using the CLAS detector, we measure the K(sup+)(Lambda) and K(sup+)(Sigma)(sup 0) electroproduction response functions over the continuous kinematic range from threshold to W= 2.05 GeV and for Q(sup 2) between 0.5 and 1.5 (GeV/c)(sup 2), with nearly complete angular coverage in the center-of-momentum frame angles. The(sigma)(sub T)+(epsilon)(sigma)(sub L),(sigma)(sub TT) terms are extracted and compared to recent theoretical calculations based upon a hadrodynamic effective-Lagrangian framework. From examining the W-dependence of the response functions for the K(sup+)(Lambda) final state, we find features in the ((sigma)(sub T)+(epsilon)(sigma)(sub L)) term in the W= 1.75 to 1.90GeV region, similar to features seen in recent photoproduction results. In general, the(sigma)(sub TT) and(sigma)(sub LT) response-functions for(Lambda) production are of the same order of magnitude as the ((sigma)(sub T)+(epsilon)(sigma)(sub L)) term, suggesting that both(sigma)(sub T) and(sigma)(sub L) contribute significantly. For the K(sup+)(Sigma)(sup 0) final state the W-dependence of the ((sigma)(sub T)+(epsilon)(sigma)(sub L)) and(sigma)(sub TT) terms have large, resonant-like features near W= 1.9GeV. Unlike in(Lambda) electroproduction, the(sigma)(sub LT) interference term for(Sigma)(sup 0) electroproduction is found to be consistent with zero across nearly the entire kinematic range, while(sigma)(sub TT) is comparable in magnitude to the(sigma)(sub T)+(epsilon)(sigma)(sub L) differential cross-section. The models, while achieving some qualitative agreement with the data, fail to both describe the details of the angular distributions and reproduce the resonant-like behavior observed.
NTIS
Angular Distribution; Kinematics; Photoproduction; Protons

20050041960 Fermi National Accelerator Lab., Batavia, IL, USA
Coming Revolution in Particle Physics. Report of the Fermilab Long Range Planning Committee
Jun. 2004; In English
Report No.(s): DE2004-825231; FERMILAB-TM-2253; No Copyright; Avail: National Technical Information Service (NTIS)

In early 2003, the Fermilab Director formed a committee (Appendix A) to examine options for the long-range future of Fermilab. Specifically, the committee was asked to respond to a charge (Appendix B), which laid out the assumptions, which were to underlie our discussions. The committee met a few times during the spring of 2003 and formulated a plan of action. It identified a number of issues that deserved attention, and a subcommittee was formed to focus on each. We agreed that in addressing these key issues, a broader participation was appropriate. The manner in which that was achieved varied from subcommittee to subcommittee to group. In some cases the expanded membership participated in all the discussions, in others, particular presentations were solicited and heard. Some subgroups met regularly over several months, others convened only for a small number of discussions. We have attempted to list participants in Appendix C. General presentations indicating the purpose of the work were given, for example at the Fermilab Users Annual Meeting. In the remainder of the report we use chapter 2 to describe the Physics Landscape 2010-2020, which is the basis for what we would like to see happen. In chapter 3 we discuss the Linear Collider, which will be a major component of the laboratory program under any scenario and, if constructed nearby, a dominant one. In chapter 4 we describe a vigorous but evolutionary program to address the key neutrino physics areas, and in chapter 5 we discuss attractive initiatives, which would provide the necessary powerful source of protons and, hence, neutrinos for this program. A strong participation in the machine, the experiment (CMS), and the physics at the Large Hadron Collider is a constant for our deliberations and is discussed in chapter 6. Astroparticlephysics, which was introduced to the Laboratory twenty years ago, continues to develop and its growth is discussed in chapter 7. Accelerator research and development, the underpinning of our science core is addressed in chapter 8, and its sister discipline, detector research and development, is covered in chapter 9. In chapter 10 we examine the interdisciplinary science close to our field, which encircles our laboratory. In chapter 11 we outline some of the resource issues and the extent to which they were addressed before we present the conclusions.
NTIS
Particle Emission; Protons; Neutrinos; Hadrons

20050041961 Akademiya Meditsinskikh Nauk SSSR, Moscow, Russia, Fermi National Accelerator Lab., Batavia, IL, USA, Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, State Research Center of Russia, Protvino, Russian Federation
Lead-Glass Electromagnetic Calorimeter for the SELEX Experiment
Balatz, M. Y.; Cooper, P. S.; Davidenko, G. V.; Dolgolenko, A. G.; Dzyubenko, G. B.; Jun. 2004; 46 pp.; In English
Report No.(s): DE2004-825953; FERMILAB-TM-2252; No Copyright; Avail: Department of Energy Information Bridge

A large-acceptance, highly segmented electromagnetic lead glass calorimeter for Experiment E781 (SELEX) at Fermi National Acceleration Laboratory was designed and built. This detector has been used to reconstruct photons and electrons with energies ranging from few GeV up to 500 GeV in the collisions of the 650 GeV (Sigma)(sup -) hyperons and (pi)(sup -) mesons with the target nucleons. The design, calibration and performance of the calorimeter are described. Energy resolution and position resolution are assessed using both calibration electron beams and (pi)(sup 0) mesons reconstructed in 650 GeV hadron-hadron interactions. The performance of the calorimeter in selecting resonant states that involve photons is demonstrated.
NTIS
Calorimeters; Lead (Metal); Glass; Photons; Electrons

20050041965 Michigan Univ., Ann Arbor, MI, USA
Top Physics: CDF Results
Bloom, K.; Jun. 2004; In English
Report No.(s): DE2004-825279; FERMILAB-CONF-04/071-E; No Copyright; Avail: National Technical Information Service (NTIS)

The top quark plays an important role in the grand scheme of particle physics, and is also interesting on its own merits. We present recent results from CDF on top-quark physics based on 100-200 pb(sup -1) of p(bar p) collision data. We have measured the t(bar t) cross section in different decay modes using several different techniques, and are beginning our studies of top-quark properties. New analyses for this conference include a measurement of(sigma)(sub t(bar t)) in the lepton-plus-jets channel using a neural net to distinguish signal and background events, and measurements of top-quark branching fractions.
NTIS
Collisions; Neural Nets; Quarks

20050041972 Fermi National Accelerator Lab., Batavia, IL, USA
Beam-Based Determination of the Offset of Booster (gamma)(sub T) Quads
Yang, X.; Ankenbrandt, C. M.; MacLachlan, J.; Jun. 23, 2004; In English
Report No.(s): DE2004-825278; FERMILAB-TM-2254; No Copyright; Avail: National Technical Information Service (NTIS)

Twelve pulsed(gamma)(sub T) quads have been installed in the Booster to provide fast transition crossing. The less time the beam stays in the non-adiabatic period near transition, the less the longitudinal emittance grows. From the past experience, the(gamma)(sub T) quads are not well aligned relative to the usual closed orbit. Quad steering can cause beam loss and a dispersion wave after transition. To make the(gamma)(sub T) quads routinely operational, procedures for finding the center of the beam relative to the quads and centering the beam through all of them are very important. A program, which uses the difference in the closed orbits when(gamma)(sub T) quads are on and off and calculates the offsets of the beam relative to(gamma)(sub T) quads, has been developed and tested. A radial orbit offset (ROF) of about 3 mm has been experimentally determined to be nearly the optimal radial position for centering the beam through all the(gamma)(sub T) quads, thereby eliminating the immediate need for repositioning the quads.
NTIS
Beams (Radiation); Boosters (Explosives); Steering

20050041973 Fermi National Accelerator Lab., Batavia, IL, USA
Measurement of (gamma)(sub T) with the (gamma)(sub T) Quads on and Off
Tang, X.; MacLachlan, J.; Ankenbrandt, C. M.; 2004; In English
Report No.(s): DE2004-825286; FERMILAB-TM-2255; No Copyright; Avail: National Technical Information Service (NTIS)
An experimental procedure for measuring(gamma)(sub T) has been developed and tested in two different measurements, with the(gamma)(sub T) quads on and off. The results were compared to MAD calculations. The discrepancy between the measured(gamma)(sub T) and the calculated(gamma)(sub T) is less than 5%.
NTIS
Electromagnetic Measurement; Experimentation; Computation

20050041975 Fermi National Accelerator Lab., Batavia, IL, USA
Distribution of Incoherent Space-Charge Tune Shift of a Bi-Gaussian Beam
Ng, K. Y.; Apr. 15, 2004; In English
Report No.(s): DE2004-825289; TM-2241; No Copyright; Avail: National Technical Information Service (NTIS)
The incoherent space-charge self-force tune shift of a bi-Gaussian coasting beam is revisited. The distribution density of the incoherent horizontal or vertical space-charge tune shift is computed numerically using a statistical method. Analytic approach has also been made with approximation. The results show a broad peak centered about 0.633 with a rms spread 0.168 of the linear space-charge tune shift.
NTIS
Space Charge; Beams (Radiation)

20050041983 Bucharest Univ., Romania, New Hampshire Univ., Durham, NH, USA
Survey of Beam Asymmetries in Semi-Exclusive Electron Scattering on (sup 4)HE and (sup 12)C
2004; In English
Report No.(s): DE2004-824919; No Copyright; Avail: National Technical Information Service (NTIS)
A study of the polarized electron beam asymmetry in semi-exclusive (e,e(prime)p) reactions on(sup 4)He and(sup 12)C over a large kinematic range has been performed. The beam asymmetry A(prime)(sub LT) is related to the imaginary part of the longitudinal-transverse interference and therefore it vanishes in reactions proceeding through a channel with a single dominant mechanism. In quasifree nucleon knockout, the helicity asymmetry provides an unambiguous signature for the interference between direct knockout and rescattering amplitudes. The data were taken in April-May 1999 using polarized beams of energies between 2.2 and 4.4 GeV, with the CEBAF Large Acceptance Spectrometer (CLAS) detector located in Hall B at the Jefferson Laboratory, VA. The measured asymmetries compare well with the theoretical predictions.
NTIS
Asymmetry; Electron Beams; Electron Scattering; Carbon 12; Linear Accelerators; Helium Isotopes

20050041992 Massachusetts Inst. of Tech., Cambridge, MA, USA
Precision Measurement of the Spin-Dependent Asymmetry in the Threshold Region of Quasielastic 3He (polarized e, e prime)
Xiong, F.; 2004; In English
Report No.(s): DE2004-824959; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Asymmetry; Beam Currents

20050041996 Chengdu Univ. of Science and Technology, Chengdu, China, Massachusetts Inst. of Tech., Cambridge, MA, USA

Searching for Short Range Correlations Using (e,e'NN) Reactions

Zhang, B.; 2004; In English

Report No.(s): DE2004-824928; No Copyright; Avail: National Technical Information Service (NTIS)

Electron induced two nucleon knockout reactions (e, e'pp) and (e,e'np) were performed for(sup 3)He,(sup 4)He, and(sup 12)C nuclei with incident energies of 2. 261 GeV and 4.461 GeV using the CLAS detector at Jefferson Lab. Events with missing momenta lower than the Fermi level and missing energies smaller than the pion threshold were studied. The residual system was assumed to be a spectator and the process was considered as a quasi-free knockout of an NN pair. The data showed that the initial momentum extends up to 800 MeV/c with considerable strength. The cross sections for(sup 3)He(e,e'pp)n were compared to the calculations of J.M. Laget. It was found that the final state interactions (FSI) and the meson exchange currents (MEC) dominate the cross sections and the short range properties of the NN pair were substantially undermined. However, the node of the S state wave function of the pp pair at around 400 MeV/c initial momentum starts to be recognizable in the 4.461 GeV data. The data and the theory suggest that with higher momentum transfers, especially in the region x(sub Bj); 1, the competing processes such as FSI and MEC will be less important and the detailed study of the short-range properties of nucleons inside nuclei will be more desirable.

NTIS

Momentum; Wave Functions; Nucleons

20050042001 Fermi National Accelerator Lab., Batavia, IL, USA

Thermal Modeling of the Tevatron Magnet System

Theilacker, J. C.; Klebaner, A. L.; 2001; 12 pp.; In English

Report No.(s): DE2004-826006; FERMILAB-CONF-01/481-AD; No Copyright; Avail: Department of Energy Information Bridge

Operation of the Tevatron at lower temperatures, for the purpose of allowing higher energies, has resulted in a renewed interest in thermal modeling of the magnet strings. Static heat load and AC loses in the superconducting coils are initially transported through subcooled liquid helium. Heat exchange between the subcooled liquid and a counter flowing two-phase stream transfers the load to the latent heat. Stratification of the two-phase helium stream has resulted in considerably less heat exchange compared to the original design. Spool pieces have virtually no heat transfer to the two-phase resulting in a 'warm' dipole just downstream. A model of the magnet string thermal behavior has been developed. The model has been used to identify temperature profiles within magnet strings. The temperature profiles are being used in conjunction with initial magnet quench performance data to predict the location of quench limiting magnets within the Tevatron. During thermal cycles of magnet strings, the model is being used to 'shuffle' magnets within the magnet string in order to better match the magnets quench performance with its actual predicted temperature. The motivation for this analysis is to raise the operating energy of the Tevatron using a minimal number of magnets from the spares pool.

NTIS

Heat Transfer; Temperature Effects; Superconductivity

20050042008 Bergen Univ., Norway, Stanford Linear Accelerator Center, CA, USA

Probing the CKM Triangle at BABAR

Eigen, G.; Nov. 2003; In English

Report No.(s): DE2004-826748; SLAC-PUB-10340; No Copyright; Avail: National Technical Information Service (NTIS)

We present recent BABAR measurements that constrain both the sides and the angles of the Unitarity Triangle.

NTIS

Measurement; Triangles; Angles (Geometry); Limits (Mathematics)

20050042009 Navy Personnel Research and Development Center, San Diego, CA, USA, Stanford Linear Accelerator Center, CA, USA

Spectral Analysis of the Black Hole Candidate 4U 1630-47

Saxena, R.; Aug. 2002; 30 pp.; In English

Report No.(s): DE2004-826725; SLAC-PUB-9394; No Copyright; Avail: Department of Energy Information Bridge

We performed spectral analysis on the 1999 X-ray outburst of the soft X-ray transient black hole candidate (BHC) 4U 1630-47, in order to learn about physical processes (such as changes in inner disk radius of the accretion disk) that manifest

themselves as changes of state. This source goes through an outburst every 600-690 days, which is a very short time period compared with other transient X-ray sources, The overall shape of the outburst's light curve was very similar to that of the 1996 outburst, but noticeably different from that of the 1998 outburst. We fitted 47 observations of the outburst to a model consisting of a disk blackbody, inverse Comptonization power law, and Gaussian component, multiplied by an absorption constant and an overall normalization constant. We found that the BHC progressed from a low state to high, and then back to low during its outburst. This pattern is common to persistent sources, not transient sources. We also found that when the source is in the low state, the flux and hardness are anticorrelated, as is predicted by theory. However, when 4U 1630-47 is in the high state, it is unclear whether or not the flux and hardness are correlated as theory says they should be.
NTIS
Galactic Clusters; Black Holes (Astronomy); Spectrum Analysis

20050042019 San Francisco State Univ., CA, USA, Stanford Linear Accelerator Center, CA, USA
Scintillator Replacement Option for BaBar
Lometti, M.; Aug. 2002; 32 pp.; In English
Report No.(s): DE2004-826728; SLAC-PUB-9398; No Copyright; Avail: Department of Energy Information Bridge

A replacement technology for the muon detection system in BaBar using scintillator bars with Wavelength Shifting (WLS) fibers and Avalanche Photo Diodes (APDs). APDs must be used in BaBar due to the high magnetic fields that disrupt the electron multiplying effects of Photo Multiplier Tubes (PMTs). Muons passing through scintillator cause fluors in the scintillator to emit photons, which are captured by WLS fibers and then re-emitted at the ends of the fibers to awaiting APDs. The detector configuration that will produce the largest Light Yield (LY) and produce a clear APD signal that will be larger than background noise is the main goal of the study. Bar dimensions, number of WLS fibers, and placement of fibers are parameters that may be adjusted to produce the largest LY. Additionally, good timing resolution is needed to determine where a muon passed through the detector along the long direction of the bar. A scintillator bar 2cm x 4cm in x-y with four round lmm fibers produced the largest LY out of four different configurations with a timing resolution of 25cm. A Monte Carlo simulation confirmed the relative LY compared to other detectors. This detector was able to produce a 40mV pulse from the APD that was easily discernable above the 2-SmV background noise. Refinement of the fabrication process could produced higher LYs and better timing resolutions, while a redesign of the electronics may increase the signal to noise ratio.
NTIS
Scintillation Counters; Background Noise; Signal to Noise Ratios

20050042022 Stanford Linear Accelerator Center, CA, USA, Stanford Univ., CA, USA
Scaling of the No-Scale Potential and de Sitter Model Building
Saltman, A.; Silverstein, E.; Feb. 2004; 16 pp.; In English
Report No.(s): DE2004-826752; SLAC-PUB-10347; SU-ITP-04/06; No Copyright; Avail: Department of Energy Information Bridge

We propose a variant of the KKLT (A)dS flux vacuum construction which does not require an antibrane to source the volume modulus. The strategy is to find nonzero local minima of the no-scale potential in the complex structure and dilaton directions in moduli space. The corresponding no-scale potential expanded about this point sources the volume modulus in the same way as does the antibrane of the KKLT construction. We exhibit explicit examples of such nonzero local minima of the no-scale potential in a simple toroidal orientifold model.
NTIS
Scaling; Point Sources; Vacuum

20050042033 Stanford Linear Accelerator Center, CA, USA
Model of High Current Breakdown from Cathode Field Emission in Aged Wire Chambers
Boyarski, A. M.; Mar. 31, 2004; 14 pp.; In English
Report No.(s): DE2004-826767; SLAC-PUB-10212; No Copyright; Avail: Department of Energy Information Bridge

Observing single electron pulses provides insight into the mechanism that leads to sudden high current jumps (breakdown) in aged wire chambers. This single electron activity is found to be consistent with the Fowler-Nordheim equation for field emission of electrons from a cathode surface in a high electric field. The high electric field arises from the positive ion buildup on a very thin insulating layer on the cathode surface. A model is presented to explain the transient behavior of single electron pulses in response to abrupt changes in chamber ionization, as well as the steady state rate during a long term

aging run. The model is based on properties of the insulating layer (dielectric constant, conductivity, and hole-mobility) as well as the Fowler-Nordheim equation.
NTIS
Electric Fields; Electrons; High Current; Field Emission

20050042037 Harvard Univ., Cambridge, MA, USA, Stanford Linear Accelerator Center, CA, USA, Stanford Univ., CA, USA
Non-Singular Solutions for S-branes
Jones, G.; Maloney, A.; Strominger, A.; 2004; 26 pp.; In English
Report No.(s): DE2004-826774; SLAC-PUB-10324; No Copyright; Avail: Department of Energy Information Bridge
Exact, non-singular, time-dependent solutions of Maxwell-Einstein gravity with and without dilatons are constructed by double Wick rotating a variety of static, axisymmetric solutions. This procedure transforms arrays of charged or neutral black holes into s-brane (spacelike brane) solutions, i.e. extended, short-lived spacelike defects. Along the way, new static solutions corresponding to arrays of alternating-charge Reissner-Nordstrom black holes, as well as their dilatomic generalizations, are found. their double Wick rotation yields s-brane solutions which are periodic in imaginary time and potential large-N duals for the creation/decay of unstable D-branes in string theory.
NTIS
Black Holes (Astronomy); Gravitation; Rotation

20050050961 Colorado Univ., Boulder, CO, USA
Pseudo-Random Code Correlator Timing Errors Due to Multiple Reflections in Transmission Lines
Ascarrunz, F. G.; Parker, T. E.; Jefferts, S. R.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 433-437; In English; See also 20050050957; No Copyright; Avail: CASI; A01, Hardcopy
Multiple reflections in transmission lines can cause an amplification of timing errors associated with the delay sensitivity to environmental effects of the transmission lines. This multiplicative effect arises the timing error in an earlyl/late code correlator is a function of the relative RF carrier phase, the relative power levels, and the relative time delay between the direct and relected signal.
Author
Time Lag; Transmission Lines; Errors; Numerical Analysis; Signal Analysis

20050051230 Pennsylvania State Univ., University Park, PA USA
Harvesting Electric Energy During Walking With a Backpack: Physiological, Ergonomic, Biomechanical, and Electromechanical Materials, Devices, and System Considerations
Zhang, Qiming; Hogmann, Heath; Jan. 2005; 16 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0569
Report No.(s): AD-A428873; No Copyright; Avail: CASI; A03, Hardcopy
The objective of this program is to investigate approaches which make use of several classes of electroactive materials developed recently for harvesting electric energy during walking. These newly developed electroactive materials including the electrostrictive PVDF based polymers and piezoelectric relaxor single crystals have shown order of magnitude improvement in terms of the elastic energy density in comparison with the traditional piezoelectric materials and much improved the electromechanical coupling factors. Furthermore, in this program, we show that the electromechanical conversion efficiency of a properly designed energy harvesting system can be much higher than these of the electroactive material itself. Using this principle, we demonstrated that an electric energy output of 39 mJ/cc with a 10% efficiency can be obtained from the electrostrictive PVDF polymers. Using 1-3 composites with ferroelectric relaxor single crystals, harvested electric power density of 96 mW/cc has been obtained (at 4 Hz).
DTIC
Biodynamics; Electromechanical Devices; Physiology; Piezoelectricity; Walking

20050051552 Naval Undersea Warfare Center, Newport, RI USA
Time Diversity Automatic Repeat Request (ARQ) Equalization Scheme
Blackmon, Fletcher A., Inventor; Dec. 2004; 19 pp.; In English
Report No.(s): AD-D020165; No Copyright; Avail: CASI; A03, Hardcopy
A method and system are provided for processing communication signals. In one embodiment, the method has the steps

of providing a data signal based on a communication signal transmitted from a transmitting source, processing the data signal to determine if the data signal has acceptable error characteristics, requesting retransmission of the data signal if the data signal does not have acceptable error characteristics, coherently and jointly equalizing the data signal and the retransmitted signal to produce an equalized signal, decoding the equalized signal to provide an equalized and decoded signal, processing the equalized and decoded signal to determine if the equalized and decoded signal has acceptable error characteristics, and repeating the requesting, equalizing, decoding and processing steps as long as the equalized and decoded signal has unacceptable error characteristics.
DTIC
Automatic Repeat Request; Error Detection Codes; Signal Processing; Telecommunication

20050051781 Stanford Univ., Stanford, CA, USA, Lawrence Livermore National Lab., Livermore, CA, State Univ. of New York, Stony Brook, NY, USA
Taking X-Ray Diffraction to the Limit: Macromolecular Structures from Femtosecond X-Ray Pulses and Diffraction Microscopy of Cells with Synchrotron Radiation
Miao, J.; Chapman, H. N.; Kirz, J.; Sayre, D.; Hodgson, K. O.; 2004; In English
Report No.(s): DE2004-826961; No Copyright; Avail: National Technical Information Service (NTIS)

Recent work is extending the methodology of X-ray crystallography to the structure determination of noncrystalline specimens. The phase problem is solved using the oversampling method, which takes advantage of 'continuous' diffraction patterns from noncrystalline specimens. Here we review the principle of this newly developed technique and discuss the ongoing experiments of imaging nonperiodic objects, such as cells and cellular structures, using coherent and bright X-rays produced by third-generation synchrotron sources. In the longer run, the technique may be applicable to image single biomolecules using anticipated X-ray free electron lasers.
NTIS
X Ray Diffraction; Synchrotron Radiation

20050051782 State Univ. of New York, Stony Brook, NY, USA, Stanford Linear Accelerator Center, Stanford, CA, USA, Massachusetts Inst. of Tech., Cambridge, MA, USA
Fractional Charge Definitions and Conditions
Golderhaber, A. S.; 2004; 14 pp.; In English
Report No.(s): DE2004-826963; YITP-SB-03-22; SLAC-PUB-10483,MIT-CTP-3379; No Copyright; Avail: Department of Energy Information Bridge

Fractional charge is known through theoretical and experimental discoveries of isolable objects carrying fractions of familiar charge units--electric charge Q, spin S, and the difference of baryon and lepton numbers B-L. With a few simple assumptions all these effects may be described using a generalized version of charge renormalization for locally conserved charges, in which medium correlations yield familiar adiabatic, continuous renormalization, or sometimes nonadiabatic, discrete renormalization. Fractional charges may be carried by fundamental particles or fundamental solitons. Either picture works for the simplest fractional-quantum-Hall-effect quasiholes, though the particle description is far more general. The only known fundamental solitons in three or fewer space dimensions d are the kink (d = 1), the vortex (d = 2), and the magnetic monopole (d = 3). Further, for a charge not intrinsically coupled to the topological charge of a soliton, only the kink and the monopole may carry fractional values. The same reasoning enforces fractional values of B-L for electrically charged elementary particles.
NTIS
String Theory; Elementary Particles

20050051783 Stanford Linear Accelerator Center, Stanford, CA, USA
Quadrupole Alignment and Trajectory Correction for Future Linear Colliders: SLC Tests of a Dispersion-Free Steering Algorithm
Assmann, R.; Chen, T.; Decker, F. J.; Minty, M.; 2004; 18 pp.; In English
Report No.(s): DE2004-826964; SLAC-PUB-10485; No Copyright; Avail: Department of Energy Information Bridge

The feasibility of future linear colliders depends on achieving very tight alignment and steering tolerances. All proposals (NLC, JLC, CLIC, TESLA and S-BAND) currently require a total emittance growth in the main linac of less than 30-100%. This should be compared with a 100% emittance growth in the much smaller SLC linac. Major advances in alignment and beam steering techniques beyond those used in the SLC are necessary for the next generation of linear colliders. In this paper,

we present an experimental study of quadrupole alignment with a dispersion-free steering algorithm. A closely related method (wakefield-free steering) takes into account wakefield effects. However, this method can not be studied at the SLC.
NTIS
Beam Steering; Alignment; Linear Accelerators

20050051785 McGill Univ., Montreal, Quebec, Canada, Canadian Inst. for Theoretical Astrophysics, Toronto, Ontario, Canada, Rochester Univ., NY, USA, Lebedev Physical Inst., Moscow, Russia
Polarization and Structure of Relativistic Parsec-Scale AGN Jets
Lyutikov, M.; Pariev, V. I.; 2004; In English
Report No.(s): DE2004-826966; SLAC-PUB-10491; No Copyright; Avail: National Technical Information Service (NTIS)
We consider the polarization properties of optically thin synchrotron radiation emitted by relativistically moving electron-positron jets carrying large-scale helical magnetic fields. In our model, the jet is cylindrical, and the emitting plasma moves parallel to the jet axis with a characteristic Lorentz factor (Lambda). We draw attention to the strong influence that the bulk relativistic motion of the emitting relativistic particles has on the observed polarization.
NTIS
Polarization; Synchrotron Radiation; Electron-Positron Plasmas

20050051786 Stanford Linear Accelerator Center, Stanford, CA, USA, Brookhaven National Lab., Upton, NY, USA
Cumulative Beam Breakup due to Resistive-Wall Wake
Wang, J. M.; 2004; 16 pp.; In English
Report No.(s): DE2004-826969; SLAC-PUB-10500; No Copyright; Avail: Department of Energy Information Bridge
The cumulative beam breakup problem excited by the resistive-wall wake is formulated. An approximate analytic method of finding the asymptotic behavior for the transverse bunch displacement is developed and solved. Comparison between the asymptotic analytical expression and the direct numerical solution is presented. Good agreement is found. The criterion of using the asymptotic analytical expression is discussed.
NTIS
Linear Accelerators; Mathematical Models; Beam Interactions

20050051787 Stanford Linear Accelerator Center, Stanford, CA, USA
Multimoded Reflective Delay Lines and Their Application to Resonant Delay Line RF Pulse Compression Systems
Tantawi, S. G.; 2004; 20 pp.; In English
Report No.(s): DE2004-826970; SLAC-PUB-10501; No Copyright; Avail: Department of Energy Information Bridge
Pulse compression systems for future linear colliders, involve hundreds of kilometers of waveguide runs. These waveguides are highly overmoded to reduce the rf losses. In this paper we present a novel idea for utilizing these waveguides several times by using different modes. This idea is suitable for reflective delay lines. All the modes being used have low-loss characteristics. We describe mechanically simple mode transducers that switch the propagation mode from one configuration to another with no observable dispersion. We apply this technique to a resonant delay line pulse compression system. We also present experimental results that verify these theoretical developments.
NTIS
Radio Frequencies; Waveguides; Delay Lines; Pulse Compression

20050051788 Cornell Univ., Ithaca, NY, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
Synchro-Betatron Stop-Bands due to a Single Crab Cavity
Hoffstaetter, G. H.; Chao, A. W.; 2004; In English
Report No.(s): DE2004-826971; SLAC-PUB-10508; No Copyright; Avail: National Technical Information Service (NTIS)
We analyze the stop-band due to crab cavities for horizontal tunes that are either close to integers or close to half integers. The latter case is relevant for today's electron/positron colliders. We compare this stop-band to that created by dispersion in an accelerating cavity and show that a single typical crab cavity creates larger stop-bands than a typical dispersion at an accelerating cavity. We furthermore analyze whether it is beneficial to place the crab cavity at a position where the dispersion and its slope vanish. We find that this choice is worth while if the horizontal tune is close to a half integer, but not if it is close to an integer.
NTIS
Betatrons; Synchrotrons; Cavities

20050051789 Stanford Linear Accelerator Center, Stanford, CA, USA
Observation of CP Violation in the Neutral B Meson System
Levy, S.; 2004; In English
Report No.(s): DE2004-826982; SLAC-R-729; No Copyright; Avail: National Technical Information Service (NTIS)

This dissertation presents a measurement of time-dependent CP-violating asymmetries in neutral B meson decays collected with the BABAR detector at the PEP-II asymmetric-energy B Factory at the Stanford Linear Accelerator Center. The data sample consists of about 88 million (Upsilon)(4S) (yields) B(bar B) decays collected between 1999 and 2002. We study events in which one neutral B meson decay to the CP-eigenstates J/(psi) K(sub S)(sup 0), (psi)(2S)K(sub S)(sup 0), (chi)(sub c1)K(sub S)(sup 0), and (eta)(sub c)K(sub S)(sup 0), or to flavor-eigenstates involving D(sup (*))(pi)/(rho)/a(sub 1) and J/(psi)K*(sup 0)(K*(sup 0) (yields) K(sup +) (pi)(sup -)), is fully reconstructed. The flavor of the other neutral B meson is tagged at the time of its decay, mainly using the charge of identified leptons and kaons.
NTIS
Mesons; CP Violation; Particle Decay

20050051790 Stanford Linear Accelerator Center, Stanford, CA, USA
Radiative Characteristics of On-Chip Terahertz Undulatory Structures
Hussein, Y. A.; Jun. 2004; 14 pp.; In English
Report No.(s): DE2004-826985; SLAC-PUB-10448; No Copyright; Avail: Department of Energy Information Bridge

Work on compact, variable, efficient, and high brightness radiation sources is extended by calculating the radiated power and angular distributions for characteristic configurations and drive sources. On the assumption that the transport physics with Maxwell's Equations are valid but modified by the material properties, a number of analogs are suggested between free and bound electron sources of radiation. Characteristics of representative 1-to-n port examples are discussed in terms of a few basic shape parameters and the wavelength. Conditions for coherence and interference are discussed and demonstrated for the latter. Figures-of-merit are defined in terms of brightness, efficiencies or effective impedances such as the radiation coupling impedance Z(sub rc). Both time and frequency domain techniques are used and checked against other calculations and measurements where available. Finally, we discuss some further possibilities together with various impediments to realizing these kinds of devices such as the Terahertz (THz) modulation problem as well as nonlinear methods for their optimization. To our knowledge, there have been no implementations of such possibilities.
NTIS
Radiation Sources; Frequency Domain Analysis; Angular Distribution

20050051796 Stanford Linear Accelerator Center, Stanford, CA, USA, Argonne National Lab., IL
Pin-Hole Luminosity Monitor with Feedback
Norem, J. H.; Spencer, J. E.; May 2004; 20 pp.; In English
Report No.(s): DE2004-826932; SLAC-PUB-10447; No Copyright; Avail: Department of Energy Information Bridge

