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Langley Research Center

Scientific and Technical Information Program Office

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

Also included are two indexes, Subject Term and Personal Author. The Subject Term Index is generated from the *NASA Thesaurus* terms associated and listed with each document.

STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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Subject Divisions

Document citations are grouped first by the following divisions. Select a division title to view the category-level Table of Contents.

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F. Life Sciences
G. Mathematical and Computer Sciences
H. Physics
I. Social Sciences
J. Space Sciences
K. General

Indexes

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

Subject Term Index
Personal Author Index

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Select a category to view the collection of records cited. N.A. means no abstracts in that category.

01 Aeronautics (General) 1

02 Aerodynamics 2

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery. For related information, see also *34 Fluid Mechanics and Heat Transfer.*

03 Air Transportation and Safety 10

Includes passenger and cargo air transport operations; and aircraft accidents. For related information, see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 Aircraft Communications and Navigation 12

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information, see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *32 Communications Radar.*

05 Aircraft Design, Testing and Performance 14

Includes aircraft simulation technology. For related information, see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles, see *85 Urban Technology and Transportation*.

06 Aircraft Instrumentation 16

Includes cockpit and cabin display devices; and flight instruments. For related information, see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

07 Aircraft Propulsion and Power 17

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; 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*.

08 Aircraft Stability and Control 19

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

09 Research and Support Facilities (Air) 19

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands. For related information, see also *14 Ground Support Systems and Facilities (Space).*

Subject Categories of the Division B. Astronautics

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

12 Astronautics (General) N.A.

For extraterrestrial exploration, see *91 Lunar and Planetary Exploration*.

13 Astrodynamics 21

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

14 Ground Support Systems and Facilities (Space) 22

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

15 Launch Vehicles and Space Vehicles 22

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles. For related information, see also *20 Spacecraft Propulsion and Power.*

16 Space Transportation 23

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

17 Space Communications, Spacecraft Communications, Command and Tracking N.A.

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

18 Spacecraft Design, Testing and Performance 23

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. 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*.

19 Spacecraft Instrumentation 24

For related information, see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 Spacecraft Propulsion and Power 25

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*, *44 Energy Production and Conversion*, and *15 Launch Vehicles and Space Vehicles*.

Subject Categories of the Division C. Chemistry and Materials

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

23 Chemistry and Materials (General) 29

24 Composite Materials 33

Includes physical, chemical, and mechanical properties of laminates and other composite materials. For ceramic materials see *27 Nonmetallic Materials*.

25 Inorganic and Physical Chemistry 39

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry. For related information see also *77 Thermodynamics and Statistical Physics*.

26 Metallic Materials 47

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 Nonmetallic Materials 59

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

28 Propellants and Fuels 73

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

29 Materials Processing 78

Includes space-based development of products and processes for commercial application. For biological materials see *55 Space Biology.*

Subject Categories of the Division D. Engineering

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

31 Engineering (General) 79

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

32 Communications and Radar 83

Includes radar; land and global communications; communications theory; and optical communications. 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*.

33 Electronics and Electrical Engineering 94

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry. For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 Fluid Mechanics and Heat Transfer 108

Includes boundary layers; hydrodynamics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 Instrumentation and Photography 120

Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 Lasers and Masers 126

Includes parametric amplifiers. For related information see also *76 Solid-State Physics*.

37 Mechanical Engineering 133

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

38 Quality Assurance and Reliability 138

Includes product sampling procedures and techniques; and quality control.

39 Structural Mechanics 140

Includes structural element design and weight analysis; fatigue; and thermal stress. For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

Subject Categories of the Division E. Geosciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

42 Geosciences (General) N.A.

43 Earth Resources and Remote Sensing 148

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see *35 Instrumentation and Photography.*

44 Energy Production and Conversion 154

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower. For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

45 Environment Pollution 163

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics 176

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For space radiation see *93 Space Radiation*.

47 Meteorology and Climatology 183

Includes weather forecasting and modification.

48 Oceanography 187

Includes biological, dynamic, and physical oceanography; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

Subject Categories of the Division F. Life Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

51 Life Sciences (General) 188

52 Aerospace Medicine 192

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

53 Behavioral Sciences N.A.

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 Man/System Technology and Life Support 193

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also *16 Space Transportation.*

55 Space Biology N.A.

Includes exobiology; planetary biology; and extraterrestrial life.

Subject Categories of the Division G. Mathematical and Computer Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

59 Mathematical and Computer Sciences (General) N.A.

60 Computer Operations and Hardware 196

Includes hardware for computer graphics, firmware, and data processing. For components see *33 Electronics and Electrical Engineering.*

61 Computer Programming and Software 197

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

62 Computer Systems 208

Includes computer networks and special application computer systems.

63 Cybernetics 212

Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also *54 Man/System Technology and Life Support.*

64 Numerical Analysis 216

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability 218

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 Systems Analysis 219

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics 220

Includes topology and number theory.

Subject Categories of the Division H. Physics

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

70 Physics (General) 221

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics*.

71 Acoustics 224

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution.*

72 Atomic and Molecular Physics 227

Includes atomic structure, electron properties, and molecular spectra.

73 Nuclear and High-Energy Physics 261

Includes elementary and nuclear particles; and reactor theory. For space radiation see *93 Space Radiation.*

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Includes light phenomena and optical devices. For lasers see *36 Lasers and Masers*.

75 Plasma Physics 282

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76 Solid-State Physics 306

Includes superconductivity. For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 Thermodynamics and Statistical Physics 320

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

Subject Categories of the Division I. Social Sciences

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80 Social Sciences (General) N.A.

Includes educational matters.

81 Administration and Management 323

Includes management planning and research.

82 Documentation and Information Science 326

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see *61 Computer Programming and Software*.

83 Economics and Cost Analysis N.A.

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy 336

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 Urban Technology and Transportation N.A.

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation. For related information see *03 Air Transportation and Safety, 16 Space Transportation*, and *44 Energy Production and Conversion.*

Subject Categories of the Division J. Space Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

88 Space Sciences (General) 336

89 Astronomy N.A.

Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 Astrophysics 340

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also *75 Plasma Physics*.

91 Lunar and Planetary Exploration 345

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

92 Solar Physics 360

Includes solar activity, solar flares, solar radiation and sunspots. For related information see also *93 Space Radiation.*

93 Space Radiation 362

Includes cosmic radiation; and inner and outer earth's radiation belts. For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics.*

Subject Categories of the Division K. General

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99 General 364

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

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❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 36, SEPTEMBER 14, 1998

01
AERONAUTICS (GENERAL)

19980206747 NASA Lewis Research Center, Cleveland, OH USA

A Moving Grid Capability for NPARC

Slater, John W., NASA Lewis Research Center, USA; Jun. 1998; 14p; In English; 36th; Aerospace Sciences Meeting and Exhibit, 12-15 JAN. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 509-10-51

Report No.(s): NASA/TM-1998-207944; NAS 1.15:207944; E-11223; AIAA Paper 98-0955; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Version 3.1 of the NPARC computational fluid dynamics flow solver introduces a capability to solve unsteady flow on moving multi-block, structured grids with nominally second-order time accuracy. The grid motion is due to segments of the boundary grid that translate and rotate in a rigid-body manner or deform. The grid is regenerated at each time step to accommodate the boundary grid motion. The flow equations and computational models sense the moving grid through the grid velocities, which are computed from a time-difference of the grids at two consecutive time levels. For three-dimensional flow domains, it is assumed that the grid retains a planar character with respect to one coordinate. The application and accuracy of NPARC v3.1 is demonstrated for flow about a flying wedge, rotating flap, a collapsing bump in a duct, and the upstart / restart flow in a variable-geometry inlet. The results compare well with analytic and experimental results.

Author

Computational Fluid Dynamics; Flow Equations; Mathematical Models; Structured Grids (Mathematics); Rigid Structures

19980210004 Logistics Management Inst., McLean, VA USA

Aviation System Analysis Capability Executive Assistant Design ***Final Report***

Roberts, Eileen, Logistics Management Inst., USA; Villani, James A., Logistics Management Inst., USA; Osman, Mohammed, Logistics Management Inst., USA; Godso, David, Logistics Management Inst., USA; King, Brent, Logistics Management Inst., USA; Ricciardi, Michael, Logistics Management Inst., USA; May 1998; 218p; In English

Contract(s)/Grant(s): NAS2-14361; RTOP 538-08-11-01

Report No.(s): NASA/CR-1998-207679; NAS 1.26:207679; LMI-NS701S1; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

In this technical document, we describe the design developed for the Aviation System Analysis Capability (ASAC) Executive Assistant (EA) Proof of Concept (POC). We describe the genesis and role of the ASAC system, discuss the objectives of the ASAC system and provide an overview of components and models within the ASAC system, and describe the design process and the results of the ASAC EA POC system design. We also describe the evaluation process and results for applicable COTS software. The document has six chapters, a bibliography, three appendices and one attachment.

Author

Systems Engineering; Design Analysis; Management Systems; Procedures

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery. For related information see also 34 Fluid Mechanics and Heat Transfer.

19980209691 Naval Postgraduate School, Monterey, CA USA
Flight Testing and Real-Time System Identification Analysis of a UH-60A Black Hawk Helicopter with an Instrumented External Sling Load
McCoy, Allen H., Naval Postgraduate School, USA; Dec. 1997; 104p; In English
Report No.(s): AD-A343449; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Historically, helicopter and load combinations have been qualified through flight testing, requiring considerable time and cost. With advancements in simulation and flight test techniques, there is potential to substantially reduce costs and increase the safety of helicopter sling load certification. Validated simulation tools make possible accurate prediction of operational flight characteristics before initial flight tests. Real time analysis of test data improves the safety and efficiency of the testing programs. to advance these concepts, the US Army and NASA, in cooperation with the Israeli Air Force and Technion, under a Memorandum of Agreement, seek to develop and validate a numerical model of the UH-60 with sling load and demonstrate a method of near real time flight test analysis. This thesis presents results from flight tests of a US Army Black Hawk helicopter with various external loads. Tests were conducted as the US first phase of this MOA task. The primary load was a container express box (CONEX), which contained a compact instrumentation package. The flights covered the airspeed range from hover to 70 knots. Primary maneuvers were pitch and roll frequency sweeps, steps, and doublets. Results of the test determined the effect of the suspended load on both the aircraft's handling qualities and it's control system's stability margins. Included were calculations of the stability characteristics of the load's pendular motion. Utilizing CIFER
DTIC
Computerized Simulation; Flight Characteristics; Flight Simulation; Frequencies; Real Time Operation; UH-60A Helicopter; Control Stability; Aerodynamic Loads

19980209729 Army Research Lab., Aberdeen Proving Ground, MD USA
Dynamic Analyses of the Mortar Dragster Tab Mechanism ***Final Report***
Condon, John A., Army Research Lab., USA; Hollis, Michael S., Army Research Lab., USA; Apr. 1998; 25p; In English
Report No.(s): AD-A345815; ARL-TN-107; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As a means of verifying the design and operation of the Mortar Dragster, a commercially available, three-dimensional rigid body dynamics simulation program was exercised. The Mortar Dragster is a conceptual design for a range correction device for the 81-mm mortar. The design includes a series of drag surfaces, or tabs, which are actuated at some point in the trajectory of the projectile. The actuation places the entire series of drag surfaces into the airstream, thus slowing the projectile. of specific interest are the collision forces and resulting tab hinge loads imparted by the opening tabs impacting the adjacent connected body because of integral torsion springs and air drag-induced torque loads. Collision forces predicted by the simulation program were of the same order of magnitude as hand calculations. The results of this investigation provided confidence in the final design of the tab mechanism before its flight testing and also provided further verification of the simulation program's performance.
DTIC
Aerodynamic Drag; Dynamic Tests; Computerized Simulation; Mortars (Material)

19980209732 Arnold Engineering Development Center, Arnold AFS, TN USA
Development of the Porous-Slot Geometry of the NWTC Test Section
Steinle, Frank W., Jr., Arnold Engineering Development Center, USA; Jan. 1997; 14p; In English; 35th; Aerospace Sciences, 6-10 Jan. 1997, Reno, NV, USA
Report No.(s): AD-A345793; AIAA Paper 97-0097; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The development of the concept features of the wall configuration of the National Wind Tunnel Complex project is described in the context of the project history. Flow quality requirements concerning stream angle homogeneity at the outer edge of the test volume, requirements for maximum wall interference, optical access, and test volume acoustic considerations in addition to Mach number range and tunnel operational mode were factors in the design. The development process included 2D calculations for stream angle homogeneity to establish slot width and spacing, 3D calculations for verification of slot geometry and crossflow control, and experimental development of slot-baffle insert geometry that would be rugged, allow control of crossflow, and not

produce strong resonant tones. results of 2D calculations, 3D calculations to illustrate need for control of crossflow, and experimental evaluation of baseline slot baffle acoustic properties are presented.
DTIC
Porosity; Walls; Slots; Wind Tunnels; Transonic Wind Tunnels; Procedures; Configuration Management

19980209734 Sverdrup Technology, Inc., Arnold AFS, TN USA
CO2 Vibrational Relaxation Effects in a Laser Heated Hypersonic Flow
Limbaugh, C. C., Sverdrup Technology, Inc., USA; Drakes, J. A., Sverdrup Technology, Inc., USA; Jun. 1997; 17p; In English; 32nd; Thermophysics Conference, 23-25 Jun. 1997, Atlanta, GA, USA
Contract(s)/Grant(s): AF Proj. 3220
Report No.(s): AD-A345777; AIAA Paper No. 97-2492; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The establishment of flow conditions characteristic of hypersonic flight in a ground test facility by conventional means requires plenum conditions that have very high temperatures and give rise to a variety of materials problems. A well-known approach to solving these problems is to use high-pressure, moderate temperature plenum conditions and add energy as the flow expands through a carefully designed nozzle. A modern approach (Radiatively Heated Wind Tunnel) uses an HF laser to excite the (02'1) mode of CO2 naturally present or added to the flow. One of the early challenges in the development will be to demonstrate the ability to add energy into the supersonic flow in a predictable and controllable manner. Consequently, a subscale experiment, the Laser Demonstration Device (LDD), is planned to investigate the transfer of laser energy to a small, expanding nozzle flow. Previous modeling of the energy transfer of the laser energy into the gas for the LDD depended on a conventional two-temperature approach to describe the internal structure of the molecules and to determine the rate coefficients. Realizing that the detailed physics of the energy transfer was important to the description of the wind tunnel performance and, hence, its viability, an effort was undertaken to compute the effect of CO2 relaxation using a technique in which the individual vibrational states are considered. Results of these computations are reported here.
DTIC
Vibration; Energy Transfer; Carbon Dioxide; Heat; Hypersonic Flow; Vibrational States; Hf Lasers; Molecular Relaxation