Previously, the generalized luminosity L was defined and calculated for all incident channels based on an NLC e (sup +)e(sup -) design. Alternatives were then considered to improve the differing beam-beam e(sup -)e(sup -) e (gamma) and (gamma) (gamma) channels. Regardless of the channel, there was a large flux of outgoing, high energy photons that were produced from the beam-beam interaction e.g. beamsstrahlung that needs to be disposed of and whose flux depended on L. One approach to this problem is to consider it a resource and attempt to take advantage of it by disposing of these straight-ahead photons in more useful ways than simply dumping them. While there are many options for monitoring the luminosity, any method that allows feedback and optimization in real time and in a non-intercepting and non-interfering way during normal data taking is extremely important--especially if it provides other capabilities such as high resolution tuning of spot sizes and can be used for all incident channels without essential modifications to their setup. Our 'pin-hole' camera appears to be such a device if it can be made to work with high energy photons in ways that are compatible with the many other constraints and demands on space around the interaction region.
NTIS
Feedback; Luminosity; Beam Interactions; Cameras

20050051801, Stanford Univ., Stanford, CA, USA, International Business Machines Corp., San Jose, CA, Queens Coll., Scotland, UK
Structural and Magnetic Model of Self-Assembled FePt Nanoparticles Arrays
Thomson, T.; Toney, M. F.; Raoux, S.; Lee, S. L.; Sun, S.; May 2004; 28 pp.; In English
Report No.(s): DE2004-826934; No Copyright; Avail: Department of Energy Information Bridge

Chemically ordered, self-assembled FePt nanoparticle arrays with high magnetic anisotropy are considered a candidate medium for data storage beyond 1 Tbit/in(sup 2). We report comprehensive structural and magnetic studies on thin (3 layer) assemblies of polyethylenimine (PEI) and 4 nm Fe(sub 58)Pt(sub 42) nanoparticles using X-ray diffraction, small angle neutron scattering and magnetometry. We show that prior to annealing FePt nanoparticles in the PEI-FePt assembly consist of a metallic, magnetic core surrounded by a weakly magnetic or non-magnetic shell. High temperature annealing creates the desired L1(sub 0) chemical ordering and results in high coercivity FePt nanoparticles. However, we find that the high temperatures necessary to establish full chemical ordering leads to particle sintering and agglomeration. Understanding the magnetic and physical properties of these assemblies allows future research directions to be clarified for nanoparticle arrays as data storage media.
NTIS
Nanoparticles; Iron; Platinum; Magnetic Properties; Self Assembly

20050051806 Stanford Univ., Stanford, CA, USA, International Business Machines Corp., San Jose, CA
Orgin of Low-Friction Behavior in Graphite Investigated by Surface X-Ray Diffraction
Yen, B. K.; Schwickert, B. E.; Toney, M. E.; 2004; 18 pp.; In English
Report No.(s): DE2004-826917; SLAC-PUB-10429; No Copyright; Avail: Department of Energy Information Bridge
Contrary to popular belief, the slipperiness of graphite is not an intrinsic property. The presence of vapors, such as water, is required for graphite to lubricate; in vacuum or dry environments, the friction and wear rate of graphite are high. A widely accepted explanation involves weakening of the binding force between basal planes near the surface, thereby allowing these planes to shear easily. This weakening results from proposed chemisorption or intercalation of vapor molecules near the surface, leading to an increase in the interlayer spacing between nearsurface basal planes. Here we use X-ray diffraction from a synchrotron source to show that the basal plane spacing at the surface is the same in vacuum, ambient air, or water vapor saturated air. These results refute this long-held view that the low friction behavior of graphite is due to shearing of weakened basal planes.
NTIS
Graphite; Friction; Lubrication

20050051808 Stanford Linear Accelerator Center, Stanford, CA, USA, Yale Univ., New Haven, CT, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
Composite Vector Mesons from QCD to the Little Higgs
Piai, M.; Pierce, A.; Wacker, J. G.; May 2004; 34 pp.; In English
Report No.(s): DE2004-826937; SLAC-PUB-10457; No Copyright; Avail: Department of Energy Information Bridge
We review how the (rho) meson can be modeled in an effective theory and discuss the implications of applying this approach to heavier spin-one resonances. Georgi's vector limit is explored, and its relationship to locality in a deconstructed extra-dimension is discussed. We then apply the formalism for (rho)'s to strongly coupled theories of electroweak symmetry breaking, studying the lightest spin-one techni-(rho)'s resonances. Understanding these new particles in Little Higgs models can shed light on previously incalculable, ultraviolet sensitive physics, including the mass of the Higgs boson.
NTIS
Electroweak Interactions (Field Theory); Higgs Bosons; Quantum Chromodynamics; Vector Mesons

20050051810 Stanford Linear Accelerator Center, Stanford, CA, USA
Measurement of the Inclusive Semileptonic Branching Fraction of B Mesons Using Fully Reconstructed B-Mesons as Tags in the BABAR Experiment
Miftakov, V. G.; 2004; In English
Report No.(s): DE2004-826943; SLAC-R-718; No Copyright; Avail: National Technical Information Service (NTIS)
The BABAR experiment at SLAC provides an opportunity for measurement of the Standard Model parameters describing CP violation. A method of measuring the CKM matrix element (V(sub cb)) using Inclusive Semileptonic B decays in events tagged by a fully reconstructed decay of one of the B mesons is presented here. This mode is considered to be one of the most powerful approaches due to its large branching fraction, simplicity of the theoretical description and very clean experimental signatures. Using fully reconstructed B mesons to flag B(bar B) event we were able to produce the spectrum and branching fraction for electron momenta P(sub C.M.S.) > 0.5 GeV/c. Extrapolation to the lower momenta has been carried out with Heavy Quark Effective Theory. The branching fractions are measured separately for charged and neutral B mesons. For 82 fb(sup -1) of data collected at BABAR we obtain: BR(B(sup (+-)) (yields) X e(bar (nu))) = 10.63 (+-) 0.24 (+-) 0.29%,

BR(B(sup 0) (yields) X e(bar (nu))) = 10.68 (+-) 0.34 (+-) 0.31%, averaged BR(B (yields) X e(bar (nu))) = 10.65 (+-) 0.19 (+-) 0.27%, ratio of Branching fractions BR(B(sup (+-)))/BR(B(sup 0)) = 0.996 (+-) 0.039 (+-) 0.015 (errors are statistical and systematic, respectively). They also obtain V(sub cb) = 0.0409 (+-) 0.00074 (+-) 0. 0010 (+-) 0.000858 (errors are: statistical, systematic and theoretical).
NTIS
Mesons; Particle Decay; Standard Model (Particle Physics); Leptons

20050051811 Stanford Linear Accelerator Center, Stanford, CA, USA
Phenomenology of Higgsless Electroweak Symmetry Breaking
Rizzo, T. G.; 2004; In English
Report No.(s): DE2004-826918; SLAC-PUB-10431; No Copyright; Avail: National Technical Information Service (NTIS)
It is possible to construct models based on warped extra dimensions in which electroweak symmetry breaking takes place without the introduction of any Higgs fields. This breaking can occur through the judicious choice of boundary conditions applied to gauge fields living in the bulk. One then finds that the fifth components of these bulk fields act as the Goldstone bosons, even for the would-be zero modes of the Kaluza-Klein tower. In this talk I will discuss the phenomenology of such scenarios, in particular, the problems associated with the construction of realistic models due to the simultaneous constraints imposed by precision electroweak data, present collider search limits and the requirement of perturbative unitarity in W(sub L)(sup +)W(sub L)(sup -) elastic scattering. Future collider signatures for such scenarios are also discussed.
NTIS
Broken Symmetry; Phenomenology

20050051812 Stanford Linear Accelerator Center, Stanford, CA, USA
Effectiveness of Emittance Bumps on the NLC and US Cold LC Main Linear Accelerators
Tenenbaum, P.; May 2004; In English
Report No.(s): DE2004-826947; SLAC-TN-04-038; No Copyright; Avail: National Technical Information Service (NTIS)
We report on a series of studies on the effectiveness of closed orbit bumps in the linacs of the NLC and the US Cold LC. In the first study, emittance dilutions of a pure-wakefield or puredispersion character are introduced in each linac, and a set of emittance bumps is tested to determine the most effective bump location in the linac, and the net effectiveness. In the second study, a more realistic set of dilutions are introduced and the wakefield bumps used in the first study are applied.
NTIS
Emittance; Linear Accelerators; Beams (Radiation)

20050051816 Stanford Linear Accelerator Center, Stanford, CA, USA
Machine Protection Issues in the Beam Delivery System
Keller, L.; Markiewicz, T.; 2004; In English
Report No.(s): DE2004-826948; SLAC-TN-04-039; No Copyright; Avail: National Technical Information Service (NTIS)
This note reports on an EGS study of the collimation and protection devices contained within the TRC version of the NLC lattice. For each fault scenario, the likelihood for damage to collimators, spoilers, absorbers or magnet apertures is arrived at by finding the maximum energy density the device must support when a full NLC bunch train is lost on it or nearby it. We find that certain devices will not survive as currently specified. Modest design changes are recommended that should permit the system to operate up at 500 GeV center of mass energy; for 1 TeV operation, certain devices are still at risk.
NTIS
Collimation; Beam Interactions

20050051818 Stanford Linear Accelerator Center, Stanford, CA, USA
Some Alignment Considerations for the Next Linear Collider
Ruland, R. E.; 2004; 16 pp.; In English
Report No.(s): DE2004-826952; SLAC-PUB-7060; No Copyright; Avail: Department of Energy Information Bridge
Next Linear Collider type accelerators require a new level of alignment quality. The relative alignment of these machines is to be maintained in an error envelope dimensioned in micrometers and for certain parts in nanometers. In the nanometer domain our terra firma cannot be considered monolithic but compares closer to jelly. Since conventional optical alignment

methods cannot deal with the dynamics and cannot approach the level of accuracy, special alignment and monitoring techniques must be pursued.
NTIS
Alignment; Linear Accelerators

20050051831 Stanford Linear Accelerator Center, Stanford, CA, USA, Trieste Univ., Italy
Contribution from Neutrino Yukawa Couplings to Lepton Electric Dipole Moments
Farzan, Y.; Peskin, M. E.; 2004; 38 pp.; In English
Report No.(s): DE2004-826926; SLAC-PUB-10440; No Copyright; Avail: Department of Energy Information Bridge

To explain the observed neutrino masses through the seesaw mechanism, a supersymmetric generalization of the Standard Model should include heavy right-handed neutrino supermultiplets. Then the neutrino Yukawa couplings can induce CP violation in the lepton sector. In this paper, we compute the contribution of these CP violating terms to lepton electric dipole moments. We introduce a new formalism that makes use of supersymmetry to expose the GIM cancellations. In the region of small tan (beta), we find a different result from that given previously by Ellis, Hisano, Raidal, and Shimizu. We confirm the structure found by this group, but with a much smaller overall coefficient. In the region of large tan (beta), we recompute the leading term that has been identified by Masina and confirm her result up to minor factors. We discuss the implications of these results for constraints on the Y(sub v).
NTIS
Neutrinos; Couplings; Leptons; Dipole Moments; Electric Dipoles

20050051832 Stanford Linear Accelerator Center, Stanford, CA, USA, Stanford Univ., Stanford, CA, USA
TASI/PiTP/ISS Lectures On Moduli and Microphysics
Silverstein, E.; 2004; 40 pp.; In English
Report No.(s): DE2004-826927; SLAC-PUB-10441; No Copyright; Avail: Department of Energy Information Bridge

The author reviews basic forces on moduli that lead to their stabilization, for example in the supercritical and KKLT models of de Sitter space in string theory, as well as an AdS(sub 4) x S(sup 3) x S(sup 3) model the author includes which is not published elsewhere. These forces come from the classical dilaton tadpole in generic dimensionality, internal curvature, fluxes, and branes and orientifolds as well as non-perturbative effects. The resulting (A)dS solutions of string theory make detailed predictions for microphysical entropy, whose leading behavior we exhibit on the Coulomb branch of the system. Finally, I briefly review recent developments concerning the role of velocity-dependent effects in the dynamics of moduli. These lecture notes are based on material presented at various stages in the 1999 TASI, 2002 PiTP, 2003 TASI, and 2003 ISS schools
NTIS
String Theory; Entropy; Microanalysis; Physics

20050051836 Stanford Linear Accelerator Center, Stanford, CA, USA
PEP-II Beta Fixes with MIA
Yan, Y. T.; Cal, Y.; Decker, F. J.; Irwin, J.; 2004; In English
Report No.(s): DE2004-826797; No Copyright; Avail: National Technical Information Service (NTIS)

We first find a virtual accelerator for the HER or the LER through determination of all quadrupole strengths and sextupole feed-downs as well as all BPM gains and BPM cross-plane couplings by an SVD-enhanced Least-squares fitting of the quantities derivable from a complete set of orbits. These quantities are the phase advances, the Green's functions, and the tilt angles and axis ratios of the coupling eigen ellipses. They are obtained by analyzing turn-by-turn Beam Position Monitor (BPM) data with a high-resolution model-independent analysis (MIA). Once the virtual accelerator is found, we select a limited number of key quadrupoles, for example, the linear trombone quadrupoles and the global skews, for Least-square fitting of their strengths to minimize the beta beat while keeping other optics characters unchanged if not improved. We then dial in these limited number of quadrupole strength changes to the real accelerator (HER or LER) to achieve a better-performance PEPII.
NTIS
Storage Rings (Particle Accelerators); Linear Accelerators

20050051837 State Univ. of New York, Stony Brook, NY, USA, Laboratorio di Sanita Pubblica, Alessandria, Italy, European

Organization for Nuclear Research, Geneva, Switzerland, , CA, USA
Landau Background Gauge Fixing and the IR Properties of YM Green Functions
Grassi, P. A.; Hurth, T.; Quadri, A.; 2004; 32 pp.; In English
Report No.(s): DE2004-826954; YITP-SB-04-26; IHES/P/04/23,CERN-PH-TH/2004-083,SLAC-PUB-10442; No Copyright; Avail: Department of Energy Information Bridge

We analyse the complete algebraic structure of the background field method for Yang-Mills theory in the Landau gauge and show several structural simplifications within this approach. In particular we present a new way to study the IR behavior of Green functions in the Landau gauge and show that there exists a unique Green function whose IR behaviour controls the IR properties of the gluon and the ghost propagators.
NTIS
Measuring Instruments; Yang-Mills Theory

20050051840 Stanford Linear Accelerator Center, Stanford, CA, USA
Highly-Polarized Electron Emission from Strain-Compensated Superlattices and Superlattices with High-Valence-Band Splitting
Rochansky, A. V.; Mar. 2004; 14 pp.; In English
Report No.(s): DE2004-826800; SLAC-PUB-10375; No Copyright; Avail: Department of Energy Information Bridge

Strained layer heterostructure and short-period superlattice structures have been used to advantage in achieving highly spin-polarized electron photoemission. The strain-induced splitting of the valence band at the band-gap minimum provides a high electron polarization in the conduction band under excitation by circularly polarized light. Smearing of the interband absorption edge and the hole scattering processes lead to polarization in the band-edge absorption of less than 100%, polarization losses being typically about 6%. This mechanism sets a limit on the maximum polarization of emitted electrons. The initial polarization can be increased by choosing structures with a higher valence band splitting.
NTIS
Electron Emission; Polarized Light; Superlattices; Valence

20050051850 Stanford Linear Accelerator Center, Stanford, CA, USA
Dipole Mode Detuning in the Injector Linacs of the NLC
Bane, K.; Li, Z.; Jul. 2000; In English
Report No.(s): DE2004-826888; SLAC-TN-04-019; No Copyright; Avail: National Technical Information Service (NTIS)

The injector linacs of the JLC/NLC project include the prelinac, the e(sup +) drive linac, the e(sup -) booster, and the e(sup +) booster. The first three will be S-band machines, the last one, an L-band machine. We have demonstrated that by using detuning alone in the accelerator structure design of these linacs we will have acceptable tolerances for emittance growth due to both injection jitter and structure misalignments, for both the nominal (2.8 ns) and alternate (1.4 ns) bunch spacings. For the L-band structure (a structure with 2(pi)/3 phase advance) we take a uniform distribution in synchronous dipole mode frequencies, with central frequency 2.05 GHz and full width of 3%.
NTIS
Linear Accelerators; Dipoles

20050051851 Stanford Linear Accelerator Center, Stanford, CA, USA
Matching Program for the NLC Main Linac
Nosochkov, Y.; Raubenheimer, T.; Woodley, M.; 2004; 16 pp.; In English
Report No.(s): DE2004-826889; SLAC-TN-04-020; No Copyright; Avail: Department of Energy Information Bridge

In this note, we describe the computer code used to design the Next Linear Collider (NLC) main linac optics, and present the current parameters of the linac lattice.
NTIS
Computer Programs; Linear Accelerators

20050051852 Stanford Linear Accelerator Center, Stanford, CA, USA
High-Luminosity NLC Design with Near-Equal Horizontal and Vertical Beta Functions
Thompson, K. A.; Raubenheimer, T. O.; Tenebaum, P.; 2004; In English
Report No.(s): DE2004-826890; SLAC-TN-04-021; No Copyright; Avail: National Technical Information Service (NTIS)

Modifications are studied of the Next Linear Collider (NLC) designs with aspect ratio close to or equal to 1, so that higher luminosity and/or much-relaxed vertical tolerances are obtained.
NTIS
Aspect Ratio; Luminosity; Linearity; Weak Interactions (Field Theory)

20050051859 Stanford Linear Accelerator Center, Stanford, CA, USA
Proposed ILC Parameters
Raubenheimer, T. O.; Yokoya, K.; Jun. 05, 1998; 10 pp.; In English
Report No.(s): DE2004-826905; SLAC-TN-04-036; No Copyright; Avail: Department of Energy Information Bridge
In this note, we describe the proposed working parameter set for the KEK-SLAC ILC linear collider and discuss the reasons leading to the values listed; more extensive discussion of the optimization process will be found in subsequent notes. The parameter set is listed in Table 1 and is compared with the JLC 3-97 parameters and the NLC ZDR parameters in Table 2. The new parameter set has an operating plane which ranges from low IP emittances and high luminosity (cases A) to large IP emittances and smaller luminosity (cases C). Over this range, the bunch charge, bunch length, and IP beta functions are varied, however, the parameters have been chosen so that the tolerances on the accelerating structures are roughly constant.
NTIS
Optimization; Emittance

20050051869 Stanford Linear Accelerator Center, Stanford, CA, USA
Circumference Correction Chicanes for Damping Rings
Emma, P.; Raubenheimer, T.; Aug. 14, 1998; 14 pp.; In English
Report No.(s): DE2004-826906; SLAC-TN-04-037; No Copyright; Avail: Department of Energy Information Bridge
Several large low-emittance damping rings are presently being designed to meet the requirements of future linear colliders. These rings tend to have relatively large circumferences (approx)300 m so that they can damp many trains of bunches at the same time. With the large circumference, the path length around the ring may become quite sensitive to thermal and ground motion effects. In addition, most of the rings include damping wigglers whose path length varies with their strength.
NTIS
Damping; Storage Rings (Particle Accelerators)

20050051870 London Univ., UK
Inclusive Semileptonic B Decays at BABAR and Extraction of HQE Parameters
Flaecher, H. U.; Jun. 2004; 12 pp.; In English
Report No.(s): DE2004-827005; No Copyright; Avail: Department of Energy Information Bridge
A measurement of the first four moments of the hadronic mass distribution in B (yields) C(sub c)(ell)(bar (nu)) decays is presented for minimum lepton momenta varying between 0.9 and 1.6 GeV, using data recorded with the BABAR detector. Furthermore, a measurement of the inclusive electron energy spectrum for semileptonic B decays together with a measurement of its first, second and third moments for minimum electron energies between 0.6 and 1.5 GeV is reported. We determine the inclusive B (yields) X(sub c)(ell)(bar (nu)) branching fraction, (Beta)(sub c(ell)(nu)), the CKM matrix element (V(sub cb)), and other heavy-quark parameters from a simultaneous fit to the measured moments.
NTIS
Electron Energy; Hadrons; Particle Decay

20050051876 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Stanford Linear Accelerator Center, CA, USA
Probabilistic Model for the Simulation of Secondary Electron Emission
Furman, M. A.; Pivi, M. T. F.; 2004; In English
Report No.(s): DE2004-826907; SLAC-PUB-9912; LBNL-49771; No Copyright; Avail: National Technical Information Service (NTIS)
We provide a detailed description of a model and its computational algorithm for the secondary electron emission process. The model is based on a broad phenomenological t to data for the secondary emission yield (SEY) and the emitted-energy

spectrum. We provide two sets of values for the parameters by tting our model to two particular data sets, one for copper and the other one for stainless steel.
NTIS
Electron Emission; Energy Spectra

20050051884 Stanford Linear Accelerator Center, Stanford, CA, USA
Solving Large Sparse Linear Systems to End-to-end Accelerator Structure Simulations
Lee, L. Q.; Ge, L.; Kowalski, M.; Li, Z.; Ng, C. K.; Jan. 2004; 16 pp.; In English
Report No.(s): DE2004-826910; SLAC-PUB-10320; No Copyright; Avail: Department of Energy Information Bridge
This paper presents a case study of solving very large sparse linear systems in end-to-end accelerator structure simulations. Both direct solvers and iterative solvers are investigated. A parallel multilevel preconditioner based on hierarchical finite element basis functions is considered and has been implemented to accelerate the convergence of iterative solvers. A linear system with matrix size 93,147,736 and with 3,964,961,944 non-zeros from 3D electromagnetic finite element discretization has been solved in less than 8 minutes with 1024 CPUs on the NERSC IBM SP. The resource utilization as well as the application performance for these solvers is discussed.
NTIS
Accelerators; Linear Systems; Finite Element Method

20050051895 Stanford Linear Accelerator Center, Stanford, CA, USA
Heavy Flavor Decays of the Z(sub O) and a Search for Flavor Changing Neutral Currents
Walston, S. E.; 2004; In English
Report No.(s): DE2004-827017; SLAC-R-728; No Copyright; Avail: National Technical Information Service (NTIS)
Presented here are the results of a direct search for flavor changing neutral currents via the rare process Z(sup 0) (yields) bs and a measurement of R(sub bs) = (Lambda)(Z(sup 0) (yields) bs)/(Lambda)(Z(sup 0) (yields) hadrons). Because the decays Z(sup 0) (yields) b(bar b) and Z(sup 0) (yields) c(bar c) contribute significant backgrounds to Z(sup 0) (yields) bs, simultaneous measurements of R(sub b) = (Lambda)(Z(sup 0) (yields) b(bar b))/(Lambda)(Z(sup 0) (yields) hadrons) and R(sub c) = (Lambda)(Z(sup 0) (yields) c(bar c))/(Lambda)(Z(sup 0) (yields) hadrons) were also made. The standard double tag technique was extended and self calibrating tags were used for s, c, and b quarks.
NTIS
Particle Decay; Neutral Currents

20050051897 Stanford Linear Accelerator Center, Stanford, CA, USA
Sensitivity to Nano-Tesla Scale Stray Magnetic Fields
Frisch, J.; Raubenheimer, T. O.; Tenenbaum, P.; Jun. 2004; In English
Report No.(s): DE2004-827018; SLAC-TN-04-041; No Copyright; Avail: National Technical Information Service (NTIS)
We consider the Next Linear Collider's (NLC's) sensitivity to stray magnetic fields in the nanotesla regime.
NTIS
Magnetic Fields; Sensitivity

20050051906 Science Research Lab., Inc., Somerville, MA, USA
Long-Lifetime Low-Scatter Neutron Polarization Target
Richardson, J. M.; Jul. 09, 2004; In English
Report No.(s): DE2004-825731; No Copyright; Avail: National Technical Information Service (NTIS)
Polarized neutrons scattering is an important technology for characterizing magnetic and other materials. Polarized helium three (P-3He) is a novel technology for creating polarized beams and, perhaps more importantly, for the analysis of polarization in highly divergent scattered beams. Analysis of scattered beams requires specialized targets with complex geometries to ensure accurate results. Special materials and handling procedures are required to give the targets a long useful lifetime. In most cases, the targets must be shielded from stray magnetic fields from nearby equipment. SRL has developed and demonstrated hybrid targets made from glass and aluminum. We have also developed and calibrated a low-field NMR system for measuring polarization lifetimes. We have demonstrated that our low-field system is able to measure NMR signals in the presence of conducting (metallic) cell elements. We have also demonstrated a non-magnetic valve that can be used to seal the cells. We feel that these accomplishments in Phase I are sufficient to ensure a successful Phase II program. The commercial market for this technology is solid. There are over nine neutron scattering centers in the US and Canada and over

22 abroad. Currently, the US plans to build a new $1.4B scattering facility called the Spallation Neutron Source (SNS). The technology developed in this project will allow SRL to supply targets to both existing and future facilities. SRL is also involved with the application of P-3He to medical imaging.
NTIS
Neutron Scattering; Nuclear Magnetic Resonance

20050051910 Fermi National Accelerator Lab., Batavia, IL, USA
Coherent Parasitic Energy Loss of the Recycler Beam
Ng, K. Y.; 2004; In English
Report No.(s): DE2004-825826; No Copyright; Avail: National Technical Information Service (NTIS)

Parasitic energy loss of the particle beam in the Recycler Ring is discussed. The long beam confined between two barrier waves has a spectrum that falls off rapidly with frequency. Discrete summation over the revolution harmonics must be made to obtain the correct energy loss per particle per turn, because only a few lower revolution harmonics of real part of the longitudinal impedance contribute to the parasitic energy loss. The longitudinal impedances of the broadband rf cavities, the broadband resistive-wall monitors, and the resistive wall of the vacuum chamber are discussed. They are the main sources of the parasitic energy loss.
NTIS
Particle Beams; Radio Frequencies; Energy Dissipation

20050052019 Academia Sinica, Beijing, China, Virginia Univ., Charlottesville, VA, USA
Measurement of the Neutron Electric Form Factor in Dvec (evec,e'n)p Quasi-elastic Scattering at Q2=0.5 (GeV/C)2
Zhu, H.; 2000; In English
Report No.(s): DE2004-824965; No Copyright; Avail: National Technical Information Service (NTIS)

The form factors of the neutron give information on fundamental properties of the nucleons and provide a critical testing ground for models based on QCD. In late 1998, Jefferson Lab (JLAB) experiment E93-026 measured the spin-dependent part of the exclusive (e, e'n) scattering cross section from a polarized deuterated ammonia ((sup 15)ND(sub 3)) target at a four momentum transfer squared of Q(sup 2)= 0.5 (GeV/c)(sub 2). A longitudinally polarized electron beam was scattered from the polarized target and the quasi-elastically scattered electron was detected in coincidence with the knocked-out neutron. The data have been analyzed in terms of the spin-correlation parameter, or the electron-deuteron vector asymmetry (A(sub ed)(sup V)), of (e, e'n) to determine the neutron electric form factor G(sub E)(sup n). The result is consistent with data from existing experiments and shows a good agreement with the Galster parameterization of G(sub E)(sup n) within experimental uncertainty.
NTIS
Elastic Scattering; Form Factors; Neutrons; Quantum Chromodynamics; Scattering Cross Sections

20050052020 Basel Univ., Switzerland
Measurement of Inclusive Quasi-elastic Electron Cross Sections at less than 1 and High Q(sup2)
Petitjean, T. C.; 2000; In English
Report No.(s): DE2004-824963; No Copyright; Avail: National Technical Information Service (NTIS)

Experiment E89-008 measured inclusive electron scattering cross sections from different nuclei in Hall C at Jefferson Laboratory. Cross sections on the low energy loss side of the quasi-elastic peak (x(sub Bj) less than 1) are extracted for carbon, aluminum, iron and gold. The data cover four-momentum transfers squared of 0:97 to 5:73 GeV 2=c 2. The measured cross sections are compared to cross sections calculated using a microscopic spectral function. The cross section results are also analyzed in terms of the two scaling functions F (y) and f(psi). For both the data is found to be independent of the momentum transfer (scaling of the first kind). For f(psi) the data is in addition independent of the mass number A (scaling of the second kind) and thus exhibits superscaling properties.
NTIS
Electron Scattering; Scattering Cross Sections; Linear Accelerators

20050052022 Stanford Linear Accelerator Center, Stanford, CA, USA
New Beam Delivery System Optics: BDS9901
Tenenbaum, P.; 2004; In English
Report No.(s): DE2004-826892; SLAC-TN-04-023; No Copyright; Avail: National Technical Information Service (NTIS)

In this note, we describe the present optics design of the NLC Beam Delivery System, which has been somewhat revised for 1999. Most important optical changes include: organization of BPMs into quad-style (BPMQ), BPMs in feedback loops (BPMFB), BPMs which provide sub-train/multibunch information (BPMMB), and BPMs used to measure beam-beam detections (BPMIP); addition of a number of small quad, skew-quad, sextupole, and skew-sextupole tuning magnets; addition of actuators for the feedbacks; a 6-quadrupole final telescope, which allows all of the linear degrees of freedom to be optimized; replacement of the low-energy final quads Q1A and Q1B with a single magnet; an improved IP Switch which increases the x distance between the beamlines; and optimized final focus bandwidth.
NTIS
Actuators; Quadrupoles; Optics

20050052023 Paris Univ., Orsay, France
Exclusive Electroproduction of Meson rho on the Nucleon Virtualite Intermediate with the CLAS Detector at JLAB
Hadjidakis, C.; Dec. 2002; In French
Report No.(s): DE2004-824917; No Copyright; Avail: National Technical Information Service (NTIS)
This report presents the exclusive rho0 meson electroproduction on the nucleon at intermediate square momentum transfers Q(sup 2) (1.5 less than Q(sup 2) less than 3 GeV(sup 2)) and above the resonance region. The experiment has been taken place at the Jefferson laboratory with the CLAS detector, with a 4.2 GeV beam energy on a hydrogen target in the February-March 1999 period. They present the results and in particular the L/T separated cross sections. This experimentally unexplored domain experimentally is at the intersection between traditional 'soft' hadronic physics models (VDM and Regge inspired models) and 'hard' pQCD inspired approaches (recently introduced Generalized Parton Distribution). They discuss both approaches and their domain of validity.
NTIS
Nucleons; Linear Accelerators; Detectors; Rho-Mesons; Mesons

20050060635 Stanford Linear Accelerator Center, Stanford, CA, USA, Brookhaven National Lab., Upton, NY
Compensation of the Effects of Detector Solenoid on the Vertical Beam Orbit in NLC
Parker, B.; 2004; In English
Report No.(s): DE2004-827019; SLAC-TN-04-044; BNL-MDN-637-40,BNL-AM-MD-337; No Copyright; Avail: National Technical Information Service (NTIS)
In this note we consider compensation of the vertical angle at the IP that arises when the NLC beam enters the detector solenoid. While this angle is antisymmetric for e(sup +)e(sup -) collisions and does not affect luminosity, compensating this angle is desirable to guarantee knowledge of polarization at the IP. For the e(sup -)e(sup -) case compensation is necessary also from the luminosity point of view. We show in this note that the most effective compensation can be done locally, with a special dipole coil arrangement incorporated into the detector. It is shown that compensation can be achieved for both e(sup +)e(sup -) and e(sup -)e(sup -) case and that this scheme is compatible with beam size compensation by both the standard method, using skew quadrupoles, and by means of more advantageous method using weak antisolenoids.
NTIS
Solenoids; Luminosity

20050060639 Department of Energy, Albuquerque, NM, USA, Westinghouse TRU Solutions, LLC, Albuquerque, NM, USA, Shaw Environmental and Infrastructure, Inc., Albuquerque, NM, USA
Los Alamos National Laboratory Develops 'Quick to WIPP' Strategy
Jones, R. W.; Martin, V.; Allen, G.; Kosiewicz, S.; Organ, J.; 2004; 10 pp.; In English
Report No.(s): DE2004-827596; No Copyright; Avail: Department of Energy Information Bridge
The Cerro Grande forest fire in May of 2000 and the terrorist events of September 11, 2001 precipitated concerns of the vulnerability of legacy contact-handled (CH), high-wattage transuranic (TRU) waste stored at Los Alamos National Laboratory (LANL). An analysis of the 9,100 cubic meters of stored CH-TRU waste revealed that 400 cubic meters or 4.5% of the inventory represented 61% of the risk. The analysis further showed that this 400 cubic meters was contained in only 2,000 drums. These facts and the question 'How can the disposition of this waste to the Waste Isolation Pilot Plant (WIPP) be accelerated' formed the genesis of LANL's Quick to WIPP initiative
NTIS
Waste Management; Hydrogen; Hazardous Wastes

20050060650 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
BoNuS Detector: A Radial Time Projection Chamber for Tracking Spectator Protons
Fenker, H.; 2004; In English
Report No.(s): DE2004-822394; No Copyright; Avail: National Technical Information Service (NTIS)