19980209797 Sverdrup Technology, Inc., Arnold AFS, TN USA
Investigation of Differences Between Measured and Predicted Pressures in AEDC/VKF Hypersonic Tunnel B
Maus, James R., Sverdrup Technology, Inc., USA; Jan. 1997; 13p; In English; 35th; Aerospace Sciences, 6-10 Jan. 1997, Reno, NV, USA
Report No.(s): AD-A345792; AIAA-PAPER-97-0566; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A study has been carried out to assess the effect of flow nonuniformities in AEDC Tunnel B on surface pressures of slender bodies. The approach taken was to use flow profiles measured in a recent calibration program as inflow boundary conditions for a CFD solution to compare with the idealized case where a uniform free stream is assumed. The results of this study indicate that flow nonuniformities are at least partially responsible for discrepancies observed at low Reynolds number (Re/L = 1.0 x 10(exp 6)/ft) on slender axisymmetric bodies at zero angle of attack. There is no corresponding effect at high tunnel Reynolds number (Re/L = 3.5 x 10(exp 6)/ft). At high Reynolds number, for angles of attack that displace the nose of the vehicle more that 6-7 in. from the tunnel centerline, there is a small increase in surface pressure caused by a radial variation in Mach number.
DTIC
Computational Fluid Dynamics; Hypersonic Vehicles; Pressure; Hypersonic Wind Tunnels

19980209934 ESDU International Ltd., London, UK
Lift Curve of Wings with High-Lift Devices Deployed at Low Speeds
Jun. 1996; 24p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-96003; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96003 provides an empirical method for predicting, in two separate parts, the nonlinear lift curve up to, and including, maximum lift of aerofoils and wings with high-lift devices deployed at low speeds. The first part gives the lift curve through zero angle of attack and up to the lift coefficient at which the effects of flow breakdown start to become significant. The second part extends the lift curve up to maximum lift and includes the prediction of the angle of attack for maximum lift. The method applies to wings with aspect ratios greater than 4 and leading-edge sweeps up to about 40 degrees. Leading-edge devices considered were plain leading-edge flaps, Krueger flaps and slats of full-span and part-span extending to the wing tips. Trailing-edge flaps were split, plain, single-slotted or double-slotted. The method is expected to apply to triple-slotted flaps although no data were found to confirm that. It applies to aerofoils and so will apply well to high aspect ratio wings.

For angles of attack up to that at which the effects of flow breakdown start to become significant, the lift coefficient is predicted with an rms error of 0.016. The angle of attack for maximum lift is predicted with an rms error of 0.5 degrees. Comparisons are shown of predicted and experimental results. A worked example illustrates the use of the method.
Author
Numerical Analysis; Lift; Airfoils; Leading Edge Flaps

19980209942 ESDU International Ltd., London UK
Wing Lift Coefficient Increment at Zero Angle of Attack Due to Deployment of Plain Trailing-Edge Flaps at Low Speeds
Mar. 1997; 18p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-97011; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97011 provides an empirical method that applies to full- or part-span flaps on wings. It uses the method of ESDU 94028 to establish the lift increment due to deflection of the plain flap on an aerofoil having the geometry of the wing section at flap mid-span, taken to be representative of the wing, and then applies factors to allow for planform and part-span effects. An additional factor is required that is a function of flap deflection and the angle between the aerofoil upper surface and the aerofoil datum at the trailing-edge. Sketches compare experimental results from the literature with predictions by the method for both full- and part-span flaps on swept and unswept wings and show that predictions were accurate to within 15 per cent for 98 per cent of the test data. A worked example illustrates the use of the method.
Author
Wing Flaps; Zero Angle of Attack; Trailing Edge Flaps; Numerical Analysis

19980209943 ESDU International Ltd., London, UK
Information on the Use of Data Items on High-Lift Devices
Mar. 1997; 16p; In English; Supersedes in part ESDU-75013. Included in the Aerodynamics Sub-series
Report No.(s): ESDU-97002; ESDU-75013; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97002 is an introductory review of the methods provided in the Sub-series for the estimation of the increments in the lift, pitching moment and drag over those of the plain aerofoil or wing (in the absence of a body) at zero lift due to the deployment of high-lift leading- and/or trailing-edge devices. The methods are largely empirical, being based on extensive wind-tunnel data. The lift and pitching moment increments vary only slightly with angle of attack provided the stalled region is avoided but a method is included that predicts the lift curve to maximum lift that is significantly more realistic than the assumption of a linear variation. It is assumed that the ratio of device chord to wing chord and dimensionless wing geometry are constant spanwise. Where that is not the case, values appropriate to the mid-device span may be used to average out the effects of spanwise variations. The accuracy of the methods is discussed in the individual documents; in the absence of an explicit statement, comparisons of experimental and predicted values for increments in lift, pitching moment and profile drag coefficients suggest that errors will be within 10 per cent in most cases. All the documents contain one or more worked examples to illustrate the use of the methods. ESDU 97003 provides methods for estimating the effect of fuselage interference on the increments in lift, pitching moment and drag predicted for the isolated wing.
Author
Lift Devices; Information Resources Management; Pitching Moments; Estimating; Data Structures; Aerodynamic Drag

19980209944 ESDU International Ltd., London, UK
Subsonic and Transonic Base and Boat-Tail Pressure Drag of Cylindrical Bodies with Circular-Arc Boat-Tails
Jun. 1996; 27p; In English; Included in the Mechanisms Sub-series
Report No.(s): ESDU-96012; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96012 provides an empirical graphical method derived from a correlation of wind-tunnel data for the prediction separately of boat-tail and base pressure drag that applies at all Mach numbers up to 1.3. The method requires that there are at least three diameters of cylindrical body upstream of the boat-tail and that there is no jet efflux or base bleed. The method for base pressure drag applies for boat-tail angles (the angle made with the base) up to 45 degrees but for boat-tail drag only for boat-tail angles up to 25 degrees for subsonic Mach numbers, 30 degrees for a Mach number of 1 and 35 degrees for supersonic Mach numbers. The method may also be used for afterbodies of parabolic profile. The total afterbody drag is the sum of the two components. The quality of fit with the experimental data is illustrated; total drag coefficient based on body maxi-

mum diameter is estimated to within 0.015. However, because of the limited sample of data, it is suggested that an accuracy of 0.03 should be allowed for. A worked example illustrates the use of the method.
Author
Supersonic Speed; Transonic Speed; Pressure Drag; Cylindrical Bodies; Procedures; Aerodynamic Drag

19980209948 ESDU International Ltd., London, UK
Drag Due to Lift for Non-Planar Swept Wings up to High Angles of Attack at Subsonic Speeds
Apr. 1997; 66p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-96025; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96025 introduces ESDUpac A9625 which provides a FORTRAN program, available on disc in the Software Volume, for the calculation of the lift and the drag due to lift for planar and non-planar wings with a turbulent boundary layer, alone or in combination with a body. The program is designed for use on PCs with the FORTRAN 5.1 compiler. The method, fully described in ESDU 96025, applies for angles of attack for which there is leading-edge vortex flow and partial or full loss of leading-edge suction and but not widespread flow separation over the main part of the wing. The method of ESDU 95025 for planar wings has been extended to non-planar wings by using the theoretical distribution of the leading-edge suction for a planar wing of identical planform with a corrected local angle of attack deduced from a vortex lattice model. The method for calculating the attainable suction has been improved over that in ESDU 95025 and in calculating the vortex lift normal to the local surface allowance is made for the inboard migration of the leading-edge vortex. The resolved components of wing viscous axial force and of body axial and normal force are added to obtain total lift and drag due to lift. For the body contribution, the method of ESDU 90034 has been incorporated in the program with the assumption that the body can be approximated by an axisymmetric shape. The lift prediction is based on the leading-edge suction analogy and includes the non-linear contribution from leading-edge vortex flow together with the side-edge contribution. Sketches illustrate the quality of the prediction method when compared with experimental results extracted from the literature for wings with camber and twist in combination with bodies and the method predicts drag coefficient to within 0.01 of lift coefficient. The use of the program is fully described in ESDU 96025 and the input to and output from it illustrated by fully-worked examples.
Author
Lift; Swept Wings; Angle of Attack; Subsonic Speed; Aerodynamic Drag; Data Structures

19980209949 ESDU International Ltd., London, UK
Drag and Yawing Moment Due to Spoilers
Nov. 1996; 18p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-96026; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96026 provides an empirical method applying to a spoiler on one wing panel. The drag increment is considered as the sum of a profile drag component and an induced drag component which includes the effect of deploying a trailing-edge flap. The increment in yawing moment arises from the direct moment associated with the drag increment but includes an indirect effect due to the sidewash at the tail unit caused by the spoiler flow field. Comparisons are shown of the predicted results against experimental data. A worked example illustrates the use of the method.
Author
Drag; Yawing Moments; Numerical Analysis; Data Structures

19980210002 Arizona Univ., Tucson, AZ USA
Effects of Nose Radius and Aerodynamic Loading on Leading Edge Receptivity ***Final Report***
Hammerton, P. W., Arizona Univ., USA; Kerschen, E. J., Arizona Univ., USA; Jul. 1998; 96p; In English
Contract(s)/Grant(s): NAG1-1135; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An analysis is presented of the effects of airfoil thickness and mean aerodynamic loading on boundary-layer receptivity in the leading-edge region. The case of acoustic free-stream disturbances, incident on a thin cambered airfoil with a parabolic leading edge in a low Mach number flow, is considered. An asymptotic analysis based on large Reynolds number is developed, supplemented by numerical results. The airfoil thickness distribution enters the theory through a Strouhal number based on the nose radius of the airfoil, S = (omega)tau(sub n)/U, where omega is the frequency of the acoustic wave and U is the mean flow speed. The influence of mean aerodynamic loading enters through an effective angle-of-attack parameter ti, related to flow around the leading edge from the lower surface to the upper. The variation of the receptivity level is analyzed as a function of S, mu, and characteristics of the free-stream acoustic wave. For an unloaded leading edge, a finite nose radius dramatically reduces the recep-

tivity level compared to that for a flat plate, the amplitude of the instability waves in the boundary layer being decreased by an order of magnitude when S = 0.3. Modest levels of aerodynamic loading are found to further decrease the receptivity level for the upper surface of the airfoil, while an increase in receptivity level occurs for the lower surface. For larger angles of attack close to the critical angle for boundary layer separation, a local rise in the receptivity level occurs for the upper surface, while for the lower surface the receptivity decreases. The effects of aerodynamic loading are more pronounced at larger values of S. Oblique acoustic waves produce much higher receptivity levels than acoustic waves propagating downstream parallel to the airfoil chord.
Author
Sound Waves; Radii; Effectiveness; Noses (Forebodies); Airfoil Profiles; Numerical Analysis; Aerodynamic Loads; Thin Airfoils; Leading Edges

19980210014 Institute of Theoretical and Applied Mechanics, Siberian Div., Novosibirsk Russia
Supersonic Leading Edge Receptivity
Maslov, Anatoly A., Institute of Theoretical and Applied Mechanics, Russia; Jun. 1998; 144p; In English
Contract(s)/Grant(s): NCC1-240; NCCw-74; RTOP 282-10-01-01
Report No.(s): NASA/CR-1998-208445; NAS 1.26:208445; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This paper describes experimental studies of leading edge boundary layer receptivity for imposed stream disturbances. Studies were conducted in the supersonic T-325 facility at ITAM and include data for both sharp and blunt leading edges. The data are in agreement with existing theory and should provide guidance for the development of more complete theories and numerical computations of this phenomena.
Author
Boundary Layers; Sharp Leading Edges; Data Acquisition; Wind Tunnel Tests

19980210082 ESDU International Ltd., London UK
Wing Lift Coefficient Increment at Zero Angle of Attack Due to Deployment of Trailing-Edge Split Flaps at Low Speeds
Mar. 1997; 17p; In English; Supersedes ESDU-74009. Included in the Aerodynamics Sub-series
Report No.(s): ESDU-97009; ESDU-74009; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97009 provides an empirical method that applies to full- or part-span flaps on wings. It uses the method of ESDU 94029 to establish the lift increment due to deflection of the split flap on an aerofoil having the geometry of the wing section at flap mid-span, taken to be representative of the wing, and then applies factors to allow for planform and part-span effects. Sketches compare experimental results from the literature with predictions by the method for both full- and part-span flaps on swept and unswept wings and show that predictions were accurate to within 15 per cent for 98 per cent of the test data. A worked example illustrates the use of the method.
Author
Wing Flaps; Coefficients; Zero Angle of Attack; Aerodynamic Coefficients; Trailing Edge Flaps; Deployment; Lift

19980210219 ESDU International Ltd., London, UK
VGK Method for Two-Dimensional Aerofoil Sections, Part 2, User Manual for Operation with MS-DOS and UNIX Systems
Nov. 1996; 39p; In English; Included in the Transonic Aerodynamics Sub-series
Report No.(s): ESDU-96029; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

VGK is introduced in ESDU 96028 and is a computational fluid dynamics method coded in FORTRAN for predicting the aerodynamic characteristics of a single-element aerofoil in a subsonic freestream, including the effects of viscosity (boundary layers and wake) and shock waves. ESDU 96029 describes the use of the VGK program suite as supplied on disc running under either MS-DOS or UNIX; the source code supplied must be compiled under FORTRAN 77. Sufficient information is given to enable results to be obtained, but ESDU 96028 should be referred to for the principles and performance of the method, so that the results obtained may be properly assessed. Typical computing time for a single run of VGK using a 80486 DX processor is 90 seconds and using a Pentium processor is 30 seconds. The disc containing the files relating to VGK also contains a 'library' of files of aerofoil coordinates. Because of its good performance, VGK can be utilized effectively to investigate a number of factors, such as: the influence of aerofoil geometry (profile and camber) changes on aerofoil characteristics at and around cruise con-

ditions; the influence of changes in Mach number, Reynolds number and transition locations on aerofoil characteristics; the influence of deflection through small angles of leading- and/or trailing-edge flaps; the influence of over-fixing transition in wind-tunnel tests on aerofoils.
Author
Procedures; Two Dimensional Bodies; Airfoil Profiles; Computational Fluid Dynamics; Aerodynamic Characteristics