A GEM-based Radial Time Projection Chamber is being developed as a spectator-proton tracker for an experiment at Jefferson Lab. The purpose of the experiment is the study of the structure of nearly free neutrons. Interactions on such neutrons can be identified by the presence of a backward-moving proton in the final state of a beam-deuterium collision. The detector must be of very low mass in order to provide sensitivity to the slowest possible protons. The ionization electron trail left by the protons will drift radially outward to an amplification structure composed of curved GEMs, and the resulting charge will be collected on pads on the outer layer of the detector. Unique design challenges are imposed by the cylindrical geometry and the low mass requirement. The status of the project and results of prototype tests are presented.
NTIS
Protons; Beam Interactions; Particle Collisions

20050060653 Stanford Linear Accelerator Center, CA, USA, Tata Inst. of Fundamental Research, Bombay, India, Harvard Univ., Cambridge, MA, USA
Taxonomy of Flux Vacua
Giryavets, A.; Kachru, S.; Tripathy, P. K.; 2004; 28 pp.; In English
Report No.(s): DE2004-826916; SLAC-PUB-10425; HUTP-04/AO19,SU-ITP-04/16; No Copyright; Avail: Department of Energy Information Bridge

We investigate several predictions about the properties of IIB flux vacua on Calabi-Yau orientifolds, by constructing and characterizing a very large set of vacua in a specific example, an orientifold of the Calabi-Yau hypersurface in WP(sub 1,1,1,1,4) (sup 4). We find support for the prediction of Ashok and Douglas that the density of vacua on moduli space is governed by det(-R-(omega)) where R and (omega) are curvature and Kaehler forms on the moduli space. The conifold point (psi) = 1 on moduli space therefore serves as an attractor, with a significant fraction of the flux vacua contained in a small neighborhood surrounding (psi) = 1. We also study the functional dependence of the number of flux vacua on the D3 charge in the fluxes, finding simple power law growth.
NTIS
Flux Density; Taxonomy; Vacuum

20050060656 Genoa Univ., Genoa, Italy, Virginia Univ., Charlottesville, VA, USA
Measurement of the Double Spin Asymmetry in (pi)(sup+) Electroproduction with CLAS
De Vita, R.; Minehart, R.; 2004; In English
Report No.(s): DE2004-824907; No Copyright; Avail: National Technical Information Service (NTIS)

The present thesis describes the measurement of the double spin asymmetry in the ep(yields) e(pi)(sup+)n reaction. This represents the only existing measurement for this observable. The reaction is identified detecting the scattered electron and the emitted pion and using the missing mass technique to identify the neutron. The asymmetry is evaluated as a function of the four-momentum transfer Q(sup 2), the invariant mass W and the pion center of mass angle(theta)*. These are in fact the variables that determine the transition amplitudes for the process. The W range of this measurement varies from the pion threshold to a maximum value of 1.8 GeV, exploring the full resonance region. The results obtained with this analysis in the evaluation of the spin asymmetry are presented. The outline of the thesis can be summarized as follows. The first chapter describes the physics motivation that is at the basis of this experiment. The second and third chapters illustrate the design of the CLAS detector and the polarized target. The fourth chapter gives a description of the event reconstruction and to the event selection while the analysis procedure is described in chapter five. Chapter six discusses the results of this measurement, including the evaluation of the systematic uncertainty and the comparison with a physics model.
NTIS
Asymmetry; Momentum Transfer; Emittance

20050060657 Basel Univ., Switzerland
Precise Measurement of the Deuteron Elastic Structure Function A(A2)
Honegger-Feigenwinter, A.; 1999; In English
Report No.(s): DE2004-824967; No Copyright; Avail: National Technical Information Service (NTIS)

During summer 1997 experiment 394-018 measured the deuteron tensor polarization in D(e,e'd) scattering in Hall C at

Jefferson Laboratory. In a momentum transfer range between 0.66 and 1:8 (GeV=c)(sup 2), with slight changes in the experimental setup, the collaboration performed six precision measurements of the deuteron structure function A(Q(sup 2)) in elastic D(e,e'd) scattering . Scattered electrons and recoil deuterons were detected in coincidence in the High Momentum Spectrometer and the recoil polarimeter POLDER, respectively. At every kinematics H(e,e') data were taken to study systematic effects of the measurement. These new precise measurements resolve discrepancies between older data sets and put significant constraints on existing models of the deuteron electromagnetic structure. This work was supported by the Swiss National Science Foundation, the French Centre National de la Recherche Scientifique and the Commissariat 'a l'Energie Atomique, the U.S. Department of Energy and the National Science Foundation and the K.C. Wong Foundation.
NTIS
Deuterons; Elastic Scattering; Electrons

20050060662 Stanford Linear Accelerator Center, Stanford, CA, USA
Effects of Position and Angle Offsets on NLC Luminosity
Thompson, K. A.; Raubenheimer, T. O.; 2004; 16 pp.; In English
Report No.(s): DE2004-826895; SLAC-TN-04-26; No Copyright; Avail: Department of Energy Information Bridge
We present simulation results for the luminosity reduction due to position and angle offsets in the beams colliding at the Next Linear Collider (NLC) interaction point. We look at the nominal NLC-B-500 and NLC-B-1000 designs and also at designs having the vertical beta function doubled at the IP.
NTIS
Luminosity; Reduction; Simulation

20050060663 Stanford Linear Accelerator Center, CA, USA
Spectral Content of the NLC Bunch Train due to Long Range Wakefields
Tenenbaum, P.; 2004; 14 pp.; In English
Report No.(s): DE2004-826896; SLAC-TN-04-027; No Copyright; Avail: Department of Energy Information Bridge
The functional specifications of the sub-train position feedback for the NLC Main Linac are determined by the expected amplitude and spectrum of distortions to the bunch train, which in turn arise from the long-range wakefields of the RF structures. We describe a method for estimating the amplitude and spectrum of the distortions due to assorted structure misalignments, and apply the method to both tilted structures and structures with a cell-to-cell misalignment determined by a random-walk model. Some implications for the sub-train feedback, such as the required system bandwidth, are considered.
NTIS
Bandwidth; Linear Accelerators; Radio Frequencies; Spectrum Analysis

20050060664 Stanford Linear Accelerator Center, CA, USA
Disruption Effects in e-e- Linear Colliders
Thompson, K. A.; Chen, P.; 2004; In English
Report No.(s): DE2004-826893; SLAC-TN-04-024; No Copyright; Avail: National Technical Information Service (NTIS)
We present simple analytic approximations for the 'de-enhancement' factor H(sub D) in e(sup -)e(sup -) collisions, as a function of the disruption and hour-glass parameters and the beam aspect ratio (sigma)(sub x)/(sigma)(sub y). We treat Gaussian beams with essentially arbitrary aspect ratio R, assuming only that the vertical beam size is less than or equal to the horizontal beam size and that the vertical beta function is less than or equal to the horizontal beta function. We also examine the effect of disruption on the calculation of upsilon and n(sub D) for e(sup -)e(sup -) collisions.
NTIS
Collisions; Aspect Ratio

20050060665 Stanford Linear Accelerator Center, CA, USA
Luminosity for NLC Design Variations
Thompson, K. A.; Raubenheimer, T. O.; 2004; 18 pp.; In English
Report No.(s): DE2004-826897; SLAC-TN-04-028; No Copyright; Avail: Department of Energy Information Bridge
In this note we give Guineapig simulation results for the luminosity and luminosity spectrum of three baseline NLC designs at 0.5 TeV and 1.0 TeV and compare the simulation results with analytic approximations. We examine the effects of varying several design parameters away from the NLC-B-500 and NLC-B-1000 designs, in order to study possible trade-offs

of parameters that could ease tolerances, increase luminosity, or help to optimize machine operation for specific physics processes.
NTIS
Design Analysis; Luminosity; Spectrum Analysis

20050060667 Stanford Linear Accelerator Center, CA, USA
Synchrotron Radiation Effects in the IR Solenoid Flux Excluder
Tenenbaum, P.; 2004; 16 pp.; In English
Report No.(s): DE2004-826902; SLAC-TN-04-033; No Copyright; Avail: Department of Energy Information Bridge
We examine the emittance dilution due to synchrotron radiation in the fringing fields at the end of the flux excluder solenoid which protects the final doublet quadrupoles from the main detector solenoid field, and also the effect of SR in the main solenoid field itself. Because the detection due to the excluder fringe field is opposite in polarity from that of the main solenoid, the resulting dispersive rays cancel at the IP; as a result the synchrotron radiation from the two magnetic fields produces only a small dilution of the vertical spot size. The contribution to the spot size from the finite opening angle of the synchrotron flux is found to be comparable to the contribution from solenoidal dispersion, and both are acceptable.
NTIS
Synchrotron Radiation; Solenoids; Radiation Effects; Emittance

20050060670 Stanford Linear Accelerator Center, Stanford, CA, USA
Consistent Yokoya-Chen Approximation to Beamstrahlung
Peskin, M.; Jan. 28, 1999; In English
Report No.(s): DE2004-826901; SLAC-TN-04-032; No Copyright; Avail: National Technical Information Service (NTIS)
The author reconsiders the Yokoya-Chen approximate evolution equation for beamstrahlung and modify it slightly to generate simple, consistent analytical approximations for the electron and photon energy spectra. He compares these approximations to previous ones, and to simulation data.
NTIS
Electron Energy; Photons; Energy Spectra

20050060671 Stanford Linear Accelerator Center, CA, USA
High Luminosity Options for the JLC/NLC at 500 GeV cms
Raubenheimer, T. O.; Thompson, K. A.; Jun. 16, 1998; 14 pp.; In English
Report No.(s): DE2004-826904; SLAC-TN-04-035; No Copyright; Avail: Department of Energy Information Bridge
The present JLC/NLC parameters are chosen to provide luminosities between 0.5 (approx) 0.75 x 10(exp 34)/s sq cm at a cms energy of 500 GeV; the parameters are listed for both the 500 GeV and 1 TeV cases. In all cases, these luminosities assume extensive margins and emittance dilutions to ensure that they are attainable. In this note, they consider the feasibility of substantially higher luminosities which might be attained by operating with smaller emittance dilutins and higher beam currents. The parameters they describe are listed in Table 2 where these high luminosity sets (ILC-IHa and ILC-IHb) are compared with the base JLC/NLC set (ILC-Ib) and with the high luminosity TESLA parameter set.
NTIS
Luminosity; Beam Currents; Feasibility Analysis

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*.

20050041987 NASA Langley Research Center, Hampton, VA, USA
Acoustic Predictions of Manned and Unmanned Rotorcraft Using the Comprehensive Analytical Rotorcraft Model for Acoustics (CARMA) Code System
Boyd, D. Douglas, Jr.; Burley, Casey L.; Conner, David A.; [2005]; 22 pp.; In English; American Helicopter Society International Specialists' Meeting on Unmanned Rotorcraft, 18-20 Jan. 2005, Phoenix, AZ, USA; No Copyright; Avail: CASI; A03, Hardcopy
The Comprehensive Analytical Rotorcraft Model for Acoustics (CARMA) is being developed under the Quiet Aircraft

Technology Project within the NASA Vehicle Systems Program. The purpose of CARMA is to provide analysis tools for the design and evaluation of efficient low-noise rotorcraft, as well as support the development of safe, low-noise flight operations. The baseline prediction system of CARMA is presented and current capabilities are illustrated for a model rotor in a wind tunnel, a rotorcraft in flight and for a notional coaxial rotor configuration; however, a complete validation of the CARMA system capabilities with respect to a variety of measured databases is beyond the scope of this work. For the model rotor illustration, predicted rotor airloads and acoustics for a BO-105 model rotor are compared to test data from HART-II. For the flight illustration, acoustic data from an MD-520N helicopter flight test, which was conducted at Eglin Air Force Base in September 2003, are compared with CARMA full vehicle flight predictions. Predicted acoustic metrics at three microphone locations are compared for limited level flight and descent conditions. Initial acoustic predictions using CARMA for a notional coaxial rotor system are made. The effect of increasing the vertical separation between the rotors on the predicted airloads and acoustic results are shown for both aerodynamically non-interacting and aerodynamically interacting rotors. The sensitivity of including the aerodynamic interaction effects of each rotor on the other, especially when the rotors are in close proximity to one another is initially examined. The predicted coaxial rotor noise is compared to that of a conventional single rotor system of equal thrust, where both are of reasonable size for an unmanned aerial vehicle (UAV).
Author
Blade Slap Noise; Aeroacoustics; Rotary Wings; Rotor Aerodynamics; Acoustic Simulation

20050042021 NASA Langley Research Center, Hampton, VA, USA
Analysis of Measured and Predicted Acoustics from an XV-15 Flight Test
Boyd, D. Douglas, Jr.; Burley, Casey L.; [2001]; 40 pp.; In English; American Helicopter Society 57th Forum, 9-11 May 2001, Washington, DC, USA; Copyright; Avail: CASI; A03, Hardcopy

Flight acoustic and vehicle state data from an XV-15 acoustic flight test are examined. Flight predictions using TRAC are performed for a level flight (repeated) and four descent conditions (including a BVI). The assumptions and procedures used for TRAC flight predictions as well as the variability in flight measurements, which are used for input and comparison to predictions, are investigated in detail. Differences were found in the measured vehicle airspeed, altitude, glideslope, and vehicle orientation (yaw, pitch and roll angle) between each of the repeat runs. These differences violate some of the prediction assumptions and significantly impacted the resulting acoustic predictions. Multiple acoustic pulses, with a variable time between the pulses, were found in the measured acoustic time histories for the repeat runs. These differences could be attributed in part to the variability in vehicle orientation. Acoustic predictions that used the measured vehicle orientation for the repeat runs captured this multiple pulse variability. Thickness noise was found to be dominant on approach for all the cases, except the BVI condition. After the aircraft passed overhead, broadband noise and low frequency loading noise were dominant. The predicted LowSPL time histories compared well with measurement on approach to the array for the non-BVI conditions and poorly for the BVI condition. Accurate prediction of the lift share between the rotor and fuselage must be known in order to improve predictions. At a minimum, measurements of the rotor thrust and tip-path-plane angle are critical to further develop accurate flight acoustic prediction capabilities.
Author
Acoustic Properties; Flight Tests; Blade-Vortex Interaction; Aeroacoustics; Aircraft Noise

20050042040 NASA Langley Research Center, Hampton, VA, USA
A Simple Derivation of the Acoustic Boundary Condition in the Presence of Flow
Farassat, F.; Dunn, M. H.; Journal of Sound and Vibration; July 08, 1999; Volume 224, No. 2, pp. 384-386; In English; Copyright; Avail: CASI; A01, Hardcopy

In modeling the noise propagation in a duct of a ducted fan engine, the authors needed the boundary condition satisfied by the acoustic pressure on a lined duct wall in the presence of flow. The results, in the form used by the authors, was derived by M.K. Myers, who presented a formal derivation of a related results by K. Taylor. Here, a brief and simple derivation of the acoustic boundary condition of Myers is given. The main difference in the derivation from that by Myers is that the Gaussian coordinate system (q(exp 1, q(exp 2), q(exp 3)(q(exp 1, q(exp 2), t)) is used to specify the instantaneous position, i.e. Lagrangian variable, of the point on the mean position of the wall with curvilinear (Gaussian) coordinates (q(exp 1), q(exp 2)). Myers uses a locally orthogonal coordinate system which is somewhat less specific than what is used here.
Author (revised)
Boundary Conditions; Noise Propagation; Acoustic Scattering; Models; Flow Noise

20050051005 NASA Langley Research Center, Hampton, VA, USA
Transition in a Supersonic Boundary Layer Due to Acoustic Disturbances
Balakumar, P.; January 2005; 20 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Report No.(s): AIAA Paper 2005-0096; No Copyright; Avail: CASI; A03, Hardcopy

The boundary layer receptivity process due to the interaction of three-dimensional slow and fast acoustic disturbances with a blunted flat plate is numerically investigated at a free stream Mach number of 3.5 and at a high Reynolds number of 10(exp 6)/inch. The computations are performed with and without two-dimensional isolated roughness element located near the leading edge. Both the steady and unsteady solutions are obtained by solving the full Navier-Stokes equations using the fifth-order accurate weighted essentially non-oscillatory (WENO) scheme for space discretization and using third-order total-variation-diminishing (TVD) Runge-Kutta scheme for time integration. The simulations showed that the linear instability waves are generated very close to the leading edge. The wavelength of the disturbances inside the boundary layer first increases gradually and becomes longer than the wavelength for the instability waves within a short distance from the leading edge. The wavelength then decreases gradually and merges with the wavelength for the Tollmien-Schlichting wave. The initial amplitudes of the instability waves near the neutral points, the receptivity coefficients, are about 1.20 and 0.07 times the amplitude of the free-stream disturbances for the slow and the fast waves respectively. It was also revealed that small isolated roughness element does not enhance the receptivity process for the given nose bluntness.
Author
Supersonic Boundary Layers; Acoustic Instability; Aeroacoustics; Flat Plates; Blunt Bodies

20050051254 Space and Naval Warfare Systems Center, San Diego, CA USA
Interactive Multisensor Analysis Training
Wulfeck, Wallace H., II; Wetzel-Smith, Sandra K.; Dickieson, Janet L.; Oct. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428923; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Antisubmarine Warfare; Education; Sonar

20050051556 Department of the Navy, Washington, DC USA
Array System for Supercavitating Hydrofoils
Gieseke, Thomas J., Inventor; Jul. 2004; 13 pp.; In English
Report No.(s): AD-D020169; No Copyright; Avail: CASI; A03, Hardcopy

This patent application discloses a sonar system that includes a forward-looking array that is embedded in a cavitator for generating a gaseous cavity that minimizes hydrodynamic noise resulting from turbulent pressure fluctuations. A marine vessel incorporating the sonar system includes a hull, a hydrofoil suspended beneath the hull by a strut, and a cavitator for generating a laminar flow over the hydrofoil and for creating a cavity for eliminating turbulent flow contact. The cavitator is located at a leading edge area of the hydrofoil. The sonar array is embedded into the cavitator. (4 figures)
DTIC
Cavitation Flow; Cavities; Flow Noise; Hydrofoils; Noise Reduction; Patent Applications; Sonar; Supercavitating Flow; Turbulent Flow

20050051562 Department of the Navy, Washington, DC USA
Apparatus for Producing Gaseous Vapor Baffle
Gieseke, Thomas J., Inventor; Oct. 2004; 16 pp.; In English
Report No.(s): AD-D020175; No Copyright; Avail: CASI; A03, Hardcopy

This patent application discloses an apparatus that produces a gaseous vapor baffle that isolates an undersea sonar system from acoustic noise. The apparatus allows for craft carrying undersea sonar systems to travel at relatively high speeds while substantially isolating the undersea sonar systems from acoustic noise interference produced by propulsion systems, hull appendages, waves, and bubbles. The apparatus has a support strut that has one end that is joined or attached to the hull of a craft. A sonar pod is attached to the other end of the support strut. The support strut has a ventilation duct and a plurality of ventilation ports. A cavitator is attached to the support strut and produces a sheet cavity as the craft travels in the water. Pressurized air or other gases are injected into the ventilation duct, which then exit through the ventilation ports and into the

sheet cavity. The pressurized air or gas exiting the ventilation ports expands the sheet cavity to form a gaseous vapor baffle that isolates the sonar pod from acoustic noise. (1 figure)
DTIC
Baffles; Cavitation Flow; Noise Reduction; Patent Applications; Ships; Sonar; Turbulent Flow; Vapors

20050051962 Centre Europeen Recherche et de Formation Advance en Calcul Scientific, Toulouse, France
Analysis of Acoustic Energy and Modes in a Turbulent Swirled Combustor
Martin, C.; Benoit, L.; Nicoud, F.; Poinsot, T.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 377-394; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents the analysis of the self-excited combustion instability encountered in a lab-scale, swirl-stabilized combustion system. The instability, successfully captured by the reactive Large Eddy Simulation (LES) is used to verify an acoustic energy equation. This energy equation shows how the source term due to combustion (equivalent to the Rayleigh criterion) is balanced by the acoustic flames at the boundaries when reaching the limit cycle. Additionally, an Helmholtz-equation solver including flame-acoustics interaction modelling is used to predict the stability characteristics of the system. Feeding the flame-transfer function from the LES into this solver allows to predict an amplification rate for each mode. The unstable mode encountered in the LES compares well with the mode of the highest amplification factor in the Helmholtz-equation solver, as well in terms of mode shape as in frequency.
Author
Combustion Stability; Acoustic Emission; Combustion Chambers

20050051991 Illinois Univ., Urbana-Champaign, IL, USA
The Robustness of Acoustic Analogies
Freund, J. B.; Lele, S. K.; Wei, M.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 241-252; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

Acoustic analogies for the prediction of flow noise are exact rearrangements of the flow equations N(right arrow q) = 0 into a nominal sound source S(right arrow q) and sound propagation operator L such that L(right arrow q) = S(right arrow q). In practice, the sound source is typically modeled and the propagation operator inverted to make predictions. Since the rearrangement is exact, any sufficiently accurate model of the source will yield the correct sound, so other factors must determine the merits of any particular formulation. Using data from a two-dimensional mixing layer direct numerical simulation (DNS), we evaluate the robustness of two analogy formulations to different errors intentionally introduced into the source. The motivation is that since S can not be perfectly modeled, analogies that are less sensitive to errors in S are preferable. Our assessment is made within the framework of Goldstein's generalized acoustic analogy, in which different choices of a base flow used in constructing L give different sources S and thus different analogies. A uniform base flow yields a Lighthill-like analogy, which we evaluate against a formulation in which the base flow is the actual mean flow of the DNS. The more complex mean flow formulation is found to be significantly more robust to errors in the energetic turbulent fluctuations, but its advantage is less pronounced when errors are made in the smaller scales.
Author
Sound Propagation; Robustness (Mathematics); Flow Noise; Flow Equations

20050061038 NASA Glenn Research Center, Cleveland, OH, USA
Acoustic Source Modeling for High Speed Air Jets
Goldstein, Marvin E.; Khavaran, Abbas; January 2005; 26 pp.; In English; 43rd Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Report No.(s): NASA/TM-2005-213416; AIAA Paper 2005-0415; E-14937; No Copyright; Avail: CASI; A03, Hardcopy

The far field acoustic spectra at 90deg to the downstream axis of some typical high speed jets are calculated from two different forms of Lilley s equation combined with some recent measurements of the relevant turbulent source function. These measurements, which were limited to a single point in a low Mach number flow, were extended to other conditions with the aid of a highly developed RANS calculation. The results are compared with experimental data over a range of Mach numbers. Both forms of the analogy lead to predictions that are in excellent agreement with the experimental data at subsonic Mach

numbers. The agreement is also fairly good at supersonic speeds, but the data appears to be slightly contaminated by shock-associated noise in this case.
Author
Jet Aircraft Noise; Turbulence; Aerodynamic Noise; Acoustics; Far Fields

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20050051140 Harvard Univ., Cambridge, MA USA
Optics With Cold Atoms
Hau, Lene; Aug. 2004; 12 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0207
Report No.(s): AD-A428724; AFRL-SR-AR-TR-04-0644; No Copyright; Avail: CASI; A03, Hardcopy

For production of novel non-linear excitations in Bose-Einstein condensates, we have enhanced the efficiency and stability of our Bose-Einstein-condensate setup by upgrading one of our primary laser pumps with a modem Verdi V-10 laser system. Furthermore, we are developing the world's most sensitive single-cold-atom detector based on free-standing carbon nanotubes to ionize neutral atoms. We have generated the facilities necessary for nanotube growth and detailed characterization with the purchase of a Raman microscope. And to test the novel atom sensor, we have built a moving-molasses magneto-optical trap in a geometry tailor-suited to the nanotube detector geometry, involving construction of a highly stable laser source and electro-magnets, with associated power supplies and control circuitry. In addition, we have applied the DURIP support to produce a Continuous source of cold atoms with the highest flux ever obtained (by 1-2 orders of magnitude). This has involved significant upgrades to the optics-table Set-up, control electronics and data acquisition system, acquisition of a Fabry-Perot spectrum analyzer, purchase of acousto-optic deflectors with corresponding RF frequency drivers, and custom-building of electronic frequency-belting systems. Characterization of the generated, intense atom beam required similar infrastructure investments, including an acquisition and control computer and electronics with precise timing.
DTIC
Atomic Beams; Bose-Einstein Condensates

20050051729 NASA Glenn Research Center, Cleveland, OH, USA
Entangled Biphoton Virtual-State Spectroscopy of the A(exp 2)Sigma(sup +)-X(exp 2)Pi System of OH
Kojima, Jun; Nguyen, Quang-Viet; April 27, 2004; 20 pp.; In English
Contract(s)/Grant(s): WBS 22-714-20-05; No Copyright; Avail: CASI; A03, Hardcopy

This Letter describes the first application of entanglement-induced virtual-state spectroscopy to a molecular system. Non-classical, non-monotonic behavior in a two-photon absorption cross section of the OH A-X system, induced by an entangled biphoton state is theoretically demonstrated. A Fourier transform analysis of the biphoton cross section permits access to the energy eigenvalues of intermediate rovibronic states with a fixed excitation photon energy. The dependence of the Fourier spectrum on the tuning range of the entanglement time (T(sub e)) and the relative path delay (tau(sub e)) is discussed. Our analysis reveals that the implementation of molecular virtual-state spectroscopy for the OH A-X system requires the tuning of tau(sub e) over a pico-second range with femto-second resolution.
Author
Molecular Spectroscopy; Hydroxyl Radicals; Rotational Spectra; Vibrational Spectra

20050051765 Nippon Telegraph and Telephone Public Corp., Japan
Importance of the Sp(sup 2)-like Orbital Formation for Stabilizing Surface Local Structures
Taguchi, A.; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 50; In English; See also 20050051761; Copyright; Avail: Other Sources

Atomic configurations of GaAs (311)A, (111)A, and (110) surfaces were examined by using first-principles calculations to investigate the stabilization mechanism of surface structures. Although the bonds in the bulk state are sp(sup 3) hybridized bonds, it was found that the surface atoms form sp(sup 2)-like bonds. This is because the total energy is not sensitive to the detailed atomic configurations at the surface and the energy level of the sp2 hybridized orbital is lower than that of the sp3

orbital. The sp2-like bond formation is rather general and important in stabilizing the surface structures.
Author
Gallium Arsenides; Energy Levels

20050051778 Nippon Telegraph and Telephone Public Corp., Japan
Structure Transition of Ge/Si(113) Surfaces during Ge Epitaxial Growth
Zhang, Z.; Sumitomo, K.; Lin, F.; Omi, H.; Ogino, T.; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 50; In English; See also 20050051761; Copyright; Avail: Other Sources

It is observed that aGe wetting layer on Si(l13) changes its surface structure from an initial Si(113)-3 x 2 to Ge/Si(l13)-3 x 2 + 3 x 1, Ge/Si(113)-3 x 2 + 3 x 1 + 2 x 2, and finally Ge/Si(113)-2 x 2 for a few-ML epitaxial growth. It is demonstrated that such transition results from the epitaxial stress evolution. Specifically, the 2 x 2 confines the epilayer along the [3 3 bar-2] direction by tension and releases compression in the perpendicular direction of the [bar-1 1 0], forming trenches. Without reconstruction, the trenches are favorable for adatom nucleation and elongated growth of islands owing to dangling bonds and possible relaxation of the structure along the trenches.
Author
Epitaxy; Germanium Compounds; Silicon

20050051964 Eckerd Coll., Saint Petersburg, FL, USA
Modeling Anomalous Electron Transport in Hall Thrusters
Fernandez, E.; Cappelli, M.; Gascon, N.; Allis, M.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 85-97; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

We examine the issue of electron mobility in Hall thruster plasmas using two hybrid models, one in the radial and axial coordinates (r - z model), and the other in the azimuthal and axial coordinates (z - theta model). Unlike most r - z simulation efforts, which model the electron transport via an ad hoc Bohm parameter, the r - z model presented here uses a transport parameter based on a recent experimental measurement. An examination of equilibrium profiles as well as I-V curves reveal marked improvement over the simpler Bohm scaling results. Motivated by these results and the need to incorporate azimuthal effects, we formulate a new z - theta model. It is presented here as the simplest description of Hall thruster plasmas able to capture the azimuthal drifts absent in r - z formulations. Preliminary results show that transport arising from azimuthal disturbances can be significant.
Author
Hall Thrusters; Electron Transfer; Electron Mobility

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*.

20050051588 NASA Marshall Space Flight Center, Huntsville, AL, USA
Radio-Frequency Driven Dielectric Heaters for Non-Nuclear Testing in Nuclear Core Development
Sims, William Herbert, III, Inventor; Godfroy, Thomas J., Inventor; Bitteker, Leo, Inventor; October 05, 2004; 14 pp.; In English
Patent Info.: Filed 16 Jun. 2003; US-Patent-6,800,835; US-Patent-Appl-SN-463935; NASA-Case-MFS-31823; No Copyright; Avail: CASI; A03, Hardcopy

Apparatus and methods are provided through which a radio-frequency dielectric heater has a cylindrical form factor, a variable thermal energy deposition through variations in geometry and composition of a dielectric, and/or has a thermally isolated power input.
Official Gazette of the U.S. Patent and Trademark Office
Radio Frequencies; Heating Equipment; Dielectrics

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*.

20050042002 Stanford Linear Accelerator Center, Stanford, CA, USA
Tests of Fiber Optic Cables at 300 and 4.2 K
Huisman, F.; Aug. 13, 2002; 32 pp.; In English
Report No.(s): DE2004-826720; SLAC-PUB-9384; No Copyright; Avail: Department of Energy Information Bridge

Strange cavity lights have been observed in Superconducting Radio Frequency (SCRF) Cavities. In order to understand this phenomenon a spectral analysis of the light is necessary. However, the extreme conditions presented within the cavity require the equipment to function at cryogenic temperatures. Ocean optics P600 UV/VIS fiber optic cables were studied at 300 K and 4.2 K to determine whether or not they would be appropriate for cryogenic temperatures. At 300 K the performance of different lengths of cable, the effect of a lens and the effect of a junction were investigated by taking spectra of red, green, and yellow LEDs at a variety of distances from where the source and the cable/spectrometer were aligned. It was found that there was significant attenuation of the signal between the spectrometer alone and the spectrometer with any combination of cables. The lens reduced the number of locations where a readable signal was produced, but the intensity increased greatly when the lens was aligned with the light source. The junction did not seem to make a difference except when there was a large angle between the light source and the cable. At 4.2 K a 4 m cable and a lens were submerged in liquid Helium to test their capabilities at cryogenic temperatures. The fiber optic cable was found unsuitable for use as it did not function at 4.2 K, and the signal was essentially lost. However, the lens survived.
NTIS
Fiber Optics; Optical Fibers; Cables

20050042014 Stanford Linear Accelerator Center, CA, USA
Characterization of TI:Sapphire Laser Rods for Installation in the Polarized Light Source
Corum, S.; Aug. 13, 2002; 24 pp.; In English
Report No.(s): DE2004-826723; SLAC-PUB-9390; No Copyright; Avail: Department of Energy Information Bridge

The Flash:Ti laser in the Polarized Light Source at the Stanford Linear Accelerator Center (SLAC) is used to obtain spin polarized electrons for high-energy particle physics experiments. The Flash:Ti laser utilizes titanium-doped sapphire (Ti:Sapphire) crystals to produce laser light. The properties of these crystals, or laser rods, greatly affect the quality of the laser beam produced (e.g. power and jitter), which in turn affects the overall quality and reliability of the particle physics experiments at SLAC. In this interest, seven Ti:Sapphire laser rods were tested for absorption and transmission properties as a function of angular position (i.e. the rod was rotated along its geometrical axis). 833 nm light from a diode laser was linearly polarized and passed through the rods to test for transmission properties. The time-averaged power output of the emitted light was measured with a photodiode/powermeter apparatus. Similarly, the absorption properties of the rods were tested by passing linearly polarized light from a 543 nm green He: Ne laser through the rods. The rod with the best combination of absorption and transmission properties was selected for installation in the Polarized Light Source at the Stanford Linear Accelerator Center.
NTIS
Polarized Light; Laser Beams; Light Sources

20050042028 Stanford Linear Accelerator Center, CA, USA
Femtosecond and sub-femtosecond x-ray pulses from a SASE-based free-electron laser
Emma, P.; Bane, K.; Cornacchia, M.; Huang, Z.; Schlarb, H.; 2004; In English
Report No.(s): DE2004-826765; SLAC-PUB-10002; No Copyright; Avail: National Technical Information Service (NTIS)

We propose a novel method to generate femtosecond and sub-femtosecond photon pulses in a free electron laser by selectively spoiling the transverse emittance of the electron beam. Its merits are simplicity and ease of implementation. When the system is applied to the Linac Coherent Light Source, it can provide x-ray pulses the order of 1 femtosecond in duration containing about 1010 transversely coherent photons.
NTIS
Free Electron Lasers; X Rays; Coherent Light

20050051016 Massachusetts Inst. of Tech., Cambridge, MA USA
Optical Coherence Tomographic Imaging and Delivery for Surgical Guidance
Fujimoto, James G.; May 2004; 58 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0186; Proj-0483
Report No.(s): AD-A428494; AFRL-SR-AR-TR-04-0625; No Copyright; Avail: CASI; A04, Hardcopy

OCT is an emerging diagnostic imaging technology which was developed by our research group in part under this program. OCT generates cross-sectional images of tissue microstructure with micron scale (1-15 micrometers) resolution by measuring the echo time delay and magnitude of backscattered light. OCT can thus function as a type of 'optical biopsy,' enabling imaging of tissue with resolution approaching conventional biopsy and histopathology, but without the need to remove and process specimens. Over the three years of work under this contract, we have made significant progress in a number of areas: development of new laser technology for ultrahigh resolution imaging; new technology and measurement techniques for OCT imaging; in vitro imaging studies to establish the feasibility of using OCT for optical biopsy; and preliminary clinical studies. These key advances are summarized in sections entitled: A. Ultrahigh Resolution Technology for OCT imaging; B. Optical Biopsy and Novel Devices for Clinical Applications; C. Clinical Imaging using Optical Coherence Tomography.

DTIC
Images; Imaging Techniques; Tomography

20050051080 Rochester Univ., NY USA
Quantum Key Distribution Using Polarized Single Infrared Photons
Sobolewski, Roman; Dec. 2004; 10 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0463
Report No.(s): AD-A428613; AFRL-SR-AR-TR-04-0632; No Copyright; Avail: CASI; A02, Hardcopy

Experimental research has been conducted in order to establish the new quantum key distribution system for secure and undecipherable quantum communications. The system has been based on optical single-photon transmitters and superconducting single-photon detector receivers. The photon transmitters were based on heavily attenuated femtosecond optical pulses, generated by a high-repetition-rate laser. Novel superconducting devices were designed and developed for efficient and ultrafast counting of visible-light and near-infrared (telecommunication wavelength) photons. The devices were fabricated as nanostructured superconducting NbN serpentine lines with the active area of 100 micrometers squared and operated at 4.2 K inside a cryostat. The detector experimental quantum efficiency reached above 10% for visible-light and up to 8% for near-infrared photons. The dark counts were 0.1 per second. The real-time photon counting rate was above 2 GHz and jitter was 18 ps. In terms of the photon-counting performance, our detectors are significantly better than any competing avalanche photodiodes and photomultipliers.

DTIC
Infrared Radiation; Photons; Quantum Theory

20050051191 Naval Research Lab., Bay Saint Louis, MS USA
Colored Dissolved Organic Matter in the Coastal Ocean: An Optical Tool for Coastal Zone Environmental Assessment & Management
Coble, Paula; Hu, Chuanmin; Gould, Richard W., Jr.; Chang, Grace; Wood, A. M.; Jun. 2004; 14 pp.; In English
Report No.(s): AD-A428810; NRL/JA/7330-04-15; No Copyright; Avail: CASI; A03, Hardcopy

In the article, we focus on the properties, sources, sinks, measurement techniques, and distribution patterns of the major dissolved component of ocean color, CDOM. Through an understanding of the complex characteristics and environmental interactions of the CDOM pool, we can gain valuable insight into a variety of physical and biogeochemical processes occurring in coastal and shelf regions.

DTIC
Coasts; Color; Dissolved Organic Matter; Environment Management; Oceans; Organic Materials

20050051577 NASA Pasadena Office, CA, USA
Strongly-Refractive One-Dimensional Photonic Crystal Prisms
Ting, David Z., Inventor; November 30, 2004; 21 pp.; In English
Patent Info.: Filed 27 Jun. 2002; US-Patent-6,825,982; NASA-Case-NPO-30232; US-Patent-Appl-SN-185829; No Copyright; Avail: CASI; A03, Hardcopy

One-dimensional (1D) photonic crystal prisms can separate a beam of polychromatic electromagnetic waves into constituent wavelength components and can utilize unconventional refraction properties for wavelength dispersion over significant portions of an entire photonic band rather than just near the band edges outside the photonic band gaps. Using a ID photonic crystal simplifies the design and fabrication process and allows the use of larger feature sizes. The prism geometry broadens the useful wavelength range, enables better optical transmission, and exhibits angular dependence on wavelength with reduced non-linearity. The properties of the 1 D photonic crystal prism can be tuned by varying design parameters such as incidence angle, exit surface angle, and layer widths. The ID photonic crystal prism can be fabricated in a planar process, and can be used as optical integrated circuit elements.
Author
Prisms; Crystal Optics; Photonics; Wave Dispersion

20050051657 NASA Glenn Research Center, Cleveland, OH, USA, Kent State Univ., OH, USA
On the Fringe Field of Wide Angle LC Optical Phased Array
Wang, Xighua; Wang, Bin; Bos, Philip J.; Anderson, James E.; Pouch, John; Miranda, Felix; McManamon, Paul F.; [2004]; 25 pp.; In English; Great Lakes Photonics Symposium, 7-11 Jun. 2004, Cleveland, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 319-80-A5; Copyright; Avail: CASI; A03, Hardcopy

For free space laser communication, light weighted large deployable optics is a critical component for the transmitter. However, such an optical element will introduce large aberrations due to the fact that the surface figure of the large optics is susceptable to deformation in the space environment. We propose to use a high-resolution liquid crystal spatial light modulator to correct for wavefront aberrations introduced by the primary optical element, and to achieve very fine beam steering and shaping at the same time. A 2-D optical phased array (OPA) antenna based on a Liquid Crystal on Silicon (LCOS) spatial light modulator is described. This device offers a combination of low cost, high resolution, high accuracy, high diffraction efficiency at video speed. To quantitatively understand the influence factor of the different design parameters, a computer simulation of the device is given by the 2-D director simulation and the Finite Difference Time domain (FDTD) simulation. For the 1-D OPA, we define the maximum steering angle to have a grating period of 8 pixel/reset scheme; as for larger steering angles than this criterion, the diffraction efficiency drops dramatically. In this case, the diffraction efficiency of 0.86 and the Strehl ratio of 0.9 are obtained in the simulation. The performance of the device in achieving high resolution wavefront correction and beam steering is also characterized experimentally.
Author (revised)
Cassegrain Optics; Reflecting Telescopes; Light Modulators; Optical Correction Procedure; Aberration; Wave Fronts

20050051746 NASA Glenn Research Center, Cleveland, OH, USA
Liquid Crystal on Silicon Wavefront Corrector
Pouch, John; Miranda, Felix; Wang, Xinghua; Bos, Philip, J.; May 7, 2004; 20 pp.; In English; 5th International Congress on Wavefront Sensing and Optimized Refractive Corrections, 21-23 Feb. 2004, Whistler, Canada
Contract(s)/Grant(s): WBS 22-319-80-A5; Copyright; Avail: CASI; A03, Hardcopy

A low cost, high resolution, liquid crystal on silicon, spatial light modulator has been developed for the correction of huge aberrations in an optical system where the polarization dependence and the chromatic nature are tolerated. However, the overall system performance suggests that this device is also suitable for real time correction of aberration in human eyes. This device has a resolution of 1024 x 768, and is driven by an XGA display driver. The effective stroke length of the device is 700 nm and 2000 nm for the visible and IR regions of the device, respectively. The response speeds are 50 Hz and 5 Hz, respectively, which are fast enough for real time adaptive optics for aberrations in human eyes. By modulating a wavefront of 2 pi, this device can correct for arbitrary high order wavefront aberrations since the 2-D pixel array is independently controlled by the driver. The high resolution and high accuracy of the device allow for diffraction limited correction of the tip and tilt or defocus without an additional correction loop. We have shown that for every wave of aberration, an 8 step blazed grating is required to achieve high diffraction efficiency around 80%. In light of this, up to 125 waves peak to valley of tip and tilt can be corrected if we choose the simplest aberration. Corrections of 34 waves of aberration, including high order Zernicke terms in a high magnification telescope, to diffraction limited performance (residual wavefront aberration less than 1/30 lambda at 632.8 nm) have been observed at high efficiency.
Author
Adaptive Optics; Aberration; Liquid Crystals; Silicon; Wave Fronts; Light Modulators; Optical Correction Procedure

20050051758 NASA Glenn Research Center, Cleveland, OH, USA

Laser Beam Steering/Shaping for Free Space Optical Communication

Wang, Xinghua; Wang, Bin; Bos, Philip J.; Anderson, James E.; Pouch, John; Miranda, Felix; McManamon, Paul F.; April 8, 2004; 22 pp.; In English; SPIE Defense and Security Symposium, 12-16 Apr. 2004, Orlando, FL, USA

Contract(s)/Grant(s): WBS 22-319-80-A5; Copyright; Avail: CASI; A03, Hardcopy

The 2-D Optical Phased Array (OPA) antenna based on a Liquid Crystal On Silicon (LCoS) device can be considered for use in free space optical communication as an active beam controlling device. Several examples of the functionality of the device include: beam steering in the horizontal and elevation direction; high resolution wavefront compensation in a large telescope; and beam shaping with the computer generated kinoform. Various issues related to the diffraction efficiency, steering range, steering accuracy as well as the magnitude of wavefront compensation are discussed.

Author

Beam Steering; Free-Space Optical Communication; Laser Beams; Phased Arrays

20050051919 Sandia National Labs., Albuquerque, NM, USA

Semiconductor Light Sources Move from the IR to the Visible and UV

Tsao, Jeff; Crawford, Mary; Wilcoxon, Jess; Simmons, Jerry; Photonics; January 2005; ISSN 0731-1230; Volume 39, No. 1, pp. 51-52; In English; Original contains color illustrations; Copyright; Avail: Other Sources

For years, semiconductor technologies have dominated applications of light sources in the infrared region. For example, fiber communications makes use of light in the mid-IR range (1700 to 980 nm). and CDs and DVDs use light in the near-IR to deep red 1800 to 650 nm). In both cases, semiconductors offer a low price/performance ratio that thus far remains unmatched. Applications for light sources in the visible and ultraviolet wavelength regions, however, still are dominated by traditional technologies based on incandescent and gas-discharge lamps. This is ironic, because much of the early pioneering work in semiconductor optoelectronics focused on visible-light emission. Who knew that technologies in the visible and UV would prove so much more difficult than those in the IR? All this may soon change. Breakthrough advances in technology promise to put semiconductor light sources at the heart of visible and UV applications, just as they already are for IR applications. Visible- and UV-emitting GaN-based materials, historically much lower in performance than IR- and deep-red-emitting GaAs- and InP-based materials, are within striking distance. Emission power has increased, wavelengths have broadened to fill the visible range and to enter the ultraviolet, and costs are coming down tremendously. The result is a group of emerging semiconductor technologies that promises to revolutionize applications for light sources in the visible and ultratiolet.

Author

Light Sources; Electro-Optics; Light (Visible Radiation); Ultraviolet Radiation; Semiconductors (Materials)

20050060672 Bookham, Inc., San Jose, CA, USA

Advances in Optical Filters for the Life Sciences

Chui, Herman; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 63-66; In English; Original contains color illustrations; Copyright; Avail: Other Sources

Photonics technologies find application in many analytical instruments in the life sciences. In drug development, for example, photonics enables high-specificity, high-throughput screening for the identification of drug targets and for the genetic screening of subjects. As drug-development costs continue to rise, greater emphasis is placed on the early stages to increase the success rate in later stages. Similarly, in medical diagnosis, photonics is enabling advances in the early clinical screening of such diseases as HIV, cardiovascular disorders and glaucoma. As these and other areas continue to expand. photonics for the life sciences also should continue to experience growth. Optical filters, in particular. are a central element of these techniques and can be a determinant of accuracy and throughput. Life sciences analytical instruments increasingly are moving to a larger number of colors in multicolor measurement for improved instrument capability and performance, resulting in a greater need for optical filters for precision color separation.

Author

Optical Filters; Life Sciences; Medical Equipment

20050060684 Laurin Publishing Co., Inc., Pittsfield, MA, USA

New Variable Optical Attenuator Offers Inexpensive, Reliable Solution

Hitz, Breck; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 139-140; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

Variable optical attenuators are important components in wavelength division multiplexed telecom systems, in which they balance power levels among channels for reliable transmission. Dozens of designs have been produced and implemented in commercial systems, but many of them are not well-suited for large-scale optical integration. Besides good performance and reliability, low power consumption and high fabrication yields are of paramount importance in large-scale integration. Recently, researchers at the National Research Council's Photonics Systems Group in Ottawa proposed, analyzed and built a variable optical attenuator that they believe offers all the parameters required for large-scale integration applications.
Author
Attenuators; Optical Equipment; Waveguides; Silicon Dioxide; Thin Films

20050060692 Sandia National Labs., Albuquerque, NM, USA
Crystal Exposes Heart of Intense X-Ray Source
Gaughan, Richard; Photonics Spectra; January 2005; Volume 39, No. 1, pp. 138-139; In English; Original contains color illustrations; Copyright; Avail: Other Sources

The Z machine at Sandia National Laboratory in Albuquerque, N.M., is the world's most powerful man-made x-ray source. In operation, laser-triggered switches release the charge stored in massive capacitor blanks to channel 20 MA through an array of small wires, vaporizing them into a plasma. The magnetic field created by the current drives the plasma toward the target core, releasing nearly 250 TW of peak x-ray power along with several megajoules of kinetic energy in the form of flying debris. The energy released is dependent upon how uniformly the plasma is compressed. But how to investigate the process in such a harsh environment? A new monochromatic diagnostic x-ray imager holds the answer.
Author
X Ray Sources; Plasmas (Physics); Capacitors; Crystals; Laser Targets

20050060756 Flinn (Gregory), Munich, Germany
New Opportunities for Terahertz Research
Flinn, Gregory; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, No. 1, pp. 76, 78 and 80; In English; Original contains color and black and white illustrations; Copyright; Avail: Other Sources

The 'terahertz gap' occupies frequencies between 300 GHz and 10 THz and lies between the traditional microwave and optical regions. The term 'gap' derives from the historical inaccessibility of this region, a consequence of poor component performance for both generation and detection. Recent advances, however, have rapidly paved the way to the commercial development of terahertz systems, so much so that the February 2004 issue of Technology Review from Massachusetts Institute of Technology in Cambridge identified terahertz rays in general as one of the 10 most important emerging technologies for that year. Besides traditional fields for terahertz technology, such as space and atmospheric sciences, there are related applications in remote sensing and space-based or short-range terrestrial communications. Moreover. many visually opaque materials are partially transparent and/or exhibit molecular resonances at terahertz frequencies, so this technology provides the biomedical and biochemical fields with new diagnostic tools for tomographic imaging and spectroscopic characterization. This ability of terahertz radiation to penetrate an exterior covering also opens potential applications for security screening and process control.
Author
Electromagnetic Radiation; Submillimeter Waves; Imaging Techniques

20050060818 National Inst. of Standards and Technology, Boulder, CO, USA
NIST Symposium Reports Advances in Fiber Optic Measurements
Rochford, Kent; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 39, Issue 1, pp. 69-70; In English; Original contains color illustrations; Copyright; Avail: Other Sources

In the even-numbered years since 1980, optoelectronics metrologists have met in Boulder, Colo., for the Symposium on Optical Fiber Measurements (SOFM). Representing industry, academe and government, the participants report on measurement advances and promote the use of the best practices and standardized measurements. SOFM 2004 took place Sept. 28 to 30 and was hosted by the National Institute of Standards and Technology's (NIST) Optoelectronics Div. in Boulder, in cooperation with the Optical Society of America and IEEE Lasers and Electro-Optics Society. It drew scientists from 15 countries, and more than half of the papers originated from outside the US. A review of key papers presented provides insight into the status of fiber measurements and a good indication of future developments of the technology,
Author
Conferences; Standards; Optical Fibers; Metrology

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20050050944 Minnesota Univ., Minneapolis, MN, USA

Determining the Importance of Energy Transfer between Magnetospheric Regions via MHD Waves using Constellations of Spacecraft

Cattell, Cynthia A.; [2004]; 5 pp.; In English

Contract(s)/Grant(s): NAG5-11124; No Copyright; Avail: CASI; A01, Hardcopy

This grant was focused on research in two specific areas: (1) development of new techniques and software for assimilation, analysis and visualization of data from multiple satellites making in-situ measurements; and (2) determination of the role of MHD waves in energy transport during storms and substorms. Results were obtained in both areas and presented at national meetings and in publications. The talks and papers that were supported in part or fully by this grant are listed in this paper.

Derived from text

Energy Transfer; Magnetohydrodynamic Waves; Magnetospheres; Cluster Mission

20050051774 Nippon Telegraph and Telephone Public Corp., Japan

Electron Cyclotron Resonance Plasma Sputtering Growth of Textured Films of C-axis-oriented LiNbO3 on Si(100) and Si(111) Surfaces

Akazawa, H.; Shimada, M.; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 49; In English; See also 20050051761; Copyright; Avail: Other Sources

Textured films of c-axis-oriented lithium niobate (LN) in a single Li:Nb= 1:1 phase have been grown on Si(100) and Si(111) substrates by electron cyclotron resonance (ECR) plasma sputtering. The O2 partial pressure is critical in determining the composition of the film, whereas the substrate temperature mainly affects crystallinity. At O2 flow rates between 1 and 1.5 sccm and growth temperature between 510 and 550 C, the refractive indices of the films are within their minimum range. A crystal image of the LN film revealed columnar textured domains, about 40% of which were c-axis oriented. The plasma-enhanced migration of surface atoms is responsible for the polarized grain growth. The amorphous interlayer formed between the LN film and the Si substrate consisted of either a single layer (2 nm) or double component layers (4 nm). The orientation of the LN crystalline overlayer has some correlation with the structure of the underlying amorphous interlayer.

Author

Electron Cyclotron Resonance; Lithium Niobates; Plasmas (Physics); Sputtering; Crystallinity; Substrates

20050051862 Lawrence Livermore National Lab., Livermore, CA

Corsica: A Comprehensive Simulation of Toroidal Magnetic-Fusion Devices. Final Report to the LDRD Program

Crotinger, J. A.; LoDestro, L. L.; Pearlstein, L. D.; Tarditi, A.; Casper, T. A.; Dec. 06, 1997; In English

Report No.(s): PB2005-102154; UCRL-ID-126284; No Copyright; Avail: National Technical Information Service (NTIS)

In 1992, our group began exploring the requirements for a comprehensive simulation code for toroidal magnetic fusion experiments. There were several motivations for taking this step. First, the new machines being designed were much larger and more expensive than current experiments. Second, these new designs called for much more sophisticated control of the plasma shape and position, as well as the distributions of energy, mass, and current within the plasma. These factors alone made it clear that a comprehensive simulation capability would be an extremely valuable tool for machine design. The final motivating factor was that the national Numerical Tokamak Project (NTP) had recently received High Performance Computing and Communications (HPCC) Grand Challenge funding to model turbulent transport in tokamaks, raising the possibility that first-principles simulations of this process might be practical in the near future. We felt that the best way to capitalize on this development was to integrate the resulting turbulence simulation codes into a comprehensive simulation. Such simulations must include the effects of many microscopic length- and time-scales. In order to do a comprehensive simulation efficiently, the length- and time- scale disparities must be exploited.

NTIS

Computerized Simulation; Nuclear Fusion; Tokamak Devices; Plasmas (Physics)

20050051972 NASA Ames Research Center, Moffett Field, CA, USA

MHD Turbulence Sheared in Fixed and Rotating Frames

Kassinos, S. C.; Knaepen, B.; Wray, A.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 47-62; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

We consider homogeneous turbulence in a conducting fluid that is exposed to a uniform external magnetic field while being sheared in fixed and rotating frames. We take both the frame-rotation axis and the applied magnetic field to be aligned in the direction normal to the plane of the mean shear. Here a systematic parametric study is carried out in a series of Direct Numerical Simulations (DNS) in order to clarify the main effects determining the structural anisotropy and stability of the flow.

Author (revised)

Magnetohydrodynamic Turbulence; Homogeneous Turbulence; Shearing; Direct Numerical Simulation; Turbulence Models

20050060641 Princeton Univ., NJ

Fast Neutral Pressure Gauges in NSTX

Raman, R.; Kugel, H. W.; Gernhardt, R.; Provost, T.; Jarboe, T. R.; Apr. 2004; In English

Report No.(s): DE2004-827840; No Copyright; Avail: National Technical Information Service (NTIS)

Successful operation in NSTX of two prototype fast-response micro ionization gauges during plasma operations has motivated us to install five gauges at different toroidal and poloidal locations to measure the edge neutral pressure and its dependence on the type of discharge (L-mode, H-mode, CHI) and the fuelling method and location. The edge neutral pressure is also used as an input to the transport analysis codes TRANSP and DEGAS-2. The modified PDX-type Penning gauges are well suited for pressure measurements in the NSTX divertor where the toroidal field is relatively high. Behind the NSTX outer divertor plates where the field is lower, an unshielded fast ion gauge of a new design has been installed. This gauge was developed after laboratory testing of several different designs in a vacuum chamber with applied magnetic fields.

NTIS

Pressure Measurement; Toroidal Plasmas; Plasmas (Physics); Divertors (Fusion Reactors)

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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*.

20050041882 Rome Univ., Rome, Italy

Polycrystalline Germanium Enables Near-IR Photodetectors Integrated with Silicon CMOS Electronics

Colace, Lorenzo; Masini, Gianlorenzo; Cencelli, Valentino O.; deNotaristefani, Francesco; Assanto, Gaetano; Photonics Spectra; January 2005; ISSN 0731-1230; Volume 38, Issue 12, pp. 88-92; In English; Copyright; Avail: Other Sources

SiGe (i.e..alloys,multilayers,superlattices, etc . that combine both of these group-IV semiconductors) has been an alternative to 111-V compounds for the fabrication of near-IR optoelectronic devices monolithically integrated with silicon. Significant research efforts directed at Si-based sources, modulators and detectors. however, hit performance limitations both because of centrosymmetry,and because of the indirect nature of band-to-band transitions in Ge. Moreover, silicon and germanium exhibit a lattice mismatch of approximately 4 percent. The advantage of Si- Ge compatibility can be best exploited in arrays of near-IR photodetectors which rest on massive electronic circuity for addressing timing and processing. Because only silicon CMOS integrated circuits can meet the complex requirements of imaging devices, process compatibility is of paramount relevance.

Derived from text

CMOS; Polycrystals

20050041897 Moscow State Univ., Russia

Kinematically Complete Measurement of the Proton Structure Function F2 in the Resonance Region and Evaluation of Its Moments

Osipenko, M.; Oct. 2002; In English

Report No.(s): DE2004-824903; No Copyright; Avail: National Technical Information Service (NTIS)

The inclusive inelastic electron scattering of the proton was measured at five different beam energies 1.5, 2.5, 4.0, 4.2 and

4.4 GeV. The data were taken, during February-March 1999, on a liquid hydrogen target with the CLAS detector installed in Hall-B of the Thomas Jefferson National Accelerator Facility (TJNAF). The obtained high statistics and high precision data appear to be in good agreement with previously measured world data and permit to integrate experimental values of F(sub 2) over x at fixed Q(sup 2), allowing for the first time the evaluation of its experimental moments at low and moderate values of Q(sup 2). In a combined analysis of CLAS and world data, the Q(sup 2) -evolution of the experimental moments was explored in the range from 0.3 up to 100 GeV(sup 2). This offered a unique possibility to trace changes of the proton structure function from hard DIS down to the non-perturbative regime through the transition region, which is of particular interest for the TJNAF physics program. The obtained experimental moments allowed to perform a separation between the leading twist, calculable in the framework of the perturbative QCD (pQCD), and higher twists, treated effectively. A comparison with theoretical predictions based either on lattice QCD simulations or obtained within models of the nucleon structure may represent an important test of our understanding of the nucleon structure as observed at large wavelengths.
NTIS
Protons; Kinematics; Quantum Chromodynamics; Inelastic Scattering; Electron Scattering

20050041912 Brookhaven National Lab., Upton, NY, USA
PHENIX Experiment at RHIC: Decadal Plan 2004-2013
Zajc, W. A.; 2004; In English
Report No.(s): DE2004-15007043; BNL-72162-2004; No Copyright; Avail: National Technical Information Service (NTIS)

The PHENIX Collaboration has developed a plan for the detailed investigation of quantum chromodynamics in the next decade. The demonstrated capabilities of the PHENIX experiment to measure rare processes in hadronic, leptonic and photonic channels, in combination with RHIC's unparalleled flexibility as a hadronic collider, provides a physics program of extraordinary breadth and depth. A superlative set of measurements to elucidate the states of both hot and cold nuclear matter, and to measure the spin structure of the proton has been identified. The components of this plan include: (1) Definitive measurements that will establish the nature of the matter created in nucleus+nucleus collisions, that will determine if the description of such matter as a quark-gluon plasma is appropriate, and that will quantify both the equilibrium and non-equilibrium features of the produced medium. (2) Precision measurements of the gluon structure of the proton, and of the spin structure of the gluon and sea-quark distributions of the proton via polarized proton+proton collisions. (3) Determination of the gluon distribution in cold nuclear matter using proton+nucleus collisions.
NTIS
Quantum Chromodynamics; Hadrons; Leptons; Protons

20050041933 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Electroproduction of the phi(1020) Vector Meson at 4 GeV
Loukachine, K.; Feb. 01, 2002; In English
Report No.(s): DE2004-824905; No Copyright; Avail: National Technical Information Service (NTIS)

We studied the reaction ep(yields) e(prime)p(prime)(phi) with a 4.2 GeV incident electron beam in the region of the electroproduction variables Q(sup 2) from 0.7 to 2.2 GeV(sup 2) and W from 2.0 to 2. 6 GeV. The data were taken and analyzed at the Thomas Jefferson National Accelerator Facility. For the first time, we observe the expected t-slope dependence on Q(sup 2) and(Delta)(tau) in(phi) vector meson production. We find that the width of the forward(phi)-meson diffraction peak increases rapidly as the interaction time decreases below c(Delta)(tau) of 1 fm. Within a simple optical model framework, the data show that(phi) meson has a smaller size than the(rho). The measured(phi) cross-section dependence on Q(sup 2) is in a good agreement with previous measurements and well-described by the phenomenological Pomeron exchange model. Our cross-section data do not favor the standard Vector Meson Dominance and s(bar s)-knockout model predictions. From the angular distribution of the decay(phi)(yields) K(sup+) K(sup -), assuming the s-channel helicity conservation, we extracted the longitudinal-to-transverse cross-section ratio, R, and Vector Meson Dominance scaling parameter, (xi)(sup 2), which are consistent with the previous measurements and the model expectations.
NTIS
Angular Distribution; Electron Beams; Mesons

20050042003 Stanford Linear Accelerator Center, CA, USA
Improved Measurement of the CP-Violating Asymmetry Amplitude sin2beta
Mar. 2002; In English
Report No.(s): DE2004-826714; SLAC-PUB-9153; No Copyright; Avail: National Technical Information Service (NTIS)

We present updated results on time-dependent CP-violating asymmetries in neutral B decays to several CP eigenstates. The measurements use a data sample of about 62 million (Upsilon)(4S) (yields) B(bar B) decays collected between 1999 and 2001 by the BABAR detector at the PEP-II asymmetric-energy B Factory at SLAC. In this sample we study events in which one neutral B meson is fully reconstructed in a final state containing a charmonium meson and the flavor of the other neutral B meson is determined from its decay products. The amplitude of the CP-violating asymmetry, which in the Standard Model is proportional to sin2(beta), is derived from the decay time distributions in such events. We measure sin2(beta) = 0. 75 (+-) 0.09 (stat) (+-) 0.04 (syst) and lambda = 0.92 (+-) 0.06 (stat) (+-) 0.02 (syst). The latter is consistent with the Standard Model expectation of no direct CP violation. These results are preliminary.
NTIS
Asymmetry; Mesons

20050042007 Loyola-Marymount Univ., Los Angeles, CA, USA, Stanford Linear Accelerator Center, CA, USA
Investigation of the Stability of the RF Gun of the SSRL Injector System
Moore, J. N.; Aug. 14, 2002; 42 pp.; In English
Report No.(s): DE2004-826719; SLAC-PUB-9382; No Copyright; Avail: Department of Energy Information Bridge
In the previous three years, Stanford Synchrotron Radiation Laboratory (SSRL) has experienced electron beam instabilities in the injector system of the Stanford Positron Electron Asymmetric Ring (SPEAR). Currently, for approximately the past four months the radio frequency (RF) gun of the linear accelerator injector system of the SPEAR at SSRL has become increasingly unstable. The current of the RF gun has become progressively sluggish and the lifetime of the cathode within the RF gun has been much shorter than expected. The cathode also sustains many unexplained damages. The instability of the RF gun affects the entire operation of SPEAR, creating substantial inconvenience. Through mechanical, design, and procedural analysis of the RF gun and the cathode that emits the electron beam of the linear accelerator, a solution to prolong the life of the cathode and secure the stability of the gun can be found. The thorough analysis of the gun and cathode involves investigation into the history of cathode installation and removal through the years of SPEAR operation as well as interviews with SSRL personnel involved with the upkeep of the gun and cathode.
NTIS
Electron Beams; Particle Accelerators; Linear Accelerators

20050042015 Stanford Linear Accelerator Center, CA, USA
Higgs Coupling Measurements at a 1 TeV Linear Collider
Barklow, T. L.; Dec. 2003; In English
Report No.(s): DE2004-826737; SLAC-PUB-10283; No Copyright; Avail: National Technical Information Service (NTIS)
Methods for extracting Higgs boson signals at a 1 TeV center-of-mass energy e(sup +)e(sup -) linear collider are described. In addition, estimates are given for the accuracy with which branching fractions can be measured for Higgs boson decays to b(bar b) WW, gg, and (gamma)(gamma).
NTIS
Higgs Bosons; Particle Decay; Center of Mass

20050042020
Femtosecond Width X-ray Generation with the SLAC Linac and the FFTB Beamline
Krejcik, P.; Arthur, J.; Carr, R.; Cornacchia, M.; Emma, P.; Jun. 2001; In English
Report No.(s): DE2004-826701; SLAC-PUB-8858; No Copyright; Avail: National Technical Information Service (NTIS)
We describe a new Sub-Picosecond Photon Source (SPPS) based on proposal to generate 30 GeV bunches as short as 30 fs rms with the SLAC linac. The bunch is compressed in three stages, starting with the existing ring-to-linac compressor. A second stage of compression will be added in the form of a simple magnetic chicane installed at the 9-GeV location in the linac. The short bunch then generates a strong wakefield in the linac which follows the chicane. This wake provides a large correlated energy spread which allows a third stage of compression in the bends of the existing Final Focus Test Beam (FFTB) beamline. A proposed 10 m long undulator in the FFTB can deliver (approx) 10(sup 8) 1. 5 (angstrom) photons per pulse in a 0.1% bandwidth with a peak brightness of (approx)10(sup 25) photons/sec/mm(sup 2)/mrad(sup 2)/0.1% BW, in a pulse width of (approx)80 fs FWHM. The short electron bunches with peak currents as high as 30 kA are also ideal for plasma and wakefield studies as well as providing abundant R and D possibilities for verifying short bunch behavior in the future Linac Coherent Light Source (LCLS).
NTIS
X Rays; Photons; Electron Bunching; Light Sources; Brightness

20050042026 Stanford Linear Accelerator Center, CA, USA, Stanford Univ., CA, USA

Molecular Environmental Science: An Assessment of Research Accomplishments, Available Synchrotron Radiation Facilities, and Needs

2004; In English

Report No.(s): DE2004-826756; SLAC-R-704; No Copyright; Avail: National Technical Information Service (NTIS)

Synchrotron-based techniques are fundamental to research in 'Molecular Environmental Science' (MES), an emerging field that involves molecular-level studies of chemical and biological processes affecting the speciation, properties, and behavior of contaminants, pollutants, and nutrients in the ecosphere. These techniques enable the study of aqueous solute complexes, poorly crystalline materials, solid-liquid interfaces, mineral-aqueous solution interactions, microbial biofilm-heavy metal interactions, heavy metal-plant interactions, complex material microstructures, and nanomaterials, all of which are important components or processes in the environment. Basic understanding of environmental materials and processes at the molecular scale is essential for risk assessment and management, and reduction of environmental pollutants at field, landscape, and global scales. One of the main purposes of this report is to illustrate the role of synchrotron radiation (SR)-based studies in environmental science and related fields and their impact on environmental problems of importance to society. A major driving force for MES research is the need to characterize, treat, and/or dispose of vast quantities of contaminated materials, including groundwater, sediments, and soils, and to process wastes, at an estimated cost exceeding 150 billion dollars through 2070.