19980210220 ESDU International Ltd., London, UK
Response of Structures to Vortex Shedding. Structures of Circular or Polygonal Cross Section
Dec. 1996; 80p; In English; Included in the Wind Engineering Sub-series
Report No.(s): ESDU-96030; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96030 describes the nature of the lateral response to vortex shedding of structures of circular or of polygonal cross section with more than eight sides. A method is developed for calculation of this response together with the data required to implement it. It takes account of the response to buffeting by across-wind atmospheric turbulence components, using the methods of ESDU 89049. Comparisons of predictions with both model and full-scale measurements, and a discussion of methods of reducing response to vortex shedding are included. ESDU 96031 introduces a program running in Excel that implements the method. The method treats the following conditions: structures that are parallel-sided, tapered and stepped with smooth or rough surfaces (if ancillary structures are attached such as ladders they must be entirely in the main structure wake for the method to apply), cantilevered or between end fixings, vertical, horizontal or inclined in flow that is uniform or shear, smooth or turbulent, with natural atmospheric turbulence or simulated turbulence as in a wind-tunnel.
Author
Vortex Shedding; Circular Plates; Polygons; Procedures; Geometry

19980210221 ESDU International Ltd., London, UK
Computer Programs for Response of Structures to Vortex Shedding, Part 1, Microsoft Excel Module
Dec. 1996; 23p; In English; Included in the Wind Engineering Sub-series
Report No.(s): ESDU-96031; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96031 introduces a program for calculating the lateral response to vortex shedding of structures of circular or of polygonal section of more than eight sides. It includes the lateral response to buffeting by the across-wind components of atmospheric turbulence. The basis of the method is described in ESDU 96030 which should be consulted for details of applicability. ESDU 96031 provides guidance on the use of the Excel module, explaining the format of the input and output. Several worked examples are included to illustrate the use of the method.
Author
Computer Programs; Vortex Shedding; Circular Plates; Polygons

19980210222 ESDU International Ltd., London, UK
Wing Lift Coefficient Increment at Zero Angle of Attack due to Deployment of Leading-Edge Devices at Low Speeds
Nov. 1996; 19p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-96032; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96032 provides an empirical method developed from that for aerofoil sections in ESDU 94027 to 94031. It applies to leading-edge flaps, drooped leading edges, slats and vented Krueger flaps, and sealed slats and Krueger flaps. For wings with full-span leading-edge devices a factor, dependent on planform geometry, is applied to allow for three-dimensional effects. For part-span leading-edge devices, additional factors are introduced dependent on the device and wing geometry. The method applies for leading-edge sweep less than 47 degrees and Reynolds numbers based on aerodynamic mean chord greater than 0.6E-6. The experimental data are predicted to within 0.02 in lift coefficient based on wing area. A worked example illustrates the use of the data.
Author
Zero Angle of Attack; Wings; Lift; Aerodynamic Coefficients; Leading Edge Sweep; Airfoil Profiles

19980210225 ESDU International Ltd., London, UK

Estimation of the Unsteady Lift Coefficient of Subsonic Propeller Blades in Non-Axial Inflow

Nov. 1996; 11p; In English; Included in the Noise Sub-series

Report No.(s): ESDU-96027; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96027 provides a program for calculating the unsteady local lift coefficient on an aerofoil section of the blade in subcritical flow. This forms part of the data input required by the propeller noise prediction program introduced in ESDU 95029. The orientation of the propeller axis is described by the Euler angles of yaw and pitch relative to the flight axis. The method is applicable to an aircraft on a straight, steady flight path that need not be horizontal. The program, known as ESDUpac A9627, is written in FORTRAN 77. It is provided on disc in the software volume, uncompiled and compiled within ESDUview, a user-friendly interface that prompts on-screen for input data. The input format is explained and a worked example illustrates the format of the output data.

Author

Estimates; Unsteady State; Dynamic Characteristics; Lift; Airfoil Profiles; Data Structures

19980210226 ESDU International Ltd., London, UK

VGK Method for Two-Dimensional Aerofoil Sections, Part 1, Principles and Results

Nov. 1996; 84p; In English; Included in the Transonic Aerodynamics Sub-series

Report No.(s): ESDU-96028; No Copyright; Avail: Abstract Only (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

VGK is a computational fluid dynamics method coded in FORTRAN for predicting the aerodynamic characteristics of single-element aerofoils in a subsonic freestream, including the effects of viscosity (boundary layers and wake) and shock waves. VGK uses an iterative approach to solve coupled finite-difference equations for the inviscid flow region (assumed to be potential) and the viscous flow region (represented by integral equations). The aerofoil boundary-layers must be attached. VGK was developed at RAE (now DERA), Farnborough) and Crown copyright is retained in the source code. ESDU 96028 describes the main features of the VGK method, including the inviscid and viscous flow elements, the computational grids, and the solution process. The precise forms of finite-difference scheme and iteration procedure employed in a particular VGK ‚run' are governed by a number of parameters whose values may be selected by the user. Default values for them are given, together with comments on the effects on VGK results of variations from those values. The accuracy of results from VGK is considered both for inviscid flows, where comparisons with other theoretical methods are given, and for viscous flows, where comparisons with experiment are presented. For flows where the boundary layer is attached and any shock waves are relatively weak (which thus include most aerofoil design conditions) the performance of VGK is good, with drag coefficient being well predicted. Where the boundary layer is locally separated or close to separation, VGK can still give a valuable indication of the flow parameters, but its accuracy is then not as good. Because of its good performance, VGK can be utilized effectively to investigate a number of factors, such as: the influence of aerofoil geometry (profile and camber) changes on aerofoil characteristics at and around cruise conditions; the influence of changes in Mach number, Reynolds number and transition locations on aerofoil characteristics; the influence of deflection through small angles of leading- and/or trailing-edge flaps; the influence of over-fixing transition in wind-tunnel tests on aerofoils.

Author

Airfoil Profiles; Two Dimensional Models; Computational Fluid Dynamics; FORTRAN; Computer Programs; Computational Grids; Aerodynamic Characteristics

19980210231 ESDU International Ltd., London, UK

Effect of Stabilising Fins on Base Drag of Cylindrical Bodies at Supersonic Speeds

Aug. 1997; 12p; In English; Included in the Aerodynamics Sub-series

Report No.(s): ESDU-97022; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97022 gives a method for estimating the increment in (jet off) base drag, over that for the body alone given by ESDU 79022, due to stabilising fins on axisymmetric cylindrical bodies at zero angle of attack with a turbulent boundary layer at Mach numbers from 1.5 to 5. It is based on a simple theoretical model modified with an empirical factor to fit wind-tunnel data and was derived for cruciform or planar fins mounted with trailing-edges flush with the base or upstream of the base. It may be applied to up to six equally-spaced fins. The fins tested were of circular-arc or diamond section with maximum thickness at mid-chord but the method can be applied to other configurations. The method requires at least three

body diameters of cylindrical body length upstream of the fins to ensure there is no forebody/fin interference. Sketches compare the predictions with the experimental results and show the increment is predicted to within 0.01 in base drag coefficient based on base area. Details of geometries used in the correlation are provided, and a fully worked example illustrates the use of the method.
Author
Stabilization; Fins; Cylindrical Bodies; Procedures; Estimating; Supersonic Speed; Aerodynamic Coefficients; Aerodynamic Drag