NTIS

Chemical Reactions; Heavy Metals; Aqueous Solutions

20050042029 Stanford Linear Accelerator Center, CA, USA

Simulated X-ray Absorption Spectroscopy on the Water Dimer

Wung, A.; 2004; 36 pp.; In English

Report No.(s): DE2004-826722; SLAC-PUB-9389; No Copyright; Avail: Department of Energy Information Bridge

The ability of an individual H(sub 2)O molecule to form multiple hydrogen bonds with neighboring molecules makes it an ideal substance for the study of hydrogen bonding. X-ray absorption spectroscopy (XAS) can be used to study what intermolecular structures the hydrogen-bonded water molecules form. XAS excites core electrons from the oxygen 1 s atomic orbital to an unoccupied orbital. The resulting absorption spectrum shows the energy levels of the unoccupied orbitals, which in turn is dependent on the intermolecular structure of the H(sub 2)O system. Previous studies using molecular dynamics computer simulations have concluded that the intermolecular structure of liquid water is a distorted tetrahedron. Yet x-ray absorption spectra show discrepancies between liquid water and ice in which is already known to have a rigid tetrahedral structure. The research group, which is based in the University of Sweden in Stockholm and the Stanford Synchrotron Radiation Laboratory at the Stanford Linear Accelerator Center, has studied the possible presence of broken hydrogen bonds in the liquid water intermolecular structure to explain these deviations. Computer simulations are used to construct theoretical absorption spectra for models of liquid water including broken hydrogen bonds. Creating such models requires controlling variables. The simplest method of isolating individual variables, such as hydrogen bond length and angles, is to study the water dimer. Here, the water dimer is used to study how the absorption spectra change with the way the water molecules are positioned and oriented relative to each other.

NTIS

X Ray Absorption; Water; Absorption Spectroscopy; Mathematical Models

20050042038 Northern Illinois Univ., De Kalb, IL, USA, Fermi National Accelerator Lab., Batavia, IL, USA

Collective Modes and Colored Noise as Beam-Halo Amplifiers

Bohn, C. L.; Aug. 2004; In English

Report No.(s): DE2004-827547; FERMILAB-CONF-04/138AD; No Copyright; Avail: National Technical Information Service (NTIS)

As illustrated herein, collective modes and colored noise conspire to produce beam halo with much larger amplitude than could be generated by either phenomenon separately. Collective modes are inherent to nonequilibrium beams with space charge. Colored noise arises from unavoidable machine transitions and/or errors that influence the internal space-charge force. Lowest-order radial eigenmodes calculated self-consistently for a direct-current, cylindrically symmetric, warm-fluid Kapchinskij-Vladimirskij equilibrium serve to model the collective modes. Even with weak space charge, small-amplitude collective modes, and weak noise strength, a pronounced halo is seen to develop if these phenomena act on the beam over a sufficiently long time, such as in a synchrotron or storage ring.

NTIS

Color; Halos; Storage Rings (Particle Accelerators); Noise (Sound)

20050042047 Bethune-Cookman Coll., Daytona Beach, FL, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
Using WIRED to Study Simulated Linear Collider Detector Events
George, A.; Onibokum, A.; Aug. 2002; 24 pp.; In English
Report No.(s): DE2004-826726; SLAC-PUB-9396; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this project is to enhance the properties of the LCD WIRED Event Display. By extending the functionality of the display, physicists will be able to view events with more detail and interpret data faster. Poor characteristics associated with WIRED can severely affect the way we understand events, but by bringing attention to specific attributes we open doors to new ideas. Events displayed inside of the LCD have many different properties; this is why scientists need to be able to distinguish data using a plethora of symbols and other graphics. This paper will explain how we can view events differently using clustering and displaying results with track finding. Different source codes extracted from HEP libraries will be analyzed and tested to see which codes display the information needed. It is clear that, through these changes certain aspects of WIRED will be recognized more often allowing good event display which lead to better physics results.
NTIS
Liquid Crystals; Display Devices

20050051160 Institute of Optical Monitoring of Siberia, Tomsk, Russia
Preparation of ZnGeP2 for Nonlinear Optical Applications: Melt and Homoepitaxial Vapor Growth, Properties of the Grown Crystals
Gribenyukov, Alexander I.; Apr. 2004; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428753; ISTC-2051-2001; No Copyright; Avail: Defense Technical Information Center (DTIC)

Nonlinear optical materials are needed for use in atmospheric monitoring and remote sensing applications. ZnGeP2 is one of the most highly efficient nonlinear optical media for the middle infrared. This paper describes a research program to grow ZnGeP2 crystals and to investigate the relationship of composition to crystal structure to optical properties. The latter (transparency and damage threshold) determines the use of the material in nonlinear optics. It is known that for ZnGeP2 structural perfection is mainly determined by defects formed due to deviations from stoichiometry during synthesis and growth. Postgrowth treatment improves the physical properties of the crystals. For this project, the ZnGeP2 crystals were produced using two different synthesis techniques (one- and two-temperature synthesis and seeded melt and vapor growth) . A vapor growth technology using the chlorine method was created and applied to grow monocrystalline layers of ZnGeP2. Postgrowth treatments were carried out on these crystals. The grown and treated crystals were characterized by optical microscopy, scanning microscopy, transmission electron microscopy, microprobe analysis, and X-ray analysis. The authors were able to prepare high quality ZnGeP2 crystals, and they obtained new data on the optical properties of ZnGeP2. The results will have a great impact on the development of modern optical devices and systems and the control and management of industrial processes. Vapor growth experiments will provide data on the mechanisms of vapor growth for ZnGeP2, defect formation, and the nature of defects in film and volume ZnGeP2 crystals. The paper includes a bibliography of published papers (4) and reports (3) as well as conference presentations (10) with abstracts. (2 tables, 11 figures, 27 refs.)
DTIC
Crystal Defects; Crystal Growth; Crystals; Damage; Epitaxy; Germanium; Melts (Crystal Growth); Nonlinear Optics; Nonlinearity; Phosphorus; Vapor Deposition; Zinc Compounds

20050051193 Pennsylvania State Univ., University Park, PA USA
Crystal Growth and Thin Film Deposition of High Performance Piezoelectrics
Trolier-McKinstry, Susan; Shrout, Thomas R.; Jan. 2001; 14 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0895
Report No.(s): AD-A428818; ONR-332; No Copyright; Avail: CASI; A03, Hardcopy

Piezoelectric single crystals in the lead ytterbium niobate-lead titanate and BiScO3-PbTiO3 systems were grown and characterized as high temperature piezoelectrics. The properties were quite good, with d33 coefficients as high as 2500 pm/V in PY N-PT. Epitoxial and fiber textured thin films were prepared by pulsed-laser deposition and chemical solution deposition, respectively. These films show the highest reported e31,f coefficients for high Tc films. In addition, it was determined that the amplitude dependence of the dielectric and piezoelectric response of the films can be described using a frequency-dependent Rayleigh approach.
DTIC
Crystal Growth; Deposition; Single Crystals; Thin Films

20050051658 NASA Glenn Research Center, Cleveland, OH, USA

Radioisotope Thermophotovoltaic (RTPV) Power System for Space Applications

Chubb, Donald L.; Scheiman, David A.; [2004]; 16 pp.; In English; 2004 Space Power Workshop, 22 Apr. 2004, Manhattan Beach, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 972-30-06; Copyright; Avail: CASI; A03, Hardcopy

Thermophotovoltaic (RTV) energy conversion, coupled to the radioisotope powered General Purpose Heat Source (GPHS) is currently being developed by NASA. The goal of the program is to develop a 100 watt electrical power system with an efficient of 20%. Special control is the key element in obtaining an efficient system. Results presented show that excellent spectral control can be achieved so that reaching the goal of 20% efficiency is possible. Excellent spectral control is achieved by using a combination of selective emitters and optical filters and by eliminating radiation leakage from the optical cavity. Author

Radioisotope Heat Sources; Thermophotovoltaic Conversion; Energy Conversion; Optical Filters

20050051753 NASA Glenn Research Center, Cleveland, OH, USA

Limitation of Liquid Crystal on Silicon Spatial High Modular for Holographic Three-dimensional Displays

Wang, Xinghua; Wang, Bin; Bos, Philip J.; Anderson, James E.; Kujawinska, Malgorzata; Pouch, John; Miranda, Feliz; May 7, 2004; 17 pp.; In English; Society for Information Display (SID) 2004, 23-28 May 2004, Seattle, WA, USA

Contract(s)/Grant(s): WBS 22-319-80-A5; Copyright; Avail: CASI; A03, Hardcopy

In a 3-D display system based on an opto-electronic reconstruction of a digitally recorded hologram, the field of view of such a system is limited by the spatial resolution of the liquid crystal on silicon (LCOS) spatial light modular (SLM) used to perform the opto-electronic reconstruction. In this article, the special resolution limitation of LCOS SLM associated with the fringe field effect and interpixel coupling is determined by the liquid crystal detector simulation and the Finite Difference Time Domain (FDTD) simulation. The diffraction efficiency loss associated with the imperfection in the phase profile is studied with an example of opto-electronic reconstruction of an amplitude object. A high spatial resolution LCOS SLM with a wide reconstruction angle is proposed.

Author

Liquid Crystals; Silicon; Holography; Three Dimensional Models; Display Devices

20050051764 Nippon Telegraph and Telephone Public Corp., Japan

Theoretical Design of a Semiconductor Ferromagnet Based on Quantum Dot Superlattices

Shiraishi, K.; Tamura, H.; Takayanagi, H.; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 50; In English; See also 20050051761; Copyright; Avail: Other Sources

We report on the successful theoretical design of artificial ferromagnetic crystals based on quantum dot superlattices. Our examined quantum dot superlattice has the ferromagnetic ground state when it has a certain number of electrons even though it contains no magnetic elements. In addition, this ferromagnetism can be controlled simply by applying a gate electric field. Author

Ferromagnetic Materials; Semiconductors (Materials); Quantum Dots; Crystals; Superlattices; Magnets

20050051777 Nippon Telegraph and Telephone Public Corp., Japan

STM Observations of Three-dimensional Ge Islands on Si(111) Surfaces with Different Step Orientations and Step-bunching Conditions

Lin, F.; Sumitomo, K.; Homma, Y.; Ogino, T.; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 49; In English; See also 20050051761; Copyright; Avail: Other Sources

Ge growth on stepped Si(111) surfaces misoriented toward \h112\g. \h110\g and \h112\g was investigated with a scanning tunneling microscope (STM) on the same Si(111) substrate, where these different steps exist around the sidewall of a hole fabricated photolithographically. After high temperature (1200 C) annealing for several minutes, the steps on the sidewall of a hole exhibit the threefold symmetry, which consists of debunching \h112\g-type steps and heavy bunching \h110\g and \h112\g-type steps. After Ge deposition of up to three bilayers of Ge at 400 C, the distribution of three-dimensional (3D) islands becomes selectable on the three types of stepped surfaces. The step-flow growth in the step band region decreases the critical thickness of the transition from two-dimensional to three-dimensional growth. The surface energy at the step bunch and Ge islands become more important than the strain energy, and selective growth of Ge islands is realized.

Author

Germanium; Three Dimensional Models; Bunching; Scanning Tunneling Microscopy; Silicon; Fabrication

20050051830 Stanford Linear Accelerator Center, Stanford, CA, USA

Femtosecond X-ray Pulses from a Spatially Chirped Electron Bunch in a SASE FEL

Emma, P.; Huang, Z.; Jan. 2004; In English

Report No.(s): DE2004-826689; SLAC-PUB-10294; No Copyright; Avail: National Technical Information Service (NTIS)

We propose a simple method to produce short x-ray pulses using a spatially chirped electron bunch in a SASE FEL. The spatial chirp is generated using an rf deflector which produces a transverse offset (in y and/or y') correlated with the longitudinal bunch position. Since the FEL gain is very sensitive to an initial offset in the transverse phase space at the entrance of the undulator, only a small portion of the electron bunch with relatively small transverse offset will interact significantly with the radiation, resulting in an x-ray pulse length much shorter than the electron bunch length. The x-ray pulse is also naturally phase locked to the rf deflector and so allows high precision timing synchronization. We discuss the generation and transport of such a spatially chirped electron beam and show that tens of femtosecond long pulse can be generated for the linac coherent light source (LCLS).

NTIS

Chirp; Electron Beams; Electron Bunching; X Rays; Free Electron Lasers

20050051858 Stanford Linear Accelerator Center, Stanford, CA, USA

Radiative Corrections to the Azimuthal Asymmetry in Transversely Polarized Moller Scattering

Dixon, L.; Schreiber, M.; 2004; 12 pp.; In English

Report No.(s): DE2004-826750; SLAC-PUB-10345; No Copyright; Avail: Department of Energy Information Bridge

Experiment E158 at SLAC can measure an azimuthal asymmetry in single-spin, transversely polarized Moeller scattering, e(sup -)(up-arrow)e(sup -) (yields) e(sup -)e(sup -), which arises from a QED rescattering phase. We recompute the leading-order (one-loop) asymmetry, con.rming previous results, and calculate the leading logarithmic QED corrections due to initial-state radiation from the beam and target electrons, and due to final-state radiation. The size of these radiative corrections is quite sensitive to experimental details, such as the acceptance in energy and in polar angle of the scattered electron. For E158, the corrections are modest, increasing the parts-per-million asymmetry by roughly 1%.

NTIS

Asymmetry; Azimuth; Quantum Electrodynamics; Scattering

20050052024 Maryland Univ., College Park, MD, USA

Comparison of Longitudinal and Transverse Cross Sections in the p(e,e'K+) (Lambda) and p(e, e'K+)(Sigma)(sup O) Reactions

Beise, E. J.; 2004; 244 pp.; In English

Report No.(s): DE2004-824962; No Copyright; Avail: Department of Energy Information Bridge

Jefferson Lab Experiment E93-018 measured kaon electroproduction in hydrogen in two hyperon channels, p(e, e'K(sup+))Lambda and p(e,e'K(sup+))Sigma(sup 0). Data in both channels were taken at three (3) different values of the virtual photon transverse linear polarization, epsilon, for each of four (4) values of Q(sup 2)= (0.52, 0.75, 1.00, 2.00) GeV(sup 2). Cross sections averaged over the azimuthal angle, phi, were extracted (i.e., sigma(sub T)+ epsilon sigma(sub L)) at each of these twelve points for each hyperon. Rosenbluth separations were performed to separate the longitudinal and transverse production cross sections.

NTIS

Cross Sections; Kaon Production

20050060642 NASA Glenn Research Center, Cleveland, OH, USA

High Temperature Performance of a SiC MESFET Based Oscillator

Schwartz, Zachary D.; Ponchak, George E.; [2005]; 4 pp.; In English; IEEE International Microwave Symposium, 11-17 Jun. 2005, Long Beach, CA, USA

Contract(s)/Grant(s): WBS 22-714-70-64; No Copyright; Avail: CASI; A01, Hardcopy

A hybrid, UHF-Band differential oscillator based on 10 w SiC RF Power Metal Semiconductor Field Effect Transistor (MESFET) has been designed, fabricated and characterized through 475 C. Circuit is fabricated on an alumina substrate with thin film spiral inductors, chip capacitors, chip resistors, and wire bonds for all crossovers and interconnectors. The oscillator delivers 15.7 dBm at 515 MHz into a 50 Ohm load at 125 C with a DC to RF conversion efficiency of 2,8%. After tuning the load impedance, the oscillator delivers 18.8 dBm at 610 MHz at 200 C with a DC to RF conversion efficiency of 5.8%. Finally,

by tuning the load and bias conditions, the oscillator delivers 4.9 dBm at 453 MHz at 475 C.
Author
Oscillators; Bonding; Silicon Carbides; High Temperature; Field Effect Transistors

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*.

20050041805 Indiana Univ., Bloomington, IN, USA
Theoretical Studies of Lorentz and CPT Symmetry
Kostelecky, V. Alan; January 2005; 7 pp.; In English
Contract(s)/Grant(s): NAG8-1770; No Copyright; Avail: CASI; A02, Hardcopy

The fundamental symmetries studied here are Lorentz and CPT invariance, which form a cornerstone of the relativistic quantum theories used in modern descriptions of nature. The results obtained during the reporting period focus on the idea, originally suggested by the P.I. and his group in the late 1980s, that observable CPT and Lorentz violation in nature might emerge from the qualitatively new physics expected to hold at the Planck scale. What follows is a summary of results obtained during the period of this grant.
Author (revised)
Symmetry; Invariance; Quantum Theory

20050051124 California Univ., Berkeley, CA USA
Quantum Information Processing
Vazirani, Umesh; Papadimitriou, Christos; Sinclair, Alistair; Nov. 2004; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0601; DARPA ORDER-K328; Proj-K328
Report No.(s): AD-A428699; AFRL-IF-RS-TN-2004-3; No Copyright; Avail: Defense Technical Information Center (DTIC)

This effort supported a Quantum Information Workshop at the University of California, Berkeley. After a cut in funding, the remaining unspent funding was used to support: (I) research related to the internet involving the interplay between mechanism design and computational complexity, (2) improved understanding of the connections between phase transitions in statistical mechanics and mixing times of Markov chain Monte Carlo algorithms, and (3) an investigation of the logic of transcriptional control of various model organisms, with emphasis on characterizing the binding sites of key transcription factors via stochastic models.
DTIC
Data Processing; Quantum Theory

20050051867 Glasgow Univ., UK
p(sup 0) Meson Photoproduction using Linearly Polarised Photons with the CLAS Detector
Gordon, C. I. O.; 2004; In English
Report No.(s): DE2004-826033; No Copyright; Avail: National Technical Information Service (NTIS)

The work presented in this thesis describes the first experimental measurement of the photon asymmetry of the exclusive (rvec (gamma)) (yields) (rho)(sup 0)p (yields) (pi)(sup +)(pi)(sup -)p reaction. The data were gathered during the summer of 2001 as a proof of principle study using a polarized beam of photons with the CLAS detector in Hall B of Jefferson Lab for the first time. The aim of the g8a set of experiments is to improve the understanding of the underlying symmetry of the quark degrees of freedom in the nucleon, the nature of the parity exchange between the incident photon and the target nucleon, the mechanism of associated strangeness production in electromagnetic reactions, and to search for evidence for the existence of the so called missing resonances. A beam of tagged and collimated linearly polarized photons (energy range 1. 8-2.2 GeV) in conjunction with the large solid angle coverage of CLAS make possible the extraction of polarization observables for the photoproduction of vector mesons. For example, the azimuthal distribution of the (rho)(sup 0) as a function of its polar angle in the ((rvec (gamma)),p) c.m. system enables the measurement of the photon asymmetry parameter, (Sigma). This has been measured for (theta)(sub c.m.) (le) 65(sup o), the results of which are compared with the prediction of the quark model of Zhao for the (omega) vector meson. It has been found that the tensor coupling for the (rho)(sup 0) is quite different than that of the (omega). The experimental technique of using a beam of linear polarized photons with the CLAS detector has been shown

to be viable. By the end of the second phase of these experiments they expect to have a high quality data set which will allow the measurement of the spin density matrix elements for the (rho)(sup 0) and provide evidence relating to the existence of the missing resonances.
NTIS
Photoproduction; Photons; Vector Mesons; Radiation Detectors

20050051894 Stanford Linear Accelerator Center, Stanford, CA, USA, Cornell Univ., Ithaca, NY, USA
Sudakov Resummation for Subleading SCET Currents and Heavy-to-Light Form Factors
Hill, R. J.; Becher, T.; Lee, S. J.; Neubert, M.; Apr. 23, 2004; 54 pp.; In English
Report No.(s): DE2004-826913; SLAC-PUB-10412; No Copyright; Avail: Department of Energy Information Bridge

The hard-scattering contributions to heavy-to-light form factors at large recoil are studied systematically in soft-collinear effective theory (SCET). Large logarithms arising from multiple energy scales are resummed by matching QCD onto SCET in two stages via an intermediate effective theory. Anomalous dimensions in the intermediate theory are computed, and their form is shown to be constrained by conformal symmetry. Renormalization-group evolution equations are solved to give a complete leading-order analysis of the hard-scattering contributions, in which all single and double logarithms are resummed. In two cases, spin-symmetry relations for the soft-overlap contributions to form factors are shown not to be broken at any order in perturbation theory by hard-scattering corrections.
NTIS
Collinearity; Form Factors

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20050050941 Defence Science and Technology Organisation, Edinburgh, Australia
Short- and Long-term Effects of Participation in a Cross-cultural Simulation Game on Intercultural Awareness
Mills, Vanessa; Smith, Rebekah; November 2004; 76 pp.; In English
Report No.(s): DSTO-TR-1636; AR-013-258; Copyright; Avail: Other Sources

The increase in military operations in urban terrain has created a requirement or deployed personnel to interact with people from other cultural backgrounds. This research aims to identify a base level method of enhancing the general cultural awareness of deployed personnel. Previous research in the business community has led to developing simulation games to enhance these generic intercultural skills. The general approach of this work is for teams of players, each adopting a different synthetic culture, to negotiate a pre-defined outcome with the other teams. The aim is to produce insight into cultural differences through interactions with others, and to develop skills for dealing with those differences through negotiation. Debriefs immediately following game play are used to reinforce learning. To date, however, there are no quantitative methods of measuring the effectiveness of these games in terms of their ability to change attitudes and awareness. In addition, there do not appear to be any attempts to examine long-term retention of such changes. Consequently, this research measured the short- and long-term effectiveness of training through simulation to enhance intercultural awareness. Overall, results indicate an immediate and long-term increase in cultural understanding, while there were no changes in underlying value systems.
Author
Culture (Social Sciences); Games; Education; Personnel Development; Social Factors

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20050041811
Planning Mars Memory: Learning from the MER Mission
[2004]; 18 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation discusses ways in which the lessons learned from a mission can be systematically

remembered, retained, and applied by individuals and by an organization as a whole. The presentation cites lessons learned from the Mars Exploration Rover (MER) Mission as examples.
Author
Mars Missions; Mars Exploration; Learning; Mission Planning; Project Management

20050041926 NASA Glenn Research Center, Cleveland, OH, USA
Breakthrough Propulsion Physics Project: Project Management Methods
Millis, Marc G.; December 2004; 45 pp.; In English
Contract(s)/Grant(s): WBS 2262-949-10-01
Report No.(s): NASA/TM-2004-213406; E-14920; No Copyright; Avail: CASI; A03, Hardcopy

To leap past the limitations of existing propulsion, the NASA Breakthrough Propulsion Physics (BPP) Project seeks further advancements in physics from which new propulsion methods can eventually be derived. Three visionary breakthroughs are sought: (1) propulsion that requires no propellant, (2) propulsion that circumvents existing speed limits, and (3) breakthrough methods of energy production to power such devices. Because these propulsion goals are presumably far from fruition, a special emphasis is to identify credible research that will make measurable progress toward these goals in the near-term. The management techniques to address this challenge are presented, with a special emphasis on the process used to review, prioritize, and select research tasks. This selection process includes these key features: (a) research tasks are constrained to only address the immediate unknowns, curious effects or critical issues, (b) reliability of assertions is more important than the implications of the assertions, which includes the practice where the reviewers judge credibility rather than feasibility, and (c) total scores are obtained by multiplying the criteria scores rather than by adding. Lessons learned and revisions planned are discussed.
Author
Management Methods; Project Management; Spacecraft Propulsion; NASA Programs

20050051766 Nippon Telegraph and Telephone Public Corp., Musashino, Japan
Activities of ITU-T TSAG
Hiramatsu, Yukio; NTT Technical Review, Volume 3, No. 1; January 2005, pp. 43-47; In English; See also 20050051761; Copyright; Avail: Other Sources

This article reports on the activities of TSAG (Telecommunication Standardization Advisory Group) in the last study period (2001-2004). TSAG is responsible for administrative and operational matters that are common to all Study Groups of ITUI-T (International Telecommunication Union Telecommunication Standardization Sector).
Author
Telecommunication; Standardization; Organizations; Coordination

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*.

20050042036 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Global Unified Parallel File System (GUPFS) Project: FY2003 Activities and Results
Butler, G. F.; Baird, W. P.; Lee, R. C.; Tull, C. E.; Welcome, M. L.; 2004; In English
Report No.(s): DE2004-827569; LBNL-52456(2003); No Copyright; Avail: National Technical Information Service (NTIS)

The Global Unified Parallel File System (GUPFS) project is a multiple-phase project at the National Energy Research Scientific Computing (NERSC) Center whose goal is to provide a scalable, high-performance, high-bandwidth, shared file system for all of the NERSC production computing and support systems. The primary purpose of the GUPFS project is to make the scientific users more productive as they conduct advanced scientific research at NERSC by simplifying the scientists' data management tasks and maximizing storage and data availability. This is to be accomplished through the use of a shared file system providing a unified file namespace, operating on consolidated shared storage that is accessible by all the NERSC production computing and support systems. In order to successfully deploy a scalable high-performance shared file system with consolidated disk storage, three major emerging technologies must be brought together: (1) shared/cluster file systems software, (2) cost-effective, high-performance storage area network (SAN) fabrics, and (3) high-performance storage devices. Although they are evolving rapidly, these emerging technologies individually are not targeted towards the needs of scientific

high-performance computing (HPC). The GUPFS project is in the process of assessing these emerging technologies to determine the best combination of solutions for a center-wide shared file system, to encourage the development of these technologies in directions needed for HPC, particularly at NERSC, and to then put them into service.
NTIS
Computer Systems Programs; Data Management; Systems Engineering; File Maintenance (Computers)

20050050860 Research and Technology Organization, Neuilly-sur-Seine, France
RTO Technical Publications: A Quarterly Listing
December 2004; 2 pp.; In English
Report No.(s): RTO-04-04; No Copyright; Avail: CASI; A01, Hardcopy

This is a listing of recent unclassified RTO technical publications processed by the NASA Center for AeroSpace Information. Contents include the following: RTO Technical Publications: A Quarterly Listing. Implications of Multilingual Interoperability of Speech Technology for Military Use. Non-Lethal Weapons and Future Peace Enforcement Operations.
Derived from text
Facsimile Communication; Technology Utilization; Military Operations; Stereophonics

20050050938 Defence Science and Technology Organisation, Edinburgh, Australia
Efficient Solutions in Load Planning
Sexton, Jane; Watson, Jamie; Boswell, Sharon; April 2004; 41 pp.; In English
Contract(s)/Grant(s): NAV-01/027
Report No.(s): DSTO-TN-0587; DODA-AR-013-207; Copyright; Avail: Other Sources

The successful execution of an amphibious operation is a function of the efficient discharge of the ORBAT to the relevant points of entry in a given timeframe. Here, we consider a sea point of entry only where the planning phase considers the loading of the ORBAT onto watercraft. The current load planning capability is achieved through a conference and the use of a trim and stabilitv tool. In order to make this process more efficient - both in time and accuracy - a new method was required by the ADF. As a result, DSTO developed a command decision aid, the Littoral Battle Tool Set, LBaTS. This report describes the loading algorithm as required by the landing phase and then extends the scope to the termination phase where the ORBAT is returned to the amphibious ship. Each method will be demonstrated for a fictitious component of an ORBAT. Finally, upon introduction of a command decision aid into the distributed architecture environment, we recommend incorporating the methods described here to enhance the planning capability of the ADF.
Author
Decision Support Systems; Logistics Management; Cargo; Loading Operations; Planning

20050050986 Innovative Solutions International, Vienna, VA, USA
Thirty Years of PTTI: A Retrospective
Klepczynski, William J.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 7-10; In English; See also 20050050957; No Copyright; Avail: CASI; A01, Hardcopy

Five years ago, my predecessor at the US Naval Observatory gave a history of PTTI which covered 25 years [1]. It is an excellent, informative and insightful review and I refer everyone to it. I do not think that you can fred a better and more meaningful article. This year I was asked to give a retrospective look at 30 years of PTH. If you look up 'retrospective' in a thesaurus, you will find a group of words which imply that a retrospective look of a subject is done from a personal point of view. These words include: looking back, contemplating the past, recollection, considering past events, remembering perspective from the present, and memory. I will draw upon some of these different synonyms in this look based somewhat on personal experience. However, I will do it in a way which avoids mentioning the names of individuals, because, alas, I may miss a few and I do not wish to slight any of the people whom I might miss and for whom I have fond memories. In the early 60's, I started at USNO in the Nautical Almanac Office. It was there that I became associated with the Institute of Navigation. This exposed me to the intrinsic and intimate relation of navigation with timing. It was with the ION that I first heard of Omega, Loran-C, TRANSIT, and vaguely something about 621B and Timation, the forerunners of GPS. It was an exciting experience because one could see the change that was rapidly taking place during that decade. In fact, the impact and role of navigation sysems on timekeeping has been, is, and will continue to be dramatic. The lan- based navigation systems that impacted timekeeping, such as Omega and Loran-C, gave way to GPS and now the role of GPS may be supplemented by the Satellite-Based Augmentation Systems currently being developed. These latter systems include the WAAS, EGNOS, and

MSAS. They will enable global, realtime nanosecond synchronization to UTC.
Derived from text
Observatories; Real Time Operation; Global Positioning System

20050051006 NASA Ames Research Center, Moffett Field, CA, USA
System, Method and Apparatus for Conducting a Keyterm Search
McGreevy, Michael W., Inventor; November 23, 2004; 76 pp.; In English
Patent Info.: Filed 2 Mar. 2001
Report No.(s): US-Patent-6,823,333; US-Patent-Appl-SN-800309; NASA-Case-ARC-14512-1; No Copyright; Avail: CASI; A05, Hardcopy

A keyterm search is a method of searching a database for subsets of the database that are relevant to an input query. First, a number of relational models of subsets of a database are provided. A query is then input. The query can include one or more keyterms. Next, a gleaning model of the query is created. The gleaning model of the query is then compared to each one of the relational models of subsets of the database. The identifiers of the relevant subsets are then output.
Official Gazette of the U.S. Patent and Trademark Office
Data Bases; Search Profiles; Information Retrieval

20050051042 Defence Research and Development Canada, Valcartier, Quebec Canada
Analysing an Identity Information Fusion Algorithm Based on Evidence Theory
Jousselme, Anne-Laure; Bosse, Eloi; Jouan, Alexandre; Mar. 2004; 47 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428563; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Algorithms; Identities; Multisensor Fusion

20050051070 Defence Research and Development Canada, Valcartier, Quebec Canada
Introducing the Canadian Information Centric Workspace Concept
Thibault, Gaetan; Le May, Francois; Mar. 2004; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428600; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Canada; Data Acquisition; Information Systems; Intelligence; Military Operations; Target Acquisition; Threat Evaluation

20050051071 Defence Research and Development Canada, Valcartier, Quebec Canada
A Lessons Learned Knowledge Warehouse to Support the Army Knowledge Management Command-Centric
Champoux, Pierrette; Trudel, Martin; Thibault, Gaetan; Mar. 2004; 58 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428601; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Canada; Command and Control; Information Systems; Military Operations; Multisensor Fusion

20050051072 MEDAV G.m.b.H., Uttenreuth, Germany
The Visualisation of Diverse Intelligence
Kolb, Hans-Joachim; Towsey, Michael; Maetschke, Stefan; Uebler, Ulla; Mar. 2004; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428602; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Data Acquisition; Data Management; Graphical User Interface; Intelligence; Multisensor Fusion; Scientific Visualization

20050051073 T-SOFT Ltd., Prague, Czech Republic
Web-Based Countrywide Resources Planning System with the Centralized Support of National Mapping Center
Pejcoch, Jaroslav; Duda, Jan; Mar. 2004; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428603; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available
Data Acquisition; Emergencies; Geographic Information Systems; Management Information Systems; Management Methods; Management Planning; Resources Management

20050051074 Thales Communications, Colombes, France

Besoins operationnels en fusion en matiere d'information et de renseignement (Operational Requirements for Fusion in the Fields of Information and Intelligence)

Chantal, Louis de; Mar. 2004; 62 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428604; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available

Decision Making; Information Systems; Intelligence; Military Operations; Multisensor Fusion

20050051076 Turkish Navy, Turkey

A Wide-Area Surveillance Prototype System from Identification Fusion Perspective

Balci, A. M.; Mar. 2004; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428606; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available

Data Systems; Information Systems; Multisensor Fusion; Oceans; Prototypes; Reconnaissance; Surveillance; System Identification

20050051087 Army Command and General Staff Coll., Fort Leavenworth, KS USA

Intrepidity, Iron Will, and Intellect: General Robert L. Eichelberger and Military Genius

Fath, Matthew H.; Jun. 2004; 114 pp.; In English

Report No.(s): AD-A428623; No Copyright; Avail: Defense Technical Information Center (DTIC)

There are currently two contradictory schools of thought in the historiography of General Robert L. Eichelberger's generalship. One group of authors, John Shortal and Jay Luvaas, consider Eichelberger a brilliant World War II commander. Another author, Paul Chwialkowski, believes Eichelberger to be good, but not distinguished. This study attempts to develop a concise judgment of Eichelberger's leadership. The research analyzed Eichelberger s generalship using Clausewitz's theory of military genius as a model. The first step was to define military genius and to determine its components and subcomponents. Next, Eichelberger's pre-World War II education, mentorship, and training experiences were evaluated. The third step was to analyze Eichelberger's generalship during the Papua New Guinea, Netherlands New Guinea, and Philippines Campaigns of World War II to determine if he consistently demonstrated the qualities of military genius. This study concluded that Eichelberger definitively displayed the components of courage and determination but a judgment on his coup d'oeil required a more detailed examination and warranted further research. Eichelberger's leadership is relevant to today s military officer because he successfully defeated an enemy who employed many asymmetrical tactics of potential enemies in the contemporary operating environment: antiaccess denial, defense in complex terrain, and fanatical fighting abilities.