19980210290 NASA Lewis Research Center, Cleveland, OH USA
Transmission and Incidence Losses for a Slotted Plate
Wilson, Jack, NYMA, Inc., USA; Chima, Rodrick V., NASA Lewis Research Center, USA; Skews, Beric W., Witwatersrand Univ., South Africa; Jun. 1998; 14p; In English; 34th; Joint Propulsion Conference and Exhibit, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-27186; RTOP 523-26-13
Report No.(s): NASA/TM-1998-207420; NAS 1.15:207420; E-11175; AIAA Paper 98-3252; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this work is to find a model of the stagnation pressure loss resulting from flow through a slotted plate, which is effectively a cascade of flat plate airfoils, particularly at very large angles of incidence. Data from a published experiment is examined, and compared with control volume analysis, and CFD code calculations. An assumption that the loss can be separated into a transmission loss and an incidence loss seems to be justified by the data. Both the data and the CFD code results are consistent with an incidence loss model in which the flow component normal to the slot axis is lost. However, the experimental transmission loss is much larger than calculated values.
Author
Flat Plates; Slots; Transmission Loss; Models

19980210402 NASA Marshall Space Flight Center, Huntsville, AL USA
Comparison of the Aerodynamic Characteristics of Similar Models in Two Size Wind Tunnels at Transonic Speeds
Springer, Anthony M., NASA Marshall Space Flight Center, USA; 1998; 24p; In English; 7th; Thermophysics and Heat Transfer, 15-18 Jun. 1998, Albuquerque, NM, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-1998-208264; NAS 1.15:208264; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The aerodynamic characteristics of two similar models of a lifting body configuration were run in two transonic wind tunnels, one a 16 foot the other a 14-inch and are compared. The 16 foot test used a 2% model while the 14-inch test used a 0.7% scale model. The wind tunnel model configurations varied only in vertical tail size and an aft sting shroud. The results from these two tests compare the effect of tunnel size, Reynolds number, dynamic pressure and blockage on the longitudinal aerodynamic characteristics of the vehicle. The data accuracy and uncertainty are also presented. It was concluded from these tests that the data resultant from a small wind tunnel compares very well to that of a much larger wind tunnel in relation to total vehicle aerodynamic characteristics.
Author
Wind Tunnel Models; Transonic Speed; Aerodynamic Characteristics; Scale Models

19980210559 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
Low Speed Aerodynamics of the X-38 CRV ***Final Report, May 1997 - Apr. 1998***
Komerath, N. M., Georgia Inst. of Tech., USA; Funk, R., Georgia Inst. of Tech., USA; Ames, R. G., Georgia Inst. of Tech., USA; Mahalingam, R., Georgia Inst. of Tech., USA; Matos, C., Georgia Inst. of Tech., USA; Jun. 1998; 5p; In English
Contract(s)/Grant(s): NAG9-927
Report No.(s): NASA/CR-1998-208293; NAS 1.26:208293; GITAER-EAG-98-03; E16-N63; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project was performed in support of the engineering development of the NASA X-38 Crew Return Vehicle (CRV)system. Wind tunnel experiments were used to visualize various aerodynamic phenomena encountered by the CRV during the final stages of descent and landing. Scale models of the CRV were used to visualize vortex structures above and below the vehicle, and in its wake, and to quantify their trajectories. The effect of flaperon deflection on these structures was studied. The structure and dynamics of the CRV's wake during the drag parachute deployment stage were measured. Regions of high vorticity were identified using surveys conducted in several planes using a vortex meter. Periodic shedding of the vortex sheets from the sides of the CRV was observed using laser sheet videography as the CRV reached high angles of attack during the quasi-steady pitch-up prior to

parafoil deployment. Using spectral analysis of hot-film anemometer data, the Strouhal number of these wake fluctuations was found to be 0.14 based on the model span. Phenomena encountered in flight test during parafoil operation were captured in scale-model tests, and a video photogrammetry technique was implemented to obtain parafoil surface shapes during flight in the tunnel. Forces on the parafoil were resolved using tension gages on individual lines. The temporal evolution of the phenomenon of leading edge collapse was captured. Laser velocimetry was used to demonstrate measurement of the porosity of the parafoil surface. From these measurements, several physical explanations have been developed for phenomena observed at various stages of the X-38 development program. Quantitative measurement capabilities have also been demonstrated for continued refinement of the aerodynamic technologies employed in the X-38 project. Detailed results from these studies are given in an AIAA Paper, two slide presentations, and other material which are given on a Web-based archival resource. This is the Digital Library of the Georgia Tech Experimental Aerodynamics Group.
Author
Low Speed; Return to Earth Space Flight; Aerodynamic Characteristics; Wind Tunnel Tests; Imaging Techniques; Scale Models; Video Data

19980210597 NASA Lewis Research Center, Cleveland, OH USA
Study of Low Reynolds Number Effects on the Losses in Low-Pressure Turbine Blade Rows
Ashpis, David E., NASA Lewis Research Center, USA; Dorney, Daniel J., General Motors Inst., USA; Jun. 1998; 22p; In English; 34th; Joint Propulsion Conference and Exhibit, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG3-1668; RTOP 522-31-23
Report No.(s): NASA/TM-1998-207919; NAS 1.15:207919; AIAA Paper 98-3575; E-11202; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental data from jet-engine tests have indicated that unsteady blade row interactions and separation can have a significant impact on the efficiency of low-pressure turbine stages. Measured turbine efficiencies at takeoff can be as much as two points higher than those at cruise conditions. Several recent studies have revealed that Reynolds number effects may contribute to the lower efficiencies at cruise conditions. In the current study numerical experiments have been performed to study the models available for low Reynolds number flows, and to quantify the Reynolds number dependence of low-pressure turbine cascades and stages. The predicted aerodynamic results exhibit good agreement with design data.
Author
Low Reynolds Number; Turbine Blades; Turbines; Engine Tests; Turbomachinery; Turbulence

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents. For related information see also 16 Space Transportation and 85 Urban Technology and Transportation.

19980206509 Federal Aviation Administration, Office of Aviation Research, Washington, DC USA
Federal Aviation Administration Plan for Research, Engineering and Development, 1998: Report to the USA Congress
Feb. 1998; 183p; In English
Report No.(s): AD-A344936; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report contains plans for research and development within the FAA for 1998. Partial contents include: Objectives, aviation community initiatives, long-term research, and program area descriptions of air traffic services, airports technology, aircraft safety, aviation security, human factors and aviation medicine, environment and energy, and R,E & D program management.
DTIC
Civil Aviation; Research Management; Research and Development; Congressional Reports; Safety Factors; Aircraft Safety; Security

19980206792 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders, *Apr. 1998*

Apr. 1998; 290p; In English

Report No.(s): PB98-916704; NTSB/IDBOO-98/04; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This publication contains all Judge Initial Decisions and Board Opinions and Orders in Safety Enforcement and Seaman Enforcement Cases for April 1998.