DTIC

Iron; Leadership; Personnel

20050051089 Defence Science and Technology Organisation, Edinburgh, Australia

Information Fusion and Extraction Priorities for Australia's Information Capability

Oxenham, Martin; Percival, John; Price, Richard; Lambert, Dale; Mar. 2004; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428625; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available

Australia; Command and Control; Data Mining; Extraction; Intelligence; Multisensor Fusion; Priorities; Surveillance

20050051104 Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany

A Man-in-the-Loop Support Concept for Military Ambush Threat-Assessment Based on Reconnaissance Reports

Lorenz, Frank P.; Biermann, Joachim; Mar. 2004; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A428652; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract available

Data Processing; Decision Support Systems; Multisensor Fusion; Reconnaissance; Situational Awareness; Threat Evaluation

20050051105 Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France
Information Evaluation: Discussion about STANAG 2022 Recommendations
Cholvy, Laurence; Nimier, Vincent; Mar. 2004; 40 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428653; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Intelligence; Multisensor Fusion; North Atlantic Treaty Organization (NATO); Reliability

20050051119 Civil Aeromedical Inst., Oklahoma City, OK USA
Measures of Information Complexity and the Implications for Automation Design
Xing, Jing; Oct. 2004; 15 pp.; In English
Report No.(s): AD-A428690; DOT/FAA/AM-04/17; No Copyright; Avail: Defense Technical Information Center (DTIC)
Information complexity associated with automation aids is a bottleneck that limits their use. While automation systems are designed to bring new functions to users and increase their capacities, automation also creates new tasks associated with acquiring and integrating information from displays. For example, a complex display increases information load to human operators and reduces usability. Thus, the efficiency of an automation system largely depends on the complexity of displayed information. To evaluate the costs and benefits of an automation aid, it is important to understand how much information is shown on the display, how users look at multiple information sources to build and maintain situation awareness, and whether the information is displayed in a compatible way so it can be integrated and understood easily without the user having to make internal conversions or calculations. In this paper, we present a set of measures to assess information complexity. The metrics count information complexity as the combination of three basic factors: numeric size, variety, and relation; each factor is evaluated by the functions at three stages of brain information processing: perception, cognition, and action. Ideally, these measures provide an objective method to evaluate automation systems for acquisition and design prototypes.
DTIC
Data Processing; Display Devices

20050051125 Army Command and General Staff Coll., Fort Leavenworth, KS USA
Beginning of the End: The Leadership of SS Obersturmbannfuehrer Jochen Peiper
Bouwmeester, Han; Jun. 2004; 163 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428700; No Copyright; Avail: Defense Technical Information Center (DTIC)
SS Obersturmbannfuehrer Jochen Peiper was one of Germany's most colorful military leaders of World War II with an audacious reputation. The name Peiper will always be linked to the Malmedy Massacre, the death of Belgian civilians and more than seventy American soldiers, but there is still a myth around Peiper. Why was a twenty-nine year old Waffen-SS officer chosen to lead the German spearhead unit during the Battle of the Bulge in December 1944? Peiper was a special leader within the one of the most elite Waffen-SS divisions, the Leibstandarte-SS Adolf Hitler. Peiper was charismatic and extreme loyal to his unit. His men trusted him as a leader, even under the most extreme conditions. In Germany he was a well-known war hero. It was a logical decision that Peiper became the commander of the spearhead unit, but there were other factors leading to this decision: tactical considerations, a we-know-what-to-expect-principle, and Peiper was lucky that he was still alive and serving in the Waffen-SS.
DTIC
Biography; Leadership

20050051129 Military Academy, Brno, Czech Republic
Ontological Approach to the Representation of Military Knowledge
Winklerova, Zdenka; Mar. 2004; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428705; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Command and Control; Decision Making; Intelligence; Multisensor Fusion; Warfare

20050051130 Thales Communications, Colombes, France
The Case for Using Semantic Nets as a Convergence Format for Symbolic Information Fusion
Rohmer, Jean; Mar. 2004; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428706; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Artificial Intelligence; Convergence; Format; Multisensor Fusion; Nets; Semantics

20050051131 Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany
A Knowledge-Based Approach to Information Fusion for the Support of Military Intelligence
Biermann, Joachim; Mar. 2004; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428708; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Decision Support Systems; Heuristic Methods; Information Systems; Intelligence; Knowledge Based Systems; Multisensor Fusion

20050051132 Defence Science and Technology Organisation, Edinburgh, Australia
Multi-Sensor Kinematic and Attribute Tracking Using a Bayesian Belief Network Framework
Krieg, Mark L.; Mar. 2004; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428709; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Automatic Control; Bayes Theorem; Belief Networks; Kinematics; Multisensor Applications; Multisensor Fusion; Situational Awareness; Tracking (Position)

20050051133 Defence Research and Development Canada, Valcartier, Quebec Canada
Ontological Approach to Military Knowledge Modeling and Management
Boury-Brisset, Anne-Claire; Mar. 2004; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428710; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Military Technology; Multisensor Fusion; Situational Awareness; Threat Evaluation

20050051134 Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany
Analysis of Free-Form Battlefield Reports with Shallow Parsing Techniques
Hecking, Matthias; Mar. 2004; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428711; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Command and Control; Extraction; Linguistics; Natural Language Processing; Parsing Algorithms

20050051135 Lockheed Martin Canada, Montreal, Quebec Canada
Analysis of Adaptive Data Fusion Approaches within LM Canada's Technology Demonstrator
Shahbazian, Elisa; Baril, Louise; Michaud, Guy; Menard, Eric; Turgeon, Danel; Mar. 2004; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428712; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Adaptation; Canada; Data Management; Decision Support Systems; Military Technology; Multisensor Fusion; Proving

20050051139 Wake Forest Univ., Winston-Salem, NC USA
Computational Methods for High Resolution Imaging and Data Mining
Pauca, Victor P.; Sep. 2004; 9 pp.; In English
Contract(s)/Grant(s): FA49620-03-1-0215
Report No.(s): AD-A428723; AFRL-SR-AR-TR-04-0643; No Copyright; Avail: CASI; A02, Hardcopy
Research problems investigated during the funding period included enabling mathematics and computational research in integrated optical systems design as well as spectral data mining and analysis. Particular applications of this research to enhance image restoration of integrated optical-digital systems and space object identification were addressed. A novel minimization-maximization approach was proposed and successfully employed to optimize the design of integrated imaging systems that maximize the information strength in an incoming image signal before it is discretized and sampled in a CCD array. Five research papers were published on this work. Novel constrained nonnegative matrix factorization (CNMF) algorithms were developed and successfully used to extract material features and material composition from spectral traces of man-made space objects, such as geosynchronous satellites. A total of four papers were published as a result of this work. Technology transfer included collaboration with researchers from Oceanit Labs and Boeing Inc. (2 research papers) and transition of our CNMF algorithms for text mining and document clustering applications (2 research papers). Research results

were presented at the 2004 SIAM International Conference on Data Mining, at the Annual SPIE meeting and at the AMOS Technical Conference in both 2003 and 2004.
DTIC
Data Mining; High Resolution; Imaging Techniques; Information Retrieval

20050051145 Walter Reed Army Medical Center, Washington, DC USA
Emergency War Surgery: Third USA Revision
Jan. 2004; 469 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428731; No Copyright; Avail: Defense Technical Information Center (DTIC)
War surgery, and treatment of combat casualties at far forward locations and frequently under austere conditions, continue to save lives military medical personnel provide outstanding health support to those serving in harm's way. As the face of war continues to evolve, so must the practice of medicine, to support those who so selflessly fight the global war on terrorism, Today, American military men and women face a new terrain of mobile urban terrorism and conflict. Despite advances in personal and force protection provided to our forces, they remain vulnerable to blast wounds, burns and multiple penetrating injuries not usually encountered in the traditional civilian setting. This publication expertly addresses the appropriate medical management of these and other battle and nonbattle injuries.
DTIC
Emergencies; Handbooks; Medical Services; Military Operations; United States; Warfare

20050051176 Army Command and General Staff Coll., Fort Leavenworth, KS USA
The Changing Dynamics of Military Advantage in the Information Age
Mulcahey, Sean F.; Jun. 2004; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428772; No Copyright; Avail: Defense Technical Information Center (DTIC)
The information revolution causes dramatic changes in the geopolitical environment, which result in new challenges to U.S. national security, particularly from a new form of global insurgency. The continued development and proliferation of information technology impacts the very nature of conflict and military competitive advantage. Can the U.S. expect to maintain its current unprecedented degree of military advantage in the information-age? This thesis examines this question using a qualitative research methodology. The research analyzes the impact of information technology on the geopolitical system, the nature of conflict, and the realm of military competition. Within this context, the research examines the changing nature of military advantage. Three elements of advantage are analyzed to determine qualitative changes that result from the changing conditions of the information-age. The elements are power, legitimacy, and effects. The research also includes a comparative analysis that seeks to determine how these changing conditions affect the ability of both the U.S. military and global insurgents to gain advantage. The research concludes that U. S. military advantage will decline relative to a global insurgency. As a result, the U.S. will face significant challenges in its effort to achieve lasting success in the Global War on Terrorism (GWOT).
DTIC
Information Systems; Warfare

20050051181 Air Force Research Inst., Prague, Czech Republic
Data Collection and Global Data Fusion in C4ISR in the Czech Armed Forces
Orsak, Radek; Mar. 2004; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428783; No Copyright; Avail: Defense Technical Information Center (DTIC)
No abstract available
Armed Forces; Data Acquisition; Multisensor Fusion

20050051864 Texas Univ., Austin, TX, USA
State-of-the-Practice in Freight Data: A Review of Available Freight Data in the U.S
Mani, A.; Prozzi, J.; Feb. 2004; 152 pp.; In English
Report No.(s): PB2005-102447; CTR-0-4713-P2; No Copyright; Avail: CASI; A08, Hardcopy
State and regional transportation planning agencies are increasingly recognizing the need for policies and programs addressing freight issues to ensure an efficient and reliable freight transportation system. A major challenge, however, remains the lack of available freight data to ensure informed decisions. State Departments of Transportation seem to (1) rely on the limited data compiled and published by federal agencies for aggregate analysis, (2) obtain one of the private commercial

sources of data related to freight movements, or (3) collect original data. The principal commercial data source currently is the Reebie TRANSEARCH database. The objective of this research product is to summarize the outcome of the research teams comprehensive review of available U.S. freight data sources both public and commercial sources. The research team carefully reviewed the objectives, survey methods, assumptions, and limitations of each publicly available database, and the available documentation of commercial databases. In total, 31 databases were reviewed. This research product documents, in detail, the characteristics of the various databases, including sponsoring organization, performing organization, data collected, sampling method, survey method, quality control procedure, geographical coverage, frequency of updates, and the assumptions and limitations inherent to each data source. The contact details for the contact organization are also provided.
NTIS
Cargo; Data Bases; Planning; Policies; Transportation

20050060963 Envirocare of Utah, Inc., Salt Lake City, UT, USA
Generator Certification Process for Envirocare's Containerized Class a Disposal Facility
Rogers, B. C.; 2004; In English
Report No.(s): DE2004-828290; No Copyright; Avail: National Technical Information Service (NTIS)
On October 19, 2001, the Utah Division of Radiation Control issued Amendment 12 to Radioactive Material License UT2300249 (RML) for Envirocare of Utah, Inc. (Envirocare) disposal operations. The license amendment provides the mechanism for Envirocare to receive and dispose of containerized Class A Low-Level Radioactive Waste (LLRW) at the newly constructed Containerized Waste Facility (CWF). Due to the increased radioactivity and external dose rates of waste that will be shipped to the CWF, a Generator Certification Program has been implemented that eliminates the requirement to sample incoming shipments, thus keeping worker doses to as low as reasonably achievable (ALARA).
NTIS
Disposal; Radioactive Wastes; Radioactive Materials

20050061105 NASA Langley Research Center, Hampton, VA, USA
NASA Patent Abstracts: A Continuing Bibliography (Supplement 65)
January 2005; 35 pp.; In English
Report No.(s): NASA/SP-2005-7039/SUPPL65; No Copyright; Avail: CASI; A03, Hardcopy
This report lists NASA patent abstracts recently announced in the NASA STI Database.
Author
Bibliographies; Patents

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20050061113 PRC Energy Analysis Co., McLean, VA, USA
Satellite Power System (SPS) Initial Insurance Evaluation
September 1980; 35 pp.; In English
Contract(s)/Grant(s): AC01-77ET-21059
Report No.(s): DOE/ER/21059-01; No Copyright; Avail: CASI; A03, Hardcopy
This report represents the beginning of a process to educate the insurance industry about the Satellite Power System (SPS). The report is divided into three sections. In the first section a general history describes how space risks are being insured today. This is followed by an attempt to identify the major risks inherent to the SPS. The final section presents a general projection of insurance market reactions to the Satellite Power System.
Author
Insurance (Contracts); Economic Factors; Spacecraft Power Supplies; Space Commercialization

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TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20050051856 Japan Nuclear Cycle Development Inst., Tokai, Japan
Safety Evaluation for Hull Waste Treatment Process in JNC
Kojima, H.; Kurakata, K.; Feb. 2002; 16 pp.; In English
Report No.(s): DE2004-828317; No Copyright; Avail: Department of Energy Information Bridge

Hull wastes and some scrapped equipment are typical radioactive wastes generated from reprocessing process in Tokai Reprocessing Plant (TRP). Because hulls are the wastes remained in the fuel shearing and dissolution, they contain high radioactivity. Japan Nuclear Cycle Development Institute (JNC) has started the project of Hull Waste Treatment Facility (HWTF) to treat these solid wastes using compaction and incineration methods since 1993. It is said that Zircaloy fines generated from compaction process might burn and explode intensely. Therefore explosive conditions of the fines generated in compaction process were measured. As these results, it was concluded that the fines generated from the compaction process were not hazardous material. This paper describes the outline of the treatment process of hulls and results of safety evaluation.
NTIS
Dissolving; Hazardous Materials; Hulls (Structures); Waste Treatment

20050060651 Envirocare of Utah, Inc., Salt Lake City, UT, USA
Licensing and Operations of the Clive, Utah Low-Level Containerized Radioactive Waste Disposal Facility A Continuation of Excellence
Ledoux, M. R.; 2004; In English
Report No.(s): DE2004-828254; No Copyright; Avail: National Technical Information Service (NTIS)

Envirocare's Containerized Waste Facility (CWF) is the first commercial low-level radioactive waste disposal facility to be licensed in the 21st century and the first new site to be opened and operated since the late 1970s. The licensing of this facility has been the culmination of over a decades effort by Envirocare of Utah at their Clive, Utah site. With the authorization to receive and dispose of higher activity containerized Class A low-level radioactive waste (LLRW), this facility has provided critical access to disposal for the nuclear power industry, as well as the related research and medical communities. This paper chronicles the licensing history and operational efforts designed to address the disposal of containerized LLRW in accordance with state and federal regulations.
NTIS
Waste Disposal; Radioactive Wastes; Licensing

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20050041918 Tinsley Labs., Inc., Richmond, CA, USA
B-Roll of AMSD Mirror
[2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

This video shows the Advanced Mirror System Demonstrator (AMSD) mirror being inspected and handled at Tinsley. The mirror is a beryllium mirror technology demonstrator that is a critical item demonstrating that the James Webb Space Telescope mirrors can be fabricated and will meet the performance requirements. Because Tinsley is very concerned about sharing proprietary information, the video, shot by them, does not show any key aspects of the polishing process (such as the polishing heads). The video includes workers at Tinsley rotating and inspecting the mirror. Excerpts of this video will be provided as part of a press release on JWST technology.
Author
James Webb Space Telescope; Beryllium; Mirrors

20050041922 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A 90GHz Bolometer Camera Detector System for the Green

Benford, Dominic J.; Allen, Christine A.; Buchanan, Ernest; Chen, Tina C.; Chervenak, James A.; Devlin, Mark J.; Dicker, Simon R.; Forgione, Joshua B.; January 2004; 1 pp.; In English; 15 International Symposium on Space Terahertz Technology, 27-29 Apt. 2004, Morthampton, MA, USA; No Copyright; Avail: Other Sources; Abstract Only

We describe a close-packed, two-dimensional imaging detector system for operation at 90GHz (3.3 mm) for the 100m Green Bank Telescope (GBT). This system will provide high sensitivity (less than 1mJy in 1s) rapid imaging (15'x15' to 150 micron Jy in 1 hr) at the world's largest steerable aperture. The heart of this camera is an 8x8 close-packed, Nyquist-sampled array of superconducting transition edge sensor (TES) bolometers. We have designed and are producing a functional superconducting bolometer array system using a monolithic planar architecture and high-speed multiplexed readout electronics. With an NEP of approximately 2 x 10(exp -17) W/square root of Hz, the TES bolometers will provide fast, linear, sensitive response for high performance imaging. The detectors are read out by an 8x8 time domain SQUID multiplexer. A digital/analog electronics system has been designed to enable read out by SQUID multiplexers. First light for this instrument on the GBT is expected within a year.

Author

Bolometers; Cameras; Systems Engineering; Telescopes

20050042058 Raytheon Information Technology and Scientific Services, Lanham, MD, USA

Geolocation. Visible/Infrared Imager/Radiometer Suite Algorithm Theoretical Basis Document. Version 5, Revision 1

Byerly, W. P.; Storey, J. C.; May 2002; 108 pp.; In English

Report No.(s): PB2005-102031; SBRS-Y3258; No Copyright; Avail: CASI; A06, Hardcopy

The Visible Infrared Imaging Radiometer Suite (VIIRS) geolocation algorithm will be implemented as part of the VIIRS raw data processing software in order to include Earth location and related spatial information in the VIIRS data products. Geolocation data fields will be computed for each resolutions ideal band detectors. The Earth location fields, including geodetic latitude, longitude, and height, are computed using rigorous models of the Earth, the NPOESS spacecraft, and the VIIRS instrument. These models account for instrument dynamics including the rotating telescope and half angle mirror, spacecraft position, velocity, and attitude, and the Earths terrain surface.

NTIS

Algorithms; Geodesy; Infrared Imagery; Infrared Radiometers; Light (Visible Radiation)

20050050942 Johns Hopkins Univ., USA

Physics-Based Spectra of Accretion Disks around Black Holes

Krolik, Julian H.; January 2005; 1 pp.; In English

Contract(s)/Grant(s): NAG5-13228; No Copyright; Avail: Other Sources; Abstract Only

The purpose of this grant was to begin the process of deriving the light output of accretion disks around black holes directly from the actual processes that inject heat into the accreting matter, rather than from guessed dependences of heating rate on physical parameters. At JHU, the effort has focussed so far on models of accretion onto 'intermediate mass black holes', a possible class of black holes, examples of which may have recently been discovered in nearby galaxies. There, Krolik and his student (Yawei Hui) have computed stellar atmospheres for uniformly-heated disks around this class of black holes. Their models serve two purposes: they are the very first serious attempts to compute the spectrum from accreting black holes in this mass range; and a library of such models can be used later in this program as contrasts for those computed on the basis of real disk dynamics. The output from these local disk calculations has also been successfully coupled to a program that applies the appropriate relativistic transformations and computes photon trajectories in order to predict the spectrum received by observers located at different polar angles. The principal new result of these calculations is the discovery of potentially observable ionization edges of H-like C and O at frequencies near the peak in flux from these objects. Most of the grant money at UCSB was spent on supporting graduate student Shane Davis. In addition. some money was spent on supporting two other students: Ari Socrates (now a Hubble Fellow at Princeton), and Laura Melling. Davis spent the year constructing stellar atmosphere models of accretion disks appropriate for the high/soft (thermal) state of black hole X-ray binaries. As with AGN models published previously by our collaboration with NASA support. our models include a complete general relativistic treatment of both the disk structure and the propagation of photons from the disk to a distant observer. They also include all important continuum opacity sources, including Compton scattering and bound-free opacity from abundant metal species. The principal new result is that bound-free opacity is very significant in altering the continuum spectral shape, resulting for example in quite different 'color correction factors' compared to those predicted previously. In addition, the models predict a relationship between luminosity and inner disk temperature that is, for the first time, in accord with that observed. The

primary purpose of the grant was to incorporate more realistic accretion disk physics, learned largely from simulations, into such spectral models. The Davis et al. paper includes consideration of a vertical dissipation profile computed from radiation magneto-hydrodynamic simulations of MRI turbulence by N. J. Turner (2004). So long as the disk is effectively thick, such dissipation profiles do not affect the predicted spectrum significantly. (More work needs to be done on these simulations, however.) A potentially more serious issue is that MRI turbulence produces substantial inhomogeneities, as do photon bubble instabilities. These inhomogeneities can affect the spectra by enhancing the effects of absorption opacity over scattering opacity. We have done some preliminary Monte Carlo calculations to explore these effects.
Author
Accretion Disks; Black Holes (Astronomy); Heating; Luminosity; Stellar Atmospheres; Atmospheric Models; Spectra

20050050969 Communications Research Lab., Koganei, Japan
Millisecond Pulsar Observation at CRL
Hanado, Y.; Imae, M.; Hosokawa, M.; Sekido, M.; Kaneko, A.; Shibuya, Y.; Proceedings of the 30th Annual Precise Time and Time Interval (PTTI) Systems and Applications Meeting; 1999, pp. 89-97; In English; See also 20050050957; No Copyright; Avail: CASI; A02, Hardcopy

Communications Research Laboratory (CRL) has developed a millisecond pulsar observation system which uses an acousto-optic spectrometer (AOS). Even though our 34 m telescope is one of the smallest telescopes used for millisecond pulsar observations, we succeeded in detecting several millisecond pulsars by using our new system which has a wide detection bandwidth. We started regular observations of PSRI937+21 with the 34 m telescope one year ago. The observed pulse phases contain some systematic trends, and we are investigating the data now. We also tested our observation system at the Usuda 64 m telescope of Institute of Space and Astronomical Science (ISAS) and succeeded in detecting two other highly stable millisecond pulsars, PSRI7I3+07 and PSRI855+09.
Author
Pulsars; Acousto-Optics; Detection

20050051152 Naval Observatory, Flaggstaff, AZ USA
High-Precision Optical Interferometry and Application to Be Stars
Tycner, Christopher; Nov. 2004; 2 pp.; In English
Report No.(s): AD-A428742; No Copyright; Avail: Defense Technical Information Center (DTIC)

This dissertation presents a new technique for calibrating optical long-baseline interferometric observations that are obtained simultaneously in a number of spectral channels. For certain classes of objects such as emission-line sources or binary systems, the new technique allows the calibration corrections and source characteristics to be obtained from the observations of a program star alone. This is because for such sources, the parameters describing the characteristics of the source have a different functional dependence than the calibration parameters.
DTIC
B Stars; Calibrating; Interferometry

20050051199 Naval Observatory, Washington, DC USA
Bulletin of the American Astronomical Society. Volume 36, Number 1, 2004
Jan. 2004; 33 pp.; In English
Report No.(s): AD-A428826; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report covers the period July 2002 through June 2003. Some of the topics covered were Personnel changes; the Astronomical Applications Department; Software Products; Positional and DynamicaI Astronomy; World Wide Web Site and Other Research and Activities.
DTIC
Astronomy

20050051256 Naval Observatory, Washington, DC USA
Astrometry of 25 Southern Hemisphere Radio Sources From A VLBI Short-Baseline Survey
Fey, Alan L.; Ojha, Roopesh; Reynolds, John E.; Ellingsten, Simon P.; McCulloch, Peter M.; Nov. 2004; 7 pp.; In English
Report No.(s): AD-A428926; No Copyright; Avail: Defense Technical Information Center (DTIC)

Milliarcsecond-accurate radio positions for 25 southern hemisphere extragalactic sources are reported. These positions are derived from Mark III very Long Baseline Interferometry observations made between 2003 September and 2004 May on the

intra-Australia baseline connecting Hobart, Tasmania and Parkes, New South Wales. The results presented here represent an ongoing program intended to increase the number of phase reference sources with accurate positions in the southern hemisphere for use in astrophysical observations. The positions for all but 1 of the 25 sources are south of delta=-45 degree and have average formal uncertainties of 3 mas in alpha cos delta and 2 mas in delta. As the reported positions are in the frame of the International Celestial Reference Frame (ICRF) , the results reported here can also be used to increase the sky density of southern hemisphere ICRFastrometry catalogs quasars: general radio continuum: galaxies reference systems techniques: interferometric
DTIC
Astrometry; Radio Astronomy; Southern Hemisphere; Surveys; Very Long Base Interferometry

20050051258 Naval Observatory, Washington, DC USA
Efficient Photometric Selection of Quasars From the Sloan Digital Sky Survey: 100,000 z \h 3 Quasars From Data Release One
Richards, Gordon T.; Nichol, Robert C.; Gray, Alexander G.; Brunner, Robert J.; Lupton, Robert H.; Dec. 2004; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A428935; No Copyright; Avail: Defense Technical Information Center (DTIC)

We present a catalog of 100,563 unresolved, UV-excess (UVX) quasar candidates to g = 21 from 2099 deg squared of the Sloan Digital Sky Survey (SDSS) Data Release One (DR1) imaging data. Existing spectra of 22, 737 sources reveals that 22,191 (97.6%) are quasars; accounting for the magnitude dependence of this efficiency, we estimate that 95,502 (95.0%) of the objects in the catalog are quasars. Such a high efficiency is unprecedented in broadband surveys of quasars. this 'proof-of-concept' sample is designed to be maximally efficient, but still has 94.7% completeness to unresolved, g less than or equal 19.5, UVX quasars from the DR1 quasars catalog. This efficient and complete selection is the result of our application of a probability density type analysis to training sets that describe the four-dimensional color distribution of stars and spectroscopically confirmed quasar in the SDSS. specifically, we use a nonparametric Bayesian Classification, based on kernel density estimation, to parameterize the color distribution of astronomical sources allowing for fast and robust classification. We further supplement the catalog by providing photometric redshifts and matches to FIRST/VLA, ROSAT, and USNO-B sources. Future work needed to extend this selection algorithm to larger redshifts, fainter magnitudes, and resolved sources is discussed. Finally, we examine some science applications of the catalog, particularly a tentative quasar number counts distribution covering the largest range in magnitude (14.2 less than g less than 21.0) ever made within the framework of a single quasar survey.
DTIC
Photometry; Quasars

20050060713 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Measurement of Precision Geometric Distances to Three Anchor Points in the Local Universe
Reid, Mark J.; January 2005; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10311
Report No.(s): Rept-4; No Copyright; Avail: CASI; A01, Hardcopy

Our program, funded by a NASA/SARA 3-yr grant, seeks to provide a much improved foundation of r the extra-galactic distance scale. The goal is to measure geometric distances with accuracies of 5% of better to several anchor points in the Local Universe. There are three objects that we are observing in order to attack this problem: NGC 4258, M 33, and Sgr A*. We plan to provide distance estimates, with a minimum of systematic uncertainty, that can be used to recalibrate several 'standard candles,' such as Cepheid and RR Lyrae variables. This will place the extragalactic distance scales on much firmer ground. The program will provide crucial, independent checks and calibrations of extragalactic distance measurements, and will contribute to the ultimate success and impact of the HST Key Project on Extragalactic Distances and any future NASA astrometric missions. Additionally, since distances are fundamental to astrophysics, our results will affect a large number of general projects on NASA facilities such s the HST, CXO, and JWST.
Author
Astrometry; Distance; Estimates; Astrophysics

20050060998 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
An XMM-Newton Monitoring Campaign of the Accretion Flow in IGRJ16318-4848
Mushotzky, Richard, Technical Monitor; Nicastro, Fabrizio; January 2005; 2 pp.; In English
Contract(s)/Grant(s): NNG04GH15G; No Copyright; Avail: CASI; A01, Hardcopy

This grant is associated to a successful XMM-Newton-AO3 observational proposal to monitor the spectrum of the X-ray loud component of the recently discovered binary system IGR J16138-4848, to study the conditions of the accretion flows (and their evolution) in binary system. All four EPIC-PN and MOS observations of the target have now been performed (the last one of the 4, only 3 months ago). The four observations were logarithmically spaced, so to cover timescales from days to months. Data from all four pointings have now been reduced, using the XMM-Newton data reduction pipeline, and spectra and lightcurves from the target have been extracted. For the first three observations we have already performed the observation-by-observation data analysis, by fitting the single EPIC spectra with spectral models that include an intrinsic continuum power law (reduced at low energy by neutral absorption), a 6.4 keV iron emission line (detected in all spectra with varying intensity) and a Compton-reflection component. A Compton reflection component is also detected in all spectra, although at lower significance. The analysis of the fourth and last observation of our monitoring campaign has just recently begun. Next, we will (1) stack together the four observations of IGR J16138-4848, to obtain high-accuracy estimates of the average spectral parameters of this object; and then (2) proceed to the time-evolving analysis, of the three spectral parameters: (a) Gamma (the slope of the intrinsic continuum), (b) W(FeK), the equivalent width of the 6.4 keV Iron emission line, and (c) R, the relative amount of Compton reflection. Through this time-resolved spectroscopic analysis we hope to constrain (a) the physical state of the accreting matter and its relation with the X-ray output, and (b) the evolution of the accretion flow geometry, distribution and covering factor.
Author
XMM-Newton Telescope; Binary Stars; Accretion Disks; X Ray Spectra

20050061069 Morgan Research Corp., Huntsville, AL, USA
MSFC Stream Model Preliminary Results: Modeling Recent Leonid and Perseid Encounters
Cooke, William J.; Moser, Danielle E.; October 15, 2004; 14 pp.; In English
Contract(s)/Grant(s): NNM04AA02C; No Copyright; Avail: CASI; A03, Hardcopy

The cometary meteoroid ejection model of Jones and Brown (1996b) was used to simulate ejection from comets 55P/Tempel-Tuttle during the last 12 revolutions, and the last 9 apparitions of 109P/Swift-Tuttle. Using cometary ephemerides generated by the Jet Propulsion Laboratory s (JPL) HORIZONS Solar System Data and Ephemeris Computation Service, two independent ejection schemes were simulated. In the first case, ejection was simulated in 1 hour time steps along the comet s orbit while it was within 2.5 AU of the Sun. In the second case, ejection was simulated to occur at the hour the comet reached perihelion. A 4th order variable step-size Runge-Kutta integrator was then used to integrate meteoroid position and velocity forward in time, accounting for the effects of radiation pressure, Poynting-Robertson drag, and the gravitational forces of the planets, which were computed using JPL s DE406 planetary ephemerides. An impact parameter was computed for each particle approaching the Earth to create a flux profile, and the results compared to observations of the 1998 and 1999 Leonid showers, and the 1993 and 2004 Perseids.
Author
Comets; Ejection; Leonid Meteoroids; Meteoroid Showers; Numerical Integration

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20050041870 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Improved Simulations of Astrophysical Plasmas: Computation of New Atomic Data
Gorczyca, Thomas W.; Korista, Kirk T.; January 2005; 11 pp.; In English
Contract(s)/Grant(s): NAG5-9581; No Copyright; Avail: CASI; A03, Hardcopy

Our research program is designed to carry out state-of-the-art atomic physics calculations crucial to advancing our understanding of fundamental astrophysical problems. We redress the present inadequacies in the atomic data base along two important areas: dielectronic recombination and inner-shell photoionization and multiple electron ejection/Auger fluorescence therefrom. All of these data are disseminated to the astrophysical community in the proper format for implementation in spectral simulation code.
Author
Space Plasmas; Astronomical Models; Atomic Spectra

20050042004 Harvard Univ., Cambridge, MA, USA

Hard X-Ray RXTE Observations of Clusters of Galaxies: Searching for Hard X-ray Emission due to Non-thermal Processes

Correa, C.; 2004; 30 pp.; In English

Report No.(s): DE2004-826718; SLAC-PUB-9380; No Copyright; Avail: Department of Energy Information Bridge

We report results of hard X-Ray observations of the clusters Coma, Abell 496, Abell754, Abell 1060, Abell 1367, Abell2256 and Abell3558 using RXTE data from the NASA HEASARC public archive. Specifically we searched for clusters with hard x-ray emission that can be fitted by a power law because this would indicate that the cluster is a source of non-thermal emission. We are assuming the emission mechanism proposed by Vahk Petrosian where the inter cluster space contains clouds of relativistic electrons that by themselves create a magnetic field and emit radio synchrotron radiation. These relativistic electrons Inverse-Compton scatter Microwave Background photons up to hard x-ray energies. The clusters that were found to be sources of non-thermal hard x-rays are Coma, Abell496, Abell754 and Abell 1060.

NTIS

X Rays; Galaxies

20050042011 Stanford Linear Accelerator Center, Stanford, CA, USA

Spontaneous Gravitational Instability of Star Distribution in a nonrotating Galaxy

Chao, A.; Jun. 2003; 24 pp.; In English

Report No.(s): DE2004-826732; SLAC-PUB-10019; No Copyright; Avail: Department of Energy Information Bridge

Gravitational instability of the distribution of stars in a galaxy is a well-known phenomenon in astrophysics. This work is a preliminary attempt to analyze this effect using the standard tools developed in accelerator physics. The result is first applied to nonrotating gallaxies with spherical and planar symmetries. Extensions to rotating galaxies are not studied here.

NTIS

Stars; Gravitational Instability; Star Distribution; Galaxies

20050042013 Stanford Linear Accelerator Center, CA, USA

Complex Structure of Galaxy Cluster Abell 1689; Evidence for a Merger from X-Ray Data

Andersson, K. E.; Madejski, G. M.; 2004; 18 pp.; In English

Report No.(s): DE2004-826743; SLAC-PUB-10329; No Copyright; Avail: Department of Energy Information Bridge

Abell 1689 is a galaxy cluster at z = 0:183 where previous measurements of its mass using various techniques gave discrepant results. We present a new detailed measurement of the mass with the data based on X-ray observations with the European Photon Imaging Camera aboard the XMM-Newton Observatory, determined by using an unparameterized deprojection technique. Fitting the total mass profile to a Navarro-Frenk-White model yields halo concentration c = 7.2(sub -2.4)(sup +1.6) and r(sub 200) = 1.13 (+-) 0.21 h(sup -1) Mpc, corresponding to a mass which is less than half of what is found from gravitational lensing. Adding to the evidence of substructure from optical observations, X-ray analysis shows a highly asymmetric temperature profile and a non-uniform redshift distribution implying large scale relative motion of the gas. A lower than expected gas mass fraction f(sub gas) = 0. 072 (+-) 0.008 (for a flat (Lambda)CDM cosmology) suggests a complex spatial and/or dynamical structure. We also find no signs of any additional absorbing component previously reported on the basis of the Chandra data, confirming the XMM low energy response using data from ROSAT.

NTIS

Galactic Clusters; X Rays

20050042017 Stanford Linear Accelerator Center, CA, USA, California Univ., Berkeley, CA, USA

Time-Dependence in Relativistic Collisionless Shocks: Theory of the Variable 'Wisps' in the Crab Nebula

Spitkovsky, A.; Arons, J.; Feb. 2004; In English

Report No.(s): DE2004-826744; SLAC-PUB-10330; No Copyright; Avail: National Technical Information Service (NTIS)

We describe results from time-dependent numerical modeling of the collisionless reverse shock terminating the pulsar wind in the Crab Nebula. We treat the upstream relativistic wind as composed of ions and electron-positron plasma embedded in a toroidal magnetic field, flowing radially outward from the pulsar in a sector around the rotational equator. The relativistic cyclotron instability of the ion gyrational orbit downstream of the leading shock in the electron-positron pairs launches outward propagating magnetosonic waves. Because of the fresh supply of ions crossing the shock, this time-dependent process achieves a limit-cycle, in which the waves are launched with periodicity on the order of the ion Larmor time. Compressions in the magnetic field and pair density associated with these waves, as well as their propagation speed, semi-quantitatively

reproduce the behavior of the wisp and ring features described in recent observations obtained using the Hubble Space Telescope and the Chandra X-Ray Observatory. By selecting the parameters of the ion orbits to fit the spatial separation of the wisps, we predict the period of time variability of the wisps that is consistent with the data. When coupled with a mechanism for non-thermal acceleration of the pairs, the compressions in the magnetic field and plasma density associated with the optical wisp structure naturally account for the location of X-ray features in the Crab. We also discuss the origin of the high energy ions and their acceleration in the equatorial current sheet of the pulsar wind.
NTIS
Time Dependence; Mathematical Models; Pulsars; Crab Nebula; Cyclotrons

20050050858 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Waves and Turbulence in Stellar Winds across the H-R Diagram
Cranmer, Steven R.; Frogel, Jay, Technical Monitor; January 2005; 4 pp.; In English
Contract(s)/Grant(s): NNG04GE77G; No Copyright; Avail: CASI; A01, Hardcopy

During the first year of this project, the PI began work in several areas that are expected to yield a substantial increase in our understanding of how and why stars form winds and disks. The approach outlined in the original proposal comprised four complementary pieces (cool and hot stars; observations and theory for each), and the accomplishments in this report are thus divided into these four categories.
Author (revised)
Stellar Winds; Turbulence; Magnetohydrodynamic Waves; Stellar Physics

20050051157 Naval Observatory, Washington, DC USA
Effects of Zonal Deformations and the Earth's Rotation Rate Variations on Precession-Nutation
Lambert, S.; Capitaine, N.; Aug. 2004; 7 pp.; In English
Report No.(s): AD-A428749; No Copyright; Avail: Defense Technical Information Center (DTIC)

Because of their importance in the accurate modeling of the Earth's orientation in space, some non-negligible predictable effects on precession nutation are investigated. This paper considers the coupling effects between the axial and the equatorial components of the Earth's rotation vector in the dynamical equations, and the effects of the second order lunisolar torque due to the Earth's zonal deformations. Firstly, the coupling effects are shown to contribute for less than 0.1 mas and are therefor negligible. Secondly, we demonstrate that the 0.7 mas contribution of the rotation rate variations due to zonal tides to the nutation in obliquity deduced by Bretagnon et al. (2000, Proc. IAU Coll., 180, 230; 2001, Celest. Mech. Dyn. Astr., 80, 177) is an artefact which comes from an incomplete way of taking into account the effect of the rotation rate variations. The net contribution is shown to be negligibly small. Thirdly, for Earth model with an elastic mantle and decoupled liquid core, the contribution of the second-order lunisolar torque due to the Earth's zonal deformations is shown to be 207.9 mas and - 9.7 mas on the 18.6 year nutation respectively in longitude and in obliquity, and a correction of -4925.9 mas/century on the precession in longitude.
DTIC
Deformation; Earth Mantle; Earth Rotation; Nutation; Precession

20050051178 Defense Science Board, Washington, DC USA
Report of the Defense Science Board Task Force on the Employment of the National Ignition Facility. Volume 1
Oct. 2004; 41 pp.; In English
Report No.(s): AD-A428779; No Copyright; Avail: Defense Technical Information Center (DTIC)

The DSB Task Force was asked to: * Assess the proposed ignition and 'non-ignition' high energy density experimental physics programs at the National Ignition Facility (NIF). * Assess the program's executabitity, particularly with respect to the availability of NIF and supporting technologies. * Assess the overall balance and priority of activities within the proposed plan and the degree to which the proposed program of NIF experiments supports the near- and long-term goats of stockpile stewardship. * Assess the extent to which the major stakeholders in NIF are effectively integrated into the plan The National Ignition Facility and planned programs of high energy density work build on a 30-year program expanding understanding of astrophysics, weapons physics, and other scientific areas of interest. The NIF adds new regimes in pressure, temperature, and density that will, given success in achieving ignition, provide visibility into the physical phenomena at the heart of nuclear explosions, astrophysics, and other very high energy density plasmas. Hence the NIF capability to produce thermonuclear burn

will provide the much-needed understanding of the most important remaining question in weapons physics.
DTIC
Astrophysics; Ignition

20050051784 California Inst. of Tech., Pasadena, CA, USA, Stanford Univ., Stanford, CA, USA
Resonant Excitation of White Dwarf Oscillations in Compact Object Binaries: 1. The No Back Reaction Approximation
Rathore, Y.; Blandford, R. D.; Jun. 2004; 20 pp.; In English
Report No.(s): DE2004-826967; No Copyright; Avail: Department of Energy Information Bridge

We consider the evolution of white dwarfs with compact object companions (specifically black holes with masses up to (approx) 10(sup 6) M(sub (circle-dot)), neutron stars, and other white dwarfs). We suppose that the orbits are initially quite elliptical and then shrink and circularize under the action of gravitational radiation. During this evolution, the white dwarfs will pass through resonances when harmonics of the orbital frequency match the stellar oscillation eigenfrequencies. As a star passes through these resonances, the associated modes will be excited and can be driven to amplitudes that are so large that there is a back reaction on the orbit which, in turn, limits the growth of the modes. A formalism is presented for describing this dynamical interaction for a non-rotating star in the linear approximation when the orbit can be treated as non-relativistic. A semi-analytical expression is found for computing the resonant energy transfer as a function of stellar and orbital parameters for the regime where back reaction may be neglected. This is used to calculate the results of passage through a sequence of resonances for several hypothetical systems. It is found that the amplitude of the (ell) = m = 2 f-mode can be driven into the non-linear regime for appropriate initial conditions. We also discuss where the no back reaction approximation is expected to fail, and the qualitative effects of back reaction.
NTIS
White Dwarf Stars; Binary Stars; Black Holes (Astronomy)

20050051798 Stanford Linear Accelerator Center, Stanford, CA, USA
Quantizing Cosmology: A Simple Approach
Weinstein, M.; Jun. 02, 2004; 14 pp.; In English
Report No.(s): DE2004-826998; SLAC-PUB-10470; No Copyright; Avail: Department of Energy Information Bridge

The author discusses the problem of inflation in the context of Friedmann-Robertson-Walker Cosmology and show how, after a simple change of variables, to quantize the problem in a way which parallels the classical discussion. The result is that two of the Einstein equations arise as exact equations of motion and one of the usual Einstein equations (suitably quantized) survives as a constraint equation to be imposed on the space of physical states. However, the Friedmann equation, which is also a constraint equation and which is the basis of the Wheeler-deWitt equation, acquires a welcome quantum correction that becomes significant for small scale factors. To clarify how things work in this formalism I briefly outline the way in which our formalism works for the exactly solvable case of de-Sitter space.
NTIS
Cosmology; Mathematical Models; Equations of Motion

20050051803 California Univ., Berkeley, CA, USA, Stanford Univ., CA, USA
Probing Relativistic Winds: The Case PSRJ07370-3039
Arons, J.; Backer, D. C.; 2004; In English
Report No.(s): DE2004-826957; SLAC-PU-10472; No Copyright; Avail: National Technical Information Service (NTIS)

We propose synchrotron absorption in a magnetosheath forming a cocoon around the magnetosphere of pulsar B to be the origin of the eclipse phenomena seen in the recently discovered double pulsar system PSRJ07370-3039 A & B. The magnetosheath enfolds the magnetosphere of pulsar B, where the relativistic wind from A collides with B's magentic field. If this model is correct, it predicts the eclipses will clear at frequencies higher than those of the observations reported to date (nominally, above (nu) (approx) 5 GHz.) The model also predicts synchrotron emission at the level of a few to 10 (micro)Jy, peaking at (nu) (approx) 2.5 GHz with possible orbital modulation. We use simplified semi-analytic models to elucidate the structure of the B magnetosphere, showing that the A wind's dynamic pressure confines B's magnetic field to within a radius less than 50,000 km from B, smaller than B's light cylinder radius, on the 'daytime' side (the side facing A). Downstream of B ('nightime'), B forms a magnetotail.
NTIS
Pulsars; Magnetospheres; Stellar Winds

20050051820, Polish Academy of Sciences, Warsaw, Poland
Soft X-Ray Precursors of the Non-Thermal Flares in Blazars: Theoretical Predictions
Moderski, R.; Sikora, M.; Madejski, G. M.; Kamae, T.; Apr. 2004; 24 pp.; In English
Report No.(s): DE2004-826919; SLAC-PUB-10432; No Copyright; Avail: Department of Energy Information Bridge

This paper discusses the subject of gamma-ray flares from astrophysical sources that are expected to be detected by the GLAST satellite. Such flares most commonly originate in jets of active galaxies. In particular, the paper provides theoretical predictions regarding the soft X-ray flares that should precede the gamma-ray flares, and provides the implications on the particle content of the jet as a function of the intensity and time history of such flares.
NTIS
Blazars; Active Galaxies; Astrophysics

20050051833 Harvard Univ., Cambridge, MA, USA, Stanford Linear Accelerator Center, Stanford, CA, USA, Stanford Univ., Stanford, CA
Hartle-Hawking Vacuum for c = 1 Tachyon Condensation
Karczmarek, J. L.; Maloney, A.; Strominger, A.; 2004; 20 pp.; In English
Report No.(s): DE2004-826928; No Copyright; Avail: Department of Energy Information Bridge

Quantum vacua are constructed for a time-symmetric cosmology describing closed string tachyon condensation in two-dimensional string theory. Due to the Euclidean periodicity of the solution, and despite its time dependence, we are able to construct thermal states at discrete values of the temperature. The asymptotic thermal Green functions and stress energy tensor are computed and found to have an intriguing resemblance to those in the Hartle-Hawking vacuum of a black hole.
NTIS
Asymptotic Methods; Vacuum; Green's Functions; Stress Tensors

20050051838 Stanford Linear Accelerator Center, Stanford, CA, USA
Dark Matter in the Finely Tuned Minimal Supersymmetric Standard Model
Pierce, A.; Jun. 2004; In English
Report No.(s): DE2004-827002; SLAC-PUB-10489; No Copyright; Avail: National Technical Information Service (NTIS)

We explore dark matter in the Finely Tuned Minimal Supersymmetric Standard model recently proposed by Arkani-Hamed and Dimopoulos. Relative to the MSSM, there are fewer particles at freezeout, so the calculation of the relic abundance simplifies. Similarly, the predictions for direct detection of the dark matter sharpen. There is a large region of mixed bino-higgsino dark matter where the lightest supersymmetric particle will be accessible at both the LHC and future direct detection experiments, allowing for a conclusive identification of the dark matter particle.
NTIS
Supersymmetry; Dark Matter

20050051877 Stanford Linear Accelerator Center, CA, USA, Waterloo Univ., Ontario, Canada
Quantum Gravity and Inflation
Alexander, S.; Sep. 03, 2003; 24 pp.; In English
Report No.(s): DE2004-826908; No Copyright; Avail: Department of Energy Information Bridge

Using the Ashtekar-Sen variables of loop quantum gravity, a new class of exact solutions to the equations of quantum cosmology is found for gravity coupled to a scalar field, that corresponds to inflating universes. The scalar field, which has an arbitrary potential, is treated as a time variable, reducing the hamiltonian constraint to a time-dependent Schroedinger equation. When reduced to the homogeneous and isotropic case, this is solved exactly by a set of solutions that extend the Kodama state, taking into account the time dependence of the vacuum energy. Each quantum state corresponds to a classical solution of the Hamiltonian-Jacobi equation. The study of the latter shows evidence for an attractor, suggesting a universality in the phenomena of inflation. Finally, wavepackets can beerent ratios of kinetic to potential scalar field energy, resolving, at least in this case, the issue of normalizability of the Kodama state.
NTIS
Gravitation; Potential Fields; Wave Packets

20050051886 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA, NASA Goddard Space Flight Center,

Greenbelt, MD, USA, , Tucson, AZ, USA, , Ann Arbor, MI, USA
High Angular Resolution Mid-Infrared Imaging of Young Stars in Orion BN/KL
Greenhill, L. J.; Gezari, D. Y.; Danchi, W. C.; Najita, J.; Monnier, J. D.; Jun. 2004; In English
Report No.(s): DE2004-827014; SLAC-PUB-10522; No Copyright; Avail: National Technical Information Service (NTIS)

The authors present Keck LWS images of the Orion BN/KL star forming region obtained in the first multi-wavelength study to have 0.3--0.5 resolution from 4.7 (micro)m to 22 (micro)m. The young stellar objects designed infrared source n and radio source I are believed to dominate the BN/KL region. They have detected extended emission from a probable accretion disk around source n but infer a stellar luminosity on the order of only 2000 L(sub (center-dot)).
NTIS
Angular Resolution; Stars; Infrared Radiation

20050051889 Stanford Linear Accelerator Center, Stanford, CA, USA
Q0906 + 6930: The Highest-Redshift Blazar
Romani, R. W.; Sowards-Emmerd, D.; Greenhill, L.; Jun. 2004; 14 pp.; In English
Report No.(s): DE2004-827015; SLAC-PUB-10523; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Red Shift; Blazars

20050051952 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Determining Cloud Parameters with the Curve-Of-Growth: Application Eta Car
Vieira, G. L.; Gull, T. R.; Bruhweiler, F.; Nielsen, K. E.; Verner, E. M.; [2004]; 1 pp.; In English; American Astronomical Society Meeting, 4-8 Jan. 2004, Atlanta, GA, USA; No Copyright; Avail: Other Sources; Abstract Only

We have investigated the NUV part of the Eta Car spectrum, using data with high spatial and high spectral resolving power obtained with the HST/STIS under the Treasury Program. The NUV spectrum of Eta Car Shows a great contribution of absorption features from neutral and singly ionized elements along the line-of-sight. A large number of velocity systems have been observed. The two most prominent, with Doppler shifts corresponding to -146 and -513 km/s respectively, are shown to be useful for investigations of the gaseous environments responsible for the absorption. The -146 and the -513 km/s velocity systems display different characteristics regarding the ionization state and spectral line width, which suggest that they originate at different distances from the central object. We have investigated the absorption structures before the spectroscopic minimum, occurring during the summer of 2003, with a standard curve-of-growth. We have independently derived the column density and the b-value for the Fe II (-146 km/s) and Ti II (-513 km/s) velocity systems. The excitation temperature has been determined for the -146 km/s velocity system using the photo-ionization code \textsc(cloudy). The -146 km/s velocity structure shows noticeable variation over the spectroscopic minimum. The sudden appearance and disappearance of Ti II and V II are astonishing. We have made an attempt to analyze these variations with the curve-of-growth method and will present preliminary results.
Author
Ultraviolet Astronomy; Molecular Clouds; Stellar Envelopes; Peculiar Stars; Variable Stars

20050051971 Michigan Univ., Dearborn, MI, USA
Anisotropy of MHD Turbulence at Low Magnetic Reynolds Number
Zikanov, O.; Vorobev, A.; Thess, A.; Davidson, P. A.; Knaepen, B.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 35-46; In English; See also 20050051959
Contract(s)/Grant(s): DE-FG02-03ER-46062; CTS-0320621; No Copyright; Avail: CASI; A03, Hardcopy

Turbulent fluctuations in MHD flows are known to become dimensionally anisotropic under the action of a sufficiently strong magnetic field. We consider the technologically relevant case of low magnetic Reynolds number and apply the method of DNS of forced flow in a periodic box to generate velocity fields. The analysis based on different anisotropy characteristics shows that the dimensional anisotropy is virtually scale-independent. We also find that, except for the case of very strong magnetic field, the flow is componentally isotropic. Its kinetic energy is practically uniformly distributed among the velocity components.
Author
Magnetohydrodynamic Turbulence; Direct Numerical Simulation; Kinetic Energy; Magnetic Fields; Magnetohydrodynamic Flow; Anisotropy; Turbulent Flow

20050051973 Technische Hochschule, Ilmenau, German Democratic Republic

On the Transition from Two-Dimensional to Three-Dimensional MHD Turbulence

Thess, A.; Zikanov, Oleg; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 63-74; In English; See also 20050051959

Contract(s)/Grant(s): DE-FG02-03ER-46062; No Copyright; Avail: CASI; A03, Hardcopy

We report a theoretical investigation of the robustness of two-dimensional inviscid MHD flows at low magnetic Reynolds numbers with respect to three-dimensional perturbations. We analyze three model problems, namely flow in the interior of a triaxial ellipsoid, an unbounded vortex with elliptical streamlines, and a vortex sheet parallel to the magnetic field. We demonstrate that motion perpendicular to the magnetic field with elliptical streamlines becomes unstable with respect to the elliptical instability once the velocity has reached a critical magnitude whose value tends to zero as the eccentricity of the streamlines becomes large. Furthermore, vortex sheets parallel to the magnetic field, which are unstable for any velocity and any magnetic field, are found to emit eddies with vorticity perpendicular to the magnetic field and with an aspect ratio proportional to N(sup 1/2). The results suggest that purely two-dimensional motion without Joule energy dissipation is a singular type of flow which does not represent the asymptotic behaviour of three-dimensional MHD turbulence in the limit of infinitely strong magnetic fields.

Author

Magnetohydrodynamic Turbulence; Robustness (Mathematics); Low Reynolds Number; Magnetic Fields; Vortex Sheets; Perturbation; Ellipsoids

20050060637 Princeton Univ., NJ

Mini-Conference and Related Sessions on Laboratory Plasma Astrophysics

Ji, H.; Brown, M.; Hsu, S. C.; Li, H.; Drake, R. P.; 2004; 46 pp.; In English

Report No.(s): DE2004-827507; PPPL-3926; No Copyright; Avail: Department of Energy Information Bridge

This paper provides a summary of some major physics issues and future perspectives discussed in the Mini-Conference on Laboratory Plasma Astrophysics. This Mini-conference, sponsored by the Topical Group on Plasma Astrophysics, was held as part of the American Physical Society's Division of Plasma Physics 2003 Annual Meeting (October 27-31, 2003). Also included are brief summaries of selected talks on the same topic presented at two invited paper sessions (including a tutorial) and two contributed focus oral sessions, which were organized in coordination with the Mini-Conference by the same organizers.

NTIS

Astrophysics; Plasma Physics; Conferences

20050060725 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Coronal Diagnostics of Intermediate Activity Star XI Boo A

Drake, Jeremy; January 2005; 2 pp.; In English

Contract(s)/Grant(s): NAG5-9985; No Copyright; Avail: CASI; A01, Hardcopy

The analysis of Xi Boo A proved difficult to adapt to our line-by-line approach because of the strong wings of the RGS instrumental profile, as has been detailed in earlier reports. While progress was also delayed because of problems in using SAS v4, we succeeded in the past year or so to bring the analysis to conclusion. Abundances have been derived using both EPIC and RGS data, confirming earlier EUVE findings of a mild solar-like FIP effect, though with some evidence of a turn-up in abundances of elements with higher FIP. Plasma densities appear normal for a moderately active stellar corona. Xi Boo A nicely bridges the gap between the very active stars and stars like the Sun, and it indeed does appear that these are the stars in which the solar-like FIP effects begins to change to the 'inverse FIP' type of effect seen in the very active stars. Probing this divide was the main goal of the proposal. These results are in the process of being prepared for publication, though we have not decided the target journal as yet.

Author

Abundance; Stellar Coronas; Sun

20050060737 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

Unveiling the Engines in QSOs: Multi-Wavelength Study

Green, Paul; Oliversen, Ronald, Technical Monitor; January 2005; 2 pp.; In English

Contract(s)/Grant(s): NAG5-6410; No Copyright; Avail: CASI; A01, Hardcopy

UV/optical emission lines offer some of the most detailed information obtainable about the intrinsic properties of quasars.

Studies of the density, ionization and metal abundance of gas near the accreting black hole are probed through an intriguing but poorly understood complex of correlations between emission lines and overall quasar spectral energy distributions that has long suffered from a lack of large, consistently measured samples. As part of a broader effort to expand and systematize the data upon which these studies are built, we proposed to NASA to model, fit, and measure UV/optical emission line parameters in large samples of quasar spectra. As part of the project, we developed an automated measurement technique that accounts for galactic reddening, includes iron emission blends, galactic and intrinsic absorption lines, and performs multi-component fits to the emission line profiles. We present measured line parameters (equivalent width and FWHM) for a large number of (28) different UV/optical lines, including upper limits for undetected lines.
Author
Quasars; Black Holes (Astronomy); Emission Spectra; Line Spectra

20050060744 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Atom Resonance Lines for Modeling Atmosphere: Studies of Pressure-Broadening of Alkali Atom Resonance Lines for Modeling Atmospheres of Extrasolar Giant Planets and Brown Dwarfs
Hasan, Hashima, Technical Monitor; Kirby, K.; Babb, J.; Yoshino, K.; January 2005; 5 pp.; In English
Contract(s)/Grant(s): NAG5-12751; No Copyright; Avail: CASI; A01, Hardcopy

We report on progress made in a joint program of theoretical and experimental research to study the line-broadening of alkali atom resonance lines due to collisions with species such as helium and molecular hydrogen. Accurate knowledge of the line profiles of Na and K as a function of temperature and pressure will allow such lines to serve as valuable diagnostics of the atmospheres of brown dwarfs and extra-solar giant planets. A new experimental apparatus has been designed, built and tested over the past year, and we are poised to begin collecting data on the first system of interest, the potassium resonance lines perturbed by collisions with helium. On the theoretical front, calculations of line-broadening due to sodium collisions with helium are nearly complete, using accurate molecular potential energy curves and transition moments just recently computed for this system. In addition we have completed calculations of the three relevant potential energy curves and associated transition moments for K - He, using the MOLPRO quantum chemistry codes. Currently, calculations of the potential surfaces describing K-H2 are in progress.
Author
Alkalies; Extrasolar Planets; Brown Dwarf Stars; Resonance Lines; Molecular Spectra; Molecular Gases

20050060827 NASA Marshall Space Flight Center, Huntsville, AL, USA
Laboratory Experiments on Rotation and Alignment of the Analogs of Interstellar Dust Grains by Radiation
Abbas, M. M.; Craven, P. D.; Spann, J. F.; Tankosic, D.; LeClair, A.; Gallagher, D. L.; West, E. A.; Weingartner, J. C.; Witherow, W. K.; Tielens, A. G. G. M.; The Astrophysical Journal; October 20, 2004; Volume 614, pp. 781-795; In English; Copyright; Avail: Other Sources

The processes and mechanisms involved in the rotation and alignment of interstellar dust grains have been of great interest in astrophysics ever since the surprising discovery of the polarization of starlight more than half a century ago. Numerous theories, detailed mathematical models, and numerical studies of grain rotation and alignment with respect to the Galactic magnetic field have been presented in the literature. In particular, the subject of grain rotation and alignment by radiative torques has been shown to be of particular interest in recent years. However, despite many investigations, a satisfactory theoretical understanding of the processes involved in subject, we have carried out some unique experiments to illuminate the processes involved in the rotation of dust grains in the interstellar medium. In this paper we present the results of some preliminary laboratory experiments on the rotation of individual micron/submicron-sized, nonspherical dust grains levitated in an electrodynamic balance evacuated to pressures of approximately 10(exp -3) to 10(exp -5) torr. The particles are illuminated by laser light at 5320 A, and the grain rotation rates are obtained by analyzing the low-frequency (approximately 0 - 100 kHz) signal of the scattered light detected by a photodiode detector. The rotation rates are compared with simple theoretical models to retrieve some basic rotational parameters. The results are examined in light of the current theories of alignment.
Author
Alignment; Cosmic Dust; Interstellar Matter; Astrophysics; Radiation; Rotation; Analogs; Granular Materials

20050060909 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Modeling of the EUV and X-Ray Emission Spectra Induced by the Solar Winds Ions in the Heliosphere
Kharchenko, Vasili; January 2005; 3 pp.; In English
Contract(s)/Grant(s): NNG04GD57G; No Copyright; Avail: CASI; A01, Hardcopy

We have carried out investigation of the EUV and X-ray emission spectra induced in interaction between the Solar Wind (SW) and interstellar neutral gas. The spectra of most important SW ions have been computed for the charge-exchange mechanism of X-ray emission using new accurate spectroscopic data from recent laboratory measurements and theoretical calculations. Total spectra have been constructed as a sum of spectra induced in the charge-exchange collisions by individual O(exp q+), C(exp q+), N(exp q+), Ne(exp q+), Mg (exp q+) and Fe(exp q+) ions. Calculations have been performed for X-ray emission from the heliospheric hydrogen and helium gas. X-ray maps of the heliosphere have been computed. The power density of X-ray sources in the heliospheric ecliptic plane is shown for the H gas and for the He gas. Distances from the Sun (0,0) are given in AU. The helium cone is clear seen in the X-ray map of the charge-exchange emission induced by the solar wind. X-ray emission spectra detected by the Chandra X-ray telescope from the 'dark' side of Moon has been identified as a X-ray background emission induced by the solar wind from the geocorona. Spectra and intensities of this charge-exchange X-rays have been compared with the heliospheric component of the X-ray background. Observations and modeling of the SW spectra induced from the geocorona indicate a strong presence of emission lines of highly charged oxygen ions. Anisotropy in distribution of heliospheric X-rays has been predicted and calculated for the regions of the fast and slow solar winds.
Author
Solar Wind; Interstellar Gas; Neutral Gases; X Rays; Extreme Ultraviolet Radiation; Geocoronal Emissions

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20050041809 NASA Marshall Space Flight Center, Huntsville, AL, USA
Chandra X-ray Observations of Jovian Low-latitude Emissions: Morphological, Temporal, and Spectral Characteristics
Bhardwaj, Anil; Elsner, Ronald F.; Gladstone, G. Randall; Cravens, Thomas E.; Waiate J. Hunter, Jr.; Branduardi-Raymont, Graziella; Ford, Peter; [2004]; 1 pp.; In English; 36th Annual Meeting of the American Astronomical Society's Division for Planetary Sciences, 8-12 Nov. 2004, Louisville, KY, USA; No Copyright; Avail: Other Sources; Abstract Only

Chandra observed X-rays from Jupiter during 24-26 February 2003 for about 40 hours with the ACIS-S and HRC-I instruments. The analysis of Jovian low-latitude 'disk' Xray emissions are presented and compared with the high-latitude 'auroral' emissions. We report the first Chandra ACIS-S measured X-ray spectrum (0.3-2 keV) of Jupiter's low-latitude disk The disk X-ray emission is harder and extends to higher energies than the auroral spectrum. The temporal variation in the Jovian disk X-rays is on an average consistent with those in the solar X-rays observed by GOES, and TIMED/SSE. Contrary to the auroral X-rays, the disk emissions are uniformly distributed over Jupiter; no indication of longitudinal dependence or correlation with surface magneh field strength is visible. Also, unlike the approx. 40 +/- 20 min periodic oscillations seen in the auroral X-ray emissions, the disk emissions do not show any periodic oscillations. The disk spectrum seems to be consistent with resonant and fluorescent scattering of solar X-rays by the Jovian upper atmosphere. Jupiter's disk is found to be about 50% dimmer in soft X-rays in February 2003 compared that in December 2000, which is consistent with the decrease in solar activity. No evidence of lightning-induced X-rays is seen in the Chandra X-ray data. The Jovian disk spectra observed with Chandra-ACIS is stronger than that observed with XMM-Newton two months later during April 28-29, 2003. The XMM-Newton Xray image of Jupiter shows evidence of limb darkening on the anti-sunward side as seen from Earth, as well as an asymmetry with respect to the subsolar point: suggesting a solar driven process.
Author
Jupiter (Planet); X Ray Astronomy; Emission; Auroras; X Ray Spectra

20050050948 NASA Langley Research Center, Hampton, VA, USA
Using Wind Driven Tumbleweed Rovers to Explore Martian Gully Features
Antol, Jeffrey; Woodard, Stanley E.; Hajos, Gregory A.; Heldmann, Jennifer L.; Taylor, Bryant D.; January 2005; 12 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Report No.(s): AIAA Paper 2005-0245; No Copyright; Avail: CASI; A03, Hardcopy

Gully features have been observed on the slopes of numerous Martian crater walls, valleys, pits, and graben. Several mechanisms for gully formation have been proposed, including: liquid water aquifers (shallow and deep), melting ground ice, snow melt, CO2 aquifers, and dry debris flow. Remote sensing observations indicate that the most likely erosional agent is liquid water. Debate concerns the source of this water. Observations favor a liquid water aquifer as the primary candidate. The

current strategy in the search for life on Mars is to 'follow the water.' A new vehicle known as a Tumbleweed rover may be able to conduct in-situ investigations in the gullies, which are currently inaccessible by conventional rovers. Deriving mobility through use of the surface winds on Mars, Tumbleweed rovers would be lightweight and relatively inexpensive thus allowing multiple rovers to be deployed in a single mission to survey areas for future exploration. NASA Langley Research Center (LaRC) is developing deployable structure Tumbleweed concepts. An extremely lightweight measurement acquisition system and sensors are proposed for the Tumbleweed rover that greatly increases the number of measurements performed while having negligible mass increase. The key to this method is the use of magnetic field response sensors designed as passive inductor-capacitor circuits that produce magnetic field responses whose attributes correspond to values of physical properties for which the sensors measure. The sensors do not need a physical connection to a power source or to data acquisition equipment resulting in additional weight reduction. Many of the sensors and interrogating antennae can be directly placed on the Tumbleweed using film deposition methods such as photolithography thus providing further weight reduction. Concepts are presented herein for methods to measure subsurface water, subsurface metals, planetary winds and environmental gases. Author

Aquifers; Mars Craters; Mars Surface; Remote Sensing; Slopes; Roving Vehicles; Geological Faults

20050051004 Massachusetts Inst. of Tech., Cambridge, MA, USA

[Accomplistments in the Last Year Against the Objectives Laid Out in the Original Proposal; the Current Status of the Research; the Work to go in the Next Year; and Publications]

Elliot, James; January 2005; 3 pp.; In English

Contract(s)/Grant(s): NNG04GF25G; No Copyright; Avail: CASI; A01, Hardcopy

Below is the annual progress report (through 2005-01-31) on NASA Grant NNG04GF25G. It is organized according to: (I) Accomplishments in the last year against the objectives laid out in the original proposal; (II) The current status of the research; (III) The work to go in the next year; (IV) Publications. Since this program is a continuation of the occultation work supported in a predecessor grant, the 'Accomplishments' section lists all the tasks written into the proposal (in June 2003) through the end of the first year of the new grant.