NTIS

Air Transportation; Accident Prevention

19980209677 General Accounting Office, National Security and International Div., Washington, DC USA

Report to the Honorable John McCain, US Senate. Intratheater Airlift: Information on the Air Force's C-130 Aircraft

Apr. 1998; 36p; In English

Report No.(s): GAO/NSIAD-98-108; B-274598; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The C-130 Hercules aircraft is a medium-range, tactical airlift aircraft designed primarily for transporting personnel and cargo. The aircraft was originally flown in 1954 and has been under continuous production ever since. The Air Force currently has approximately 700 C-130s of various configurations in its current C-130E and H fleet. The average age of the active duty C-130 fleet is over 25 years old, while the average age of the Guard and Reserve C-130s is about 15 years old. These aircraft are under the management and control of the Air Mobility Command (Amc)l and are operated by the active Air Force, the Air National Guard, and the Air Force Reserve. The Air Force has just begun buying a new J model C-130. Lockheed Martin Corporation is developing the J aircraft as a commercial venture and expects it to (1) lower the cost of ownership of the fleet and (2) climb higher and faster, fly at higher cruise speeds, and take off and land in a shorter distance than the existing fleet. The J will have the same structural characteristics as previous C-130 models; however, it differs in that it includes, among other things, an advanced integrated digital avionics systems, a new engine and composite propellers, a heads-up display, and a redesigned flight station to facilitate operation by a three-man versus a five-man crew.

Derived from text

Congressional Reports; Air Transportation; C-130 Aircraft; Structural Design; Flight Operations; Cost Reduction; Armed Forces (USA)

19980210315 Brookhaven National Lab., Upton, NY USA

On the safety of aircraft systems: A case study

Martinez-Guridi, G., Brookhaven National Lab., USA; Hall, R. E., Brookhaven National Lab., USA; Fullwood, R. R., Brookhaven National Lab., USA; May 14, 1997; 45p; In English

Contract(s)/Grant(s): DE-AC02-76CH-00016; 95-G-039

Report No.(s): BNL-64946; DE98-002766; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

An airplane is a highly engineered system incorporating control- and feedback-loops which often, and realistically, are non-linear because the equations describing such feedback contain products of state variables, trigonometric or square-root functions, or other types of non-linear terms. The feedback provided by the pilot (crew) of the airplane also is typically non-linear because it has the same mathematical characteristics. An airplane is designed with systems to prevent and mitigate undesired events. If an undesired triggering event occurs, an accident may process in different ways depending on the effectiveness of such systems. In addition, the progression of some accidents requires that the operating crew take corrective action(s), which may modify the configuration of some systems. The safety assessment of an aircraft system typically is carried out using ARP (Aerospace Recommended Practice) 4761 (SAE, 1995) methods, such as Fault Tree Analysis (FTA) and Failure Mode and Effects Analysis (FMEA). Such methods may be called static because they model an aircraft system on its nominal configuration during a mission time, but they do not incorporate the action(s) taken by the operating crew, nor the dynamic behavior (non-linearities) of the system (airplane) as a function of time. Probabilistic Safety Assessment (PSA), also known as Probabilistic Risk Assessment (PRA), has been applied to highly engineered systems, such as aircraft and nuclear power plants. PSA encompasses a wide variety of methods, including event tree analysis (ETA), FTA, and common-cause analysis, among others. PSA should not be confused with ARP 4761's proposed PSSA (Preliminary System Safety Assessment); as its name implies, PSSA is a preliminary assessment at the system level consisting of FTA and FMEA.

DOE

Failure Analysis; Safety Factors; Feedback Control; Aeronautics

19980210764 NASA Ames Research Center, Moffett Field, CA USA

Dynamic Density: An Air Traffic Management Metric

Laudeman, I. V., NASA Ames Research Center, USA; Shelden, S. G., San Jose State Univ., USA; Branstrom, R., San Jose State Univ., USA; Brasil, C. L., San Jose State Univ., USA; Apr. 1998; 8p; In English

Contract(s)/Grant(s): RTOP 538-18-22

Report No.(s): NASA/TM-1998-112226; NAS 1.15:112226; A-98-10366; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The definition of a metric of air traffic controller workload based on air traffic characteristics is essential to the development of both air traffic management automation and air traffic procedures. Dynamic density is a proposed concept for a metric that includes both traffic density (a count of aircraft in a volume of airspace) and traffic complexity (a measure of the complexity of the air traffic in a volume of airspace). It was hypothesized that a metric that includes terms that capture air traffic complexity will be a better measure of air traffic controller workload than current measures based only on traffic density. A weighted linear dynamic density function was developed and validated operationally. The proposed dynamic density function includes a traffic density term and eight traffic complexity terms. A unit-weighted dynamic density function was able to account for an average of 22% of the variance in observed controller activity not accounted for by traffic density alone. A comparative analysis of unit weights, subjective weights, and regression weights for the terms in the dynamic density equation was conducted. The best predictor of controller activity was the dynamic density equation with regression-weighted complexity terms.

Author

Air Traffic Controllers (Personnel); Air Traffic Control; Air Traffic; Aircraft Safety; Approach Control

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 17 Space Communications, Spacecraft Communications, Command and Tracking and 32 Communications and Radar.

19980209675 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia

Ionospheric Effects on Global Positioning System Receivers

Knight, Mark F., Defence Science and Technology Organisation, Australia; Finn, Anthony, Defence Science and Technology Organisation, Australia; Cerera, Manuel, Defence Science and Technology Organisation, Australia; Feb. 1998; 94p; In English

Report No.(s): DSTO-RR-0121; AR-010-444; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance Research Lab., PO Box 1500, Salisbury, Australia); US Sales Only, Hardcopy, Microfiche

This report presents the results of a study conducted under tasks ADL 94/373 and ADA 96/005 into the effects of the ionosphere on Global Positioning System (GPS) receivers. The report focuses on the effects of the disturbed ionosphere on GPS as this phenomenon has the capacity to degrade the accuracy and reliability of both civilian and military GPS receivers. The impact of ionospheric disturbances on the susceptibility of GPS in a potentially hostile electromagnetic environment is also discussed.

Author

Ionospheric Disturbances; Global Positioning System; Data Acquisition

19980209720 Naval Postgraduate School, Monterey, CA USA

Integration of a Multi-Rate Position Filter in the Navigation System of an Unmanned Aerial Vehicle (UAV) for Precise Navigation in the Local Tangent Plane (LTP)

Perry, Robert C., Naval Postgraduate School, USA; Mar. 1998; 74p; In English

Report No.(s): AD-A346060; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Differential Global Positioning System (DGPS) provides highly accurate position information, but at update rates of one Hz which is inadequate for precise aircraft terminal maneuvering such as take off and landing. During this period between updates an accurate position estimate in Local Tangent Plane (LTP) can be made using complementary filtering of the DGPS position and indicated airspeed. Use of indicated airspeed as the filter velocity input necessitates the transformation from body to inertial (LTP) reference frame using Euler angle information available from the Inertial Measuring Unit (IMU) or DGPS. This filter provides accurate estimates of both vehicle position and existing wind. These filter outputs of position and wind can then be used as inputs to a trajectory controller to ultimately enable autonomous launch and recovery of an Unmanned Aerial Vehicle.