Author (revised)

Occultation; Triton; Pluto (Planet)

20050051653 Aviation Week and Space Technology, New York, NY, USA

Rover Territory

Morring, Frank, Jr.; Taverna, Michael A.; Dornheim, Michael A.; Aviation Week and Space Technology; January 24, 2005; ISSN 0005-2175; Volume 162, No. 4, pp. 24-25; In English; Copyright; Avail: Other Sources

The next Titan landing will likely include a rover, now that Europe's Huygens probe to Saturn's largest moon has delivered enticing images and data of a landscape that looks a lot like Earth - except with hydrocarbon rain, marshy methane lakebeds, and granite-like ice canyons.

Author

Huygens Probe; Titan; Satellite Surfaces; Spacecraft Landing

20050051878 Stanford Linear Accelerator Center, CA, USA, Harvard-Smithsonian Center for Astrophysics, Amado, AZ, USA, Academia Sinica, Taipei, Taiwan, Province of China

Sub-Arcsecond Sub-MM Continuum Observations of Orion-KL

Beuther, H.; Zhang, Q.; Green hill, L. J.; Reid, M. G.; 2004; 16 pp.; In English

Report No.(s): DE2004-827013; SLAC-PUB-10521; No Copyright; Avail: Department of Energy Information Bridge

We present the first 865 (micro)m continuum image with sub-arcsecond resolution obtained with the Submillimeter Array. These data resolve the Orion-KL region into the hot core, the nearby radio source I, the sub-mm counterpart to the infrared source n (radio source L), and new sub-mm continuum sources. The radio to submillimeter emission from source I may be modeled as either the result of proton-electron free-free emission that is optically thick to (approx) 100 GHz plus dust emission that accounts for the majority of the submillimeter flux, or H(sup -) free-free emission that gives rise to a power-law spectrum with power-law index of (approx) 1.6. The latter model would indicate similar physical conditions as found in the inner circumstellar environment of Mira variable stars. Future sub-arcsecond observations at shorter sub-mm wavelengths should easily discriminate between these two possibilities. The sub-mm continuum emission toward source n can be interpreted in the framework of emission from an accretion disk.

NTIS

Infrared Radiation; Radio Emission; Spectra; Submillimeter Waves

20050051942 Dornheim (Michael A.), Pasadena, CA, USA

Mission Rejuvenation

Dornheim, Michael A.; Aviation Week and Space Technology; January 31, 2005; ISSN 0005-2175; Volume 162, No. 5, pp. 24, 26; In English; Copyright; Avail: Other Sources

The Mars Exploration Rovers are both near the start of new phases in their missions, even as each has made fresh discoveries. The rover Spirit has encountered what appears to be a new type of rock with unusual chemistry, though scientists last week were still seeking confirmation of their measurements. And Spirit should, within a few weeks, if not sooner, reach a vista point that will require major decisions on how to proceed. Opportunity, on the other side of the planet, started a sprint last week toward different terrain to the south. It recently found and scrutinized a basketball-size nickel-iron meteorite lying on the flat ground. During the sprint, scientists will be looking for what should be more common stony meteorites. But looming over the rovers is the rise of year-long dust storms. They increase upper-atmosphere opacity, which cuts light to the solar arrays and the liveliness of the rovers. Engineers are preparing a list of tactics to handle opacity several times worse than already experienced.

Author

Mars Roving Vehicles; Dust Storms; Mars Environment

20050060638 NASA, Washington, DC, USA

Following Up: Huygens Data, Questions Will Guide Cassini on Its Future Titan Passes

Morring, Frank, Jr.; Taverna, Michael A.; Aviation Week and Space Technology; January 31, 2005; ISSN 0005-2175; Volume 152, No. 5, pp. 22-23; In English; Copyright; Avail: Other Sources

Planetary scientists plan to use the instruments on NASA's Cassini Saturn orbiter in future flybys of Titan to answer questions raised by Europe's Huygens probe. In particular, they hope to discover whether the dark, flat areas on the moon's surface are liquid or quasi-liquid methane seas. As the scientists plotted their next moves, European Space Agency (ESA) officials continued their investigation into how a critical command in the Huygens descent sequence was omitted costing the imaging team half of its data and rendering another Huygens instrument useless. There were suggestions that U.S. export-control rules may have hampered the sort of close international cooperation that might have caught the error.

Author

Cassini Mission; Huygens Probe; Titan

20050060661 NASA Langley Research Center, Hampton, VA, USA

Conceptual Design and Dynamics Testing and Modeling of a Mars Tumbleweed Rover

Calhoun Philip C.; Harris, Steven B.; Raiszadeh, Behzad; Zaleski, Kristina D.; January 04, 2005; 10 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Contract(s)/Grant(s): 23-979-20-10

Report No.(s): AIAA Paper 2005-0247; No Copyright; Avail: CASI; A02, Hardcopy

The NASA Langley Research Center has been developing a novel concept for a Mars planetary rover called the Mars Tumbleweed. This concept utilizes the wind to propel the rover along the Mars surface, bringing it the potential to cover vast distances not possible with current Mars rover technology. This vehicle, in its deployed configuration, must be large and lightweight to provide the ratio of drag force to rolling resistance necessary to initiate motion from rest on the Mars surface. One Tumbleweed design concept that satisfies these considerations is called the Eggbeater-Dandelion. This paper describes the basic design considerations and a proposed dynamics model of the concept for use in simulation studies. It includes a summary of rolling/bouncing dynamics tests that used videogrammetry to better understand, characterize, and validate the dynamics model assumptions, especially the effective rolling resistance in bouncing/rolling dynamic conditions. The dynamics test used cameras to capture the motion of 32 targets affixed to a test article s outer structure. Proper placement of the cameras and alignment of their respective fields of view provided adequate image resolution of multiple targets along the trajectory as the test article proceeded down the ramp. Image processing of the frames from multiple cameras was used to determine the target positions. Position data from a set of these test runs was compared with results of a three dimensional, flexible dynamics model. Model input parameters were adjusted to match the test data for runs conducted. This process presented herein provided the means to characterize the dynamics and validate the simulation of the Eggbeater-Dandelion concept. The simulation model was used to demonstrate full scale Tumbleweed motion from a stationary condition on a flat-sloped terrain using representative Mars environment parameters.

Author

Dynamic Tests; Mars Surface; Mars Roving Vehicles; Dynamic Models; Design Analysis

20050060673 NASA Langley Research Center, Hampton, VA, USA

Preliminary Dynamic Feasibility and Analysis of a Spherical, Wind-Driven (Tumbleweed), Martian Rover

Flick, John J.; Toniolo, Matthew D.; January 07, 2005; 12 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA

Contract(s)/Grant(s): 23-090-20-15

Report No.(s): AIAA Paper 2005-0250; Copyright; Avail: CASI; A03, Hardcopy

The process and findings are presented from a preliminary feasibility study examining the dynamics characteristics of a spherical wind-driven (or Tumbleweed) rover, which is intended for exploration of the Martian surface. The results of an initial feasibility study involving several worst-case mobility situations that a Tumbleweed rover might encounter on the surface of Mars are discussed. Additional topics include the evaluation of several commercially available analysis software packages that were examined as possible platforms for the development of a Monte Carlo Tumbleweed mission simulation tool. This evaluation lead to the development of the Mars Tumbleweed Monte Carlo Simulator (or Tumbleweed Simulator) using the Vortex physics software package from CM-Labs, Inc. Discussions regarding the development and evaluation of the Tumbleweed Simulator, as well as the results of a preliminary analysis using the tool are also presented. Finally, a brief conclusions section is presented.

Author

Feasibility Analysis; Dynamic Characteristics; Mars Roving Vehicles; Mars Surface; Mars Exploration; Spheres; Wind (Meteorology)

20050060674 Covault (Craig), Pasadena, CA, USA

A Whole New Mars

Covault, Craig; Aviation Week and Space Technology; January 31, 2005; ISSN 0005-2175; Volume 162, No. 5, pp. 48-52; In English; Copyright; Avail: Other Sources

The U.S. is preparing to return to Mars in August with the launch of Mars Reconnaissance Orbiter. The spacecraft's mission is to obtain extremely detailed global imagery, composition and weather data around which to focus the next 15-20 years of Mars robotic lander planning and operations. The goal of the $700-million mission is to create a comprehensive foundation of knowledge for the Mars side of NASA's new exploration vision and to accelerate the search for evidence of life on the red planet.

Author

Mars Probes; Mars Missions; Planetary Mapping

20050060679 BAE Systems Analytical Solutions, Inc., Huntsville, AL, USA

Synthesis of Sol-Gel Precursors for Ceramics from Lunar and Martian Soil Simulars

Sibille, L.; Gavira-Gallardo, J. A.; Hourlier-Bahloul, D.; [2004]; 1 pp.; In English; Space Resource Roundtable Conference, 1-3 Nov. 2004, Golden, CO, USA

Contract(s)/Grant(s): NAS8-02096; Copyright; Avail: Other Sources; Abstract Only

Recent NASA mission plans for the human exploration of our Solar System has set new priorities for research and development of technologies necessary to enable a long-term human presence on the Moon and Mars. The recovery and processing of metals and oxides from mineral sources on other planets is under study to enable use of ceramics, glasses and metals by explorer outposts. We report initial results on the production of sol-gel precursors for ceramic products using mineral resources available in martian or lunar soil. The presence of SO2, TiO2, and Al2O3 in both martian (44 wt.% SiO2, 1 wt.% TiO2, 7 wt.% Al2O3) and lunar (48 wt.% SiO2, 1.5 wt.% TiO2, 16 wt.% Al2O3) soils and the recent developments in chemical processes to solubilize silicates using organic reagents and relatively little energy indicate that such an endeavor is possible. In order to eliminate the risks involved in the use of hydrofluoric acid to dissolve silicates, two distinct chemical routes are investigated to obtain soluble silicon oxide precursors from lunar and martian soil simulars. Clear solutions of sol-gel precursors have been obtained by dissolution of silica from lunar soil similar JSC-1 in basic ethylene glycol (C2H4(OH)2) solutions to form silicon glycolates. Similarly, sol-gel solutions produced from martian soil simulars reveal higher contents of iron oxides. Characterization of the precursor molecules and efforts to further concentrate and hydrolyze the products to obtain gel materials will be presented for evaluation as ceramic precursors.

Author

Ceramics; Lunar Soil; Mars Surface; Sol-Gel Processes; Synthesis (Chemistry); Minerals

20050060754 NASA Langley Research Center, Hampton, VA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Using Wind Driven Tumbleweed Rovers to Explore Martian Gully Features
Antol, Jeffrey; Woodard, Stanley E.; Hajos, Gregory A.; Heldmann, Jennifer L.; Taylor, Bryant D.; November 30, 2004; 12 pp.; In English; 43rd AIAA Aerospace Sciences Meeting and Exhibit, 10-13 Jan. 2005, Reno, NV, USA
Contract(s)/Grant(s): 23-090-20-15
Report No.(s): AIAA Paper 2005-0245; Copyright; Avail: CASI; A03, Hardcopy

Gully features have been observed on the slopes of numerous Martian crater walls, valleys, pits, and graben. Several mechanisms for gully formation have been proposed, including: liquid water aquifers (shallow and deep), melting ground ice, snow melt, CO2 aquifers, and dry debris flow. Remote sensing observations indicate that the most likely erosional agent is liquid water. Debate concerns the source of this water. Observations favor a liquid water aquifer as the primary candidate. The current strategy in the search for life on Mars is to 'follow the water.' A new vehicle known as a Tumbleweed rover may be able to conduct in-situ investigations in the gullies, which are currently inaccessible by conventional rovers. Deriving mobility through use of the surface winds on Mars, Tumbleweed rovers would be lightweight and relatively inexpensive thus allowing multiple rovers to be deployed in a single mission to survey areas for future exploration. NASA Langley Research Center (LaRC) is developing deployable structure Tumbleweed concepts. An extremely lightweight measurement acquisition system and sensors are proposed for the Tumbleweed rover that greatly increases the number of measurements performed while having negligible mass increase. The key to this method is the use of magnetic field response sensors designed as passive inductor-capacitor circuits that produce magnetic field responses whose attributes correspond to values of physical properties for which the sensors measure. The sensors do not need a physical connection to a power source or to data acquisition equipment resulting in additional weight reduction. Many of the sensors and interrogating antennae can be directly placed on the Tumbleweed using film deposition methods such as photolithography thus providing further weight reduction. Concepts are presented herein for methods to measure subsurface water, subsurface metals, planetary winds and environmental gases. Author

Mars Surface; Roving Vehicles; Mars Craters; Aquifers

20050060790 California Inst. of Tech., Pasadena, CA, USA
Experimental Studies of Phase Equilibria of Meteorites and Planetary Bodies
Stolper, Edward M.; January 2005; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10423; No Copyright; Avail: CASI; A01, Hardcopy

The primary theme of this project was the application of experimental petrology and geochemistry to a variety of problems in meteoritics and planetary geology. The studies were designed to help develop constraints on the histories of primitive meteorites and their components, the environments in which they formed and evolved, and to understand quantitatively the processes involved in the evolution of igneous rocks on the earth and other planetary bodies. We undertook several projects relating to the origin of CAIs and chondrules. Systematics in the thermodynamic properties of CAI-like liquids were investigated and used to elucidate speciation of multi-valent cations and sulfide capacity of silicate melts and to constrain redox conditions and the vapor pressures of volatile species over molten chondrules. We experimentally determined vanadium speciation in meteoritic pyroxenes and in pyroxenes crystallized from CAI-like melts under very reducing conditions. We also found that bulk oxygen isotope compositions of chondrules in the moderately unequilibrated LL chondrites are related to the relative timing of plagioclase crystallization. We completed an experimental study on the vaporization of beta-SiC and SiO2 (glass or cristobalite) in reducing gases and established the conditions under which these presolar grains could have survived in the solar nebula. We expanded our technique for determining the thermodynamic properties of minerals and liquids to iron-bearing systems. We determined activity-composition relationships in Pt-Fe, Pt-Cr and Pt-Fe-Cr alloys. Results were used to determine the thermodynamic properties of chromite-picrochromite spinels including the free energy of formation of end-member FeCr2O4. We also established a new approach for evaluating Pt-Fe saturation experiments. We calculated the T-fO2 relationships in equilibrated ordinary chondrites and thereby constrained the conditions of metamorphism in their parent bodies.
Author

Meteorites; Meteoritic Composition; Planetary Geology; Petrology; Geochemistry; Igneous Rocks; Metamorphism (Geology)

20050061059 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Measuring the Internal Structure and Physical Conditions in Star and Planet Forming Clouds Core: Toward a Quantitative Description of Cloud Evolution
Lada, Charles J.; January 2005; 7 pp.; In English
Contract(s)/Grant(s): NAG5-13041
Report No.(s): Rept-2; No Copyright; Avail: CASI; A02, Hardcopy

This grant funds a research program to use infrared extinction measurements to probe the detailed structure of dark molecular cloud cores and investigate the physical conditions which give rise to star and planet formation. The goals of this program are to acquire, reduce and analyze deep infrared and molecular-line observations of a carefully selected sample of nearby dark clouds in order to internal structure of starless cloud cores and to quantitatively investigate the evolution of such structure through the star and planet formation process. During the second year of this grant, progress toward these goals is discussed.
Derived from text
Molecular Clouds; Planetary Evolution; Star Formation; Planetary Structure; Planetary Cores

20050061111 Massachusetts Inst. of Tech., Cambridge, MA, USA
Phase Equilibrium Investigations of Planetary Materials
Grove, T. L.; January 2005; 3 pp.; In English
Contract(s)/Grant(s): NAG5-9525; No Copyright; Avail: CASI; A01, Hardcopy

This grant provided funds to carry out phase equilibrium studies on the processes of chemical differentiation of the moon and the meteorite parent bodies, during their early evolutionary history. Several experimental studies examined processes that led to the formation of lunar ultramafic glasses. Phase equilibrium studies were carried out on selected low-Ti and high-Ti lunar ultramafic glass compositions to provide constraints on the depth range, temperature and processes of melt generation and/or assimilation. A second set of experiments examined the role of sulfide melts in core formation processes in the earth and terrestrial planets. The major results of each paper are discussed, and copies of the papers are attached as Appendix I.
Derived from text
Planetary Composition; Terrestrial Planets; Equilibrium; Phase Transformations

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20050051663 Massachusetts Inst. of Tech., Cambridge, MA, USA
Comparison of the Effects of Wave-Particle Interactions and the Kinetic Suprathermal Electron Population on the Acceleration of the Solar Wind
Tam, S. W. Y.; Chang, T.; Astronomy and Astrophysics; 2002; ISSN 0004-6361; Volume 395, pp. 1001-1012; In English
Contract(s)/Grant(s): NAG5-9616; Copyright; Avail: Other Sources

Kinetic effects due to wave-particle interactions and suprathermal electrons have been suggested in the literature as possible solar wind acceleration mechanisms. Ion cyclotron resonant heating, in particular, has been associated with some qualitative features observed in the solar wind. In terms of solar wind acceleration, however, it is interesting to compare the kinetic effects of suprathermal electrons with those due to the wave-particle interactions. The combined effects of the two acceleration mechanisms on the fast solar wind have been studied by Tam and Chang (1999a,b). In this study. we investigate the role of the suprathermal electron population in the acceleration of the solar wind. Our model follows the global kinetic evolution of the fast solar wind under the influence of ion cyclotron resonant heating, while taking into account Coulomb collisions, and the ambipolar electric field that is consistent with the particle distributions themselves. The kinetic effects due to the suprathermal electrons, which we define to be the tail of the electron distributions, can be included in the model as an option. By comparing the results with and without the inclusion of the suprathermal electron effects, we determine the relative importance of suprathermal electrons and wave-particle interactions in driving the solar wind. We find that although suprathermal electrons enhance the ambipolar electric potential in the solar wind considerably, their overall influence as an acceleration mechanism is relatively insignificant in a wave-driven solar wind.
Author
Solar Wind; Wave-Particle Interactions; Kinetics; Electron Distribution; Particle Acceleration

20050051963 Michigan State Univ., MI, USA
Solar Surface Convection
Stein, R. F.; Nordlund, A.; Ripoll, J. F.; Wray, A. A.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 21-31; In English; See also 20050051959; No Copyright; Avail: CASI; A03, Hardcopy

The dynamics of the solar surface is driven by turbulent convection, magnetic fields, and the escape of radiation. The

interaction of these various processes controls the flux of radiation received by the Earth. Convection is inherently three-dimensional, non-linear, and non-local. As a result, most progress in understanding convection has come from analying numerical simulations. The computational challenge is to compute at high enough Reynolds number to include interactions of very disparate scales of motion. This requires simulations with very large 3D computational grids. We cannot hope to model the extremely large dynamic range and high Reynolds number that occur in the Sun. We can hope that our limited numerical capabilities will provide insight into what actually occurs in the Sun.
Author (revised)
Solar Atmosphere; Solar Convection (Astronomy); Magnetohydrodynamics

20050051970 National Center for Atmospheric Research, Boulder, CO, USA
Numerical Modeling of Turbulent Convection and Acoustic Wave Propagation in the Solar Interior
Miesch, M. S.; Mansour, N. N.; Rogers, M. M.; Studying Turbulence Using Numerical Simulation Databases - X Proceedings of the 2004 Summer Program; December 2004, pp. 11-20; In English; See also 20050051959; No Copyright; Avail: CASI; A02, Hardcopy

The advent of helioseismology and the increasing sophistication of numerical models have brought forth a new era in our understanding of solar interior dynamics. High-resolution simulations of turbulent convection have become essential tools in the interpretation of helioseismic data and have provided new insight into the maintenance of large-scale flows and magnetic fields in the solar interior. Still, we can do better. One of the largest uncertainties in current numerical models is the influence of the upper and lower boundary regions which surround the convective envelope and which cannot be fully resolved in a global simulation. In this summer school we began to investigate in more detail the sensitivity of convection simulations to these boundary regions and we found that they have a more significant impact than might be supposed. We also initiated an investigation into the propagation of acoustic waves in the solar interior and their interaction with flow fields, thermal inhomogeneities, and magnetic structures. This project promises to elucidate the forward problem of helioseismology, providing essential theoretical support to ongoing observational efforts.
Author
Solar Interior; Sound Propagation; Acoustic Propagation; Solar Convection (Astronomy)

20050061087 New Jersey Inst. of Tech., Newark, NJ, USA
Thermal Diffusivity in the SGS Modeling for Solar Convection Simulations Using the ASH Code
Young, Y.-N.; Miesch, M.; Mansour, N. N.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 369-377; In English; See also 20050061070; No Copyright; Avail: CASI; A02, Hardcopy

The turbulent solar convection zone has remained one of the most challenging and important subjects in physics. Understanding the complex dynamics in the solar convection zone is crucial for gaining insight into the solar dynamo problem. Many solar observatories have generated revealing data with great details of large scale motions in the solar convection zone. For example, a strong differential rotation is observed: the angular rotation is observed to be faster at the equator than near the poles not only near the solar surface, but also deep in the convection zone. On the other hand, due to the wide range of dynamical scales of turbulence in the solar convection zone, both theory and simulation have limited success. Thus, cutting edge solar models and numerical simulations of the solar convection zone have focused more narrowly on a few key features of the solar convection zone, such as the time-averaged differential rotation. For example, Brun and Toomre report computational finding of differential rotation in an anelastic model for solar convection. A critical shortcoming in this model is that the viscous dissipation is based on application of mixing length theory to stellar dynamics with some ad hoc parameter tuning. We have implemented the Smagorinsky-Lilly subgrid scale model into the ASH (anelastic spherical harmonic) code. In this report we illustrate how this subgrid scale model works in terms of recovering differential rotation in the solar convection zone. In particular we elucidate the role of thermal diffusivity in solar convection, where the molecular thermal diffusivity is much larger than the molecular viscosity. This paper is organized as follows: In section 2 we briefly formulate the anelastic system that describes the solar convection. In section 3 we present some data diagnosis, such as the energy balance and n in the simulations. We illustrate by example how the thermal diffusivity can play an important role in terms of the differential rotation in the solar convection zone, and we will also provide some conclusions and future directions.
Author (revised)
Thermal Diffusivity; Solar Convection (Astronomy); Solar Atmosphere; Solar Rotation

20050061091 Stanford Univ., Stanford, CA, USA
Solar Convection Simulations Using a B-Spline Method
Hartlep, T.; Mansour, N. N.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 379-384; In English; See also 20050061070; No Copyright; Avail: CASI; A02, Hardcopy

Convection plays a key role in energy transport and global circulation in the outer layers of the Sun, in generation of solar magnetic fields and in many phenomena associated with solar activity and variability. Observations of the solar surface reveal structures that have been classified as granules, mesogranules, and supergranules. The nomenclature reflects organization at three spatial scales ranging from about 1 Mm to 30 Mm. Numerical simulations of the near surface region of the Sun capture structures on the granular scale, but have not been able to detect organization at large scales. The physical mechanism of supergranulation is presently unknown. It has been suggested that supergranulation corresponds to large convective cells which develop due to enhanced convective instability in the HeII ionization layer. This layer lies deeper than Stein and Nordlund have investigated so far. We know that as we go deeper from the surface of the sun, the turbulence structures become large, and the Mach number decreases. It is then advantageous to be able to change the spatial resolution in all three coordinates as a function of depth. In addition, it is numerically advantageous to use the anelastic approximation to the compressible Navier-Stokes equations for deep domains. Using B-splines in one coordinate direction and Fourier methods in the other two coordinate directions, Kravchenko and Loulou have developed B-spline-spectral numerical schemes that enable changing the resolution as a function of height. Kravchenko applied the scheme to simulate the fully developed turbulent channel flow by resolving the near-wall region and relaxing the resolution in the core region. Loulou simulated a fully developed turbulent pipe flow. They applied the scheme to remove the centerline singularity in cylindrical coordinates.
Author
Solar Granulation; Solar Convection (Astronomy); Solar Simulation

20050061096 Stanford Univ., Stanford, CA, USA
Velocity Field Decomposition in 3D Numerical Simulations of Solar Turbulent Convection
Georgobiani, D.; Mansour, N. N.; Kosovichev, A. G.; Stein, R. F.; Nordlund, A.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 355-360; In English; See also 20050061070; No Copyright; Avail: CASI; A02, Hardcopy

Three dimensional time dependent simulations of solar convection are becoming more realistic. The goal of this project is to develop a technique for decomposing the simulated turbulent velocity field into its potential and rotational components. We use flow fields from the 3D hydrodynamic code by Stein and Nordlund for our example of separation of the mean field into rotational and potential components. We look at two characteristics of the mean velocity field, it's vorticity and divergence, in the data obtained with the numerical simulations of Stein and Nordlund.
Author (revised)
Mathematical Models; Solar Convection (Astronomy); Flow Distribution

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SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20050041984 Clemson Univ., SC, USA
Analysis of CRRES PHA Data for Low-Energy-Deposition Events
McNulty, P. J.; Hardage, Donna; June 2004; 41 pp.; In English
Contract(s)/Grant(s): NASA Order H-32495-D
Report No.(s): NASA/CR-2004-213227; M-1110; No Copyright; Avail: CASI; A03, Hardcopy

This effort analyzed the low-energy deposition Pulse Height Analyzer (PHA) data from the Combined Release and Radiation Effects Satellite (CRRES). The high-energy deposition data had been previously analyzed and shown to be in agreement with spallation reactions predicted by the Clemson University Proton Interactions in Devices (CUPID) simulation model and existing environmental and orbit positioning models (AP-8 with USAF B-L coordinates). The scope of this project was to develop and improve the CUPID model by increasing its range to lower incident particle energies, and to expand the modeling to include contributions from elastic interactions. Before making changes, it was necessary to identify experimental data suitable for benchmarking the codes; then, the models to the CRRES PHA data could be applied. It was also planned to test the model against available low-energy proton or neutron SEU data obtained with mono-energetic beams.
Author
Pulse Amplitude; Extraterrestrial Radiation; Single Event Upsets; Space Environment Simulation

20050042010 Stanford Linear Accelerator Center, Stanford, CA, USA
FLUKA Calculations for the Shielding Design of the SPPS Project at SLAC
Vincke, H.; Mao, S.; Rokni, S.; Dec. 2003; In English
Report No.(s): DE2004-826731; SLAC-PUB-10010; No Copyright; Avail: National Technical Information Service (NTIS)

The SPPS project (Sub Picosecond Photon Source) at the Stanford Linear Accelerator Center (SLAC) will generate very bright sub-picosecond pulses of x-ray radiation. The peak brightness of SPPS will exceed that of any existing hard x-ray source by several orders of magnitude. The Monte Carlo particle transport code FLUKA code was used for the calculation of radiation levels at the SPPS facility at SLAC. Several beam loss scenarios were considered and the required shielding was determined. NTIS

Shielding; Linear Accelerators; Brightness

20050061073 NASA Ames Research Center, Moffett Field, CA, USA
Frequency Integrated Radiation Models for Absorbing and Scattering Media
Ripoll, J. F.; Wray, A. A.; Annual Research Briefs, 2004: Center for Turbulence Research; January 2005, pp. 281-291; In English; See also 20050061070; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this work is to contribute to the simplification of existing radiation models used in complex emitting, absorbing, scattering media. The application in view is the computation of flows occurring in such complex media, such as certain stellar interiors or combusting gases. In these problems, especially when scattering is present, the complexity of the radiative transfer leads to a high numerical cost, which is often avoided by simply neglecting it. The complexity lies partly in the strong dependence of the spectral coefficients on frequency. Models are then needed to capture the effects of the radiation when one cannot afford to directly solve for it. In this work, the frequency dependence will be modeled and integrated out in order retain only the average effects. A frequency-integrated radiative transfer equation (RTE) will be derived. Author

Radiation Effects; Radiative Transfer; Capture Effect; Coefficients

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20050041999 Atomic Energy Establishment, Winfrith, UK
Decommissioning of Shelded Facilities at Winfrith Used for Post Irradiation Examination of Nuclear Fuels and Other Active Items
Miller, K. D.; Parkinson, S. J.; Cornell, R. M.; Staples, A. T.; 2003; 16 pp.; In English
Report No.(s): DE2004-826080; No Copyright; Avail: Department of Energy Information Bridge

This paper describes the approaches used in the clearing, cleaning, decontamination and decommissioning of a very large suite of seven concrete shielded caves and other facilities used by UKAEA at Winfrith Technology Centre, England over a period of about 30 years for the postirradiation examination (PIE) of a wide range of nuclear fuels and other very active components. The basic construction of the facilities will first be described, setting the scene for the major challenges that 1970s' thinking posed for decommissioning engineers. The tendency then to use large and heavy items of equipment supported upon massive steel bench structures produced a series of major problems that had to be overcome. The means of solving these problems by utilization of relatively simple and inexpensive equipment will be described. Later, a further set of challenges was experienced to decontaminate the interior surfaces to allow man entries to be undertaken at acceptable dose rates. The paper will describe the types of tooling used and the range of complementary techniques that were employed to steadily reduce the dose rates down to acceptable levels.
NTIS

Decommissioning; Decontamination

20050050861 NASA Langley Research Center, Hampton, VA, USA

NASA Video Catalog, Supplement 15

January 2005; 539 pp.; In English

Report No.(s): NASA/SP-2005-7109/SUPPL15; No Copyright; Avail: CASI; E99, Hardcopy; No Charge

This issue of the NASA Video Catalog cites video productions listed in the NASA STI Database. The videos listed have been developed by the NASA centers, covering Shuttle mission press conferences; fly-bys of planets; aircraft design, testing and performance; environmental pollution; lunar and planetary exploration; and many other categories related to manned and unmanned space exploration. Each entry in the publication consists of a standard bibliographic citation accompanied by an abstract. The Table of Contents shows how the entries are arranged by divisions and categories according to the NASA Scope and Coverage Category Guide. For users with specific information, a Title Index is available. A Subject Term Index, based on the NASA Thesaurus, is also included. Guidelines for usage of NASA audio/visual material, ordering information, and order forms are also available.

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