DTIC

Aircraft Maneuvers; Flight Tests; Inertial Navigation; Pilotless Aircraft; Navigation Instruments; Digital Filters

19980210598 NASA Langley Research Center, Hampton, VA USA

Flight Evaluation of Center-TRACON Automation System Trajectory Prediction Process

Williams, David H., NASA Langley Research Center, USA; Green, Steven M., NASA Ames Research Center, USA; Jul. 1998; 86p; In English

Contract(s)/Grant(s): RTOP 538-04-11-16

Report No.(s): NASA/TP-1998-208439; L-17644; NAS 1.60:208439; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Two flight experiments (Phase 1 in October 1992 and Phase 2 in September 1994) were conducted to evaluate the accuracy of the Center-TRACON Automation System (CTAS) trajectory prediction process. The Transport Systems Research Vehicle (TSRV) Boeing 737 based at Langley Research Center flew 57 arrival trajectories that included cruise and descent segments; at the same time, descent clearance advisories from CTAS were followed. Actual trajectories of the airplane were compared with the trajectories predicted by the CTAS trajectory synthesis algorithms and airplane Flight Management System (FMS). Trajectory prediction accuracy was evaluated over several levels of cockpit automation that ranged from a conventional cockpit to performance-based FMS vertical navigation (VNAV). Error sources and their magnitudes were identified and measured from the flight data. The major source of error during these tests was found to be the predicted winds aloft used by CTAS. The most significant effect related to flight guidance was the cross-track and turn-overshoot errors associated with conventional VOR guidance. FMS lateral navigation (LNAV) guidance significantly reduced both the cross-track and turn-overshoot error. Pilot procedures and VNAV guidance were found to significantly reduce the vertical profile errors associated with atmospheric and airplane performance model errors.

Author

Air Traffic Control; VHF Omnirange Navigation; Transport Vehicles; Management Systems; Flight Tests; Flight Management Systems; Automatic Control; Aircraft Performance

19980210625 Ohio Univ., Avionics Engineering Center, Athens, OH USA

Defining the ATC Controller Interface for Data Link Clearances ***Final Report, 1 Oct. 1996 - 31 Oct. 1997***

Rankin, James, Ohio Univ., USA; 1998; 7p; In English

Contract(s)/Grant(s): NAG1-1788

Report No.(s): NASA/CR-1998-208288; NAS 1.26:208288; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Controller Interface (CI) is the primary method for Air Traffic Controllers to communicate with aircraft via Controller-Pilot Data Link Communications (CPDLC). The controller, wearing a microphone/headset, aurally gives instructions to aircraft as he/she would with today's voice radio systems. The CI's voice recognition system converts the instructions to digitized messages that are formatted according to the RTCA DO-219 Operational Performance Standards for ATC Two-Way Data Link Communications. The DO-219 messages are transferred via RS-232 to the ATIDS system for uplink using a Mode-S datalink. Pilot acknowledgments of controller messages are downlinked to the ATIDS system and transferred to the Cl. A computer monitor is used to convey information to the controller. Aircraft data from the ARTS database are displayed on flight strips. The flight strips are electronic versions of the strips currently used in the ATC system. Outgoing controller messages cause the respective strip to change color to indicate an unacknowledged transmission. The message text is shown on the flight strips for reference. When the pilot acknowledges the message, the strip returns to its normal color. A map of the airport can also be displayed on the monitor. In addition to voice recognition, the controller can enter messages using the monitor's touch screen or by mouse/keyboard.

Derived from text

Air Traffic Control; Data Bases; Data Links; Monitors

19980210664 Genoa Univ., Dept. of Biophysical and Electronic Engineering, Genoa, Italy

A KF-Based Integration System for Land Vehicle Tracking From Real DGPS and INS Data

Regazzoni, Carlo S., Genoa Univ., Italy; Teschioni, Andrea, Genoa Univ., Italy; Tacconi, Giorgio, Genoa Univ., Italy; Apr. 1998; 12p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The present work is addressed to perform an estimation in an accurate and robust way of the trajectory of a land vehicle by using a Differential Global Positioning System (DGPS) and an Inertial System (INS). The use of a Kalman Filter (KF) approach for integration, data-fusion and estimation tasks has been proved as able to providing precise and robust evaluation of cinematic variables (linear position and velocity) even in the case of long missions or under critical conditions of temporary incompleteness or unreliability of part of the acquired data. From the state of the art, it can be seen that the DGPS is very precise sensor providing 3D geographic position, but present low output rate and temporary signal loss or accuracy degradation, while the INS provides continuous outputs of rotation angles and linear acceleration with high output rate but the inertial units have burdensome intrinsic errors which bring about a degradation of precision increasing with time. Practically,the integration of DGPS and INS is forecast

to provide continuous estimates over time, corrupted by small and almost unchanging errors. The system has been tested over an extensive set of real data providing good results both in precision and in robustness.
Author
Global Positioning System; Kalman Filters; Multisensor Fusion; Remote Sensing; Multisensor Applications

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Urban Technology and Transportation.

19980206537 Sandia National Labs., Albuquerque, NM USA
FAA fluorescent penetrant activities
Moore, D. G., Sandia National Labs., USA; Larson, B. F., Iowa State Univ. of Science and Technology, USA; [1997]; 4p; In English; 1997 Asnt Fall Conference: Ndt - Keystone of Quality, 20 - 24 Oct. 1997, Pittsburgh, PA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2596C; CONF-971093-; DE98-001188; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Federal Aviation Administration's Airworthiness Assurance NDI Validation Center (AANC) and the Center for Aviation Systems Reliability (CASR) are currently working to develop a liquid penetrant inspection (LPI) system evaluation capability that will support the needs of the penetrant manufacturers, commercial airline industry and the FAA. The main focus of this facility is to support the evaluation of penetrant inspection materials, penetrant systems and to apply resources to support industry needs. This paper discusses efforts to create such a facility and an initial project to produce fatigue crack specimens for evaluation of Type 1 penetrant sensitivities.
DOE
Fluorescence; Penetrants; Inspection; Systems Analysis; Reliability

19980206538 Sandia National Labs., Albuquerque, NM USA
Low-voltage radiography on aircraft composite doublers
Moore, D. G., Sandia National Labs., USA; Murray, J. D., Sandia National Labs., USA; [1997]; 4p; In English; 1997 ASNT Fall Conference: Ndt - Keystone of Quality, 20 - 24 Oct. 1997, Pittsburgh, PA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2597C; CONF-971093-; DE98-001187; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Composite doublers are gaining popularity for their ability to repair and reinforce commercial aircraft structures and it is anticipated that the potential cost savings may spur wider use of this technology. But before composite doublers can be accepted by the civil aviation industry, inspection techniques must be developed to verify the integrity of the doubler and the parent material under the doubler. The Federal Aviation Administration Airworthiness Assurance NDI Validation Center (AANC) is currently developing test methods to inspect aircraft structures under composite doublers using low kilovoltage radiography. This paper documents the radiographic techniques developed by the AANC which have been found to give the best contrast of the radiographic image with reduced image distortion.
DOE
Aircraft Industry; Aircraft Reliability; Aircraft Structures; Civil Aviation; Cost Reduction; Low Voltage; Composite Materials

19980206637 Naval Postgraduate School, Monterey, CA USA
Development of Graphical User Interface (GUI) for Joint Army/Navy Rotorcraft Analysis and Design (JANRAD) Software
Lapacik, Chris F., Naval Postgraduate School, USA; Mar. 1998; 207p; In English
Report No.(s): AD-A345931; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

A Graphical User Interface (Gul) was developed and implemented as the front end of the NPS software Joint Army/Navy Rotorcraft Analysis and Design (JANRAD). The original JANRAD computer program was developed to aid in the analysis of helicopter rotor performance, stability and control and rotor dynamics. An interactive program, JANRAD was capable of accurately and quickly solving helicopter design problems at the preliminary design level. The addition of the Gul greatly simplified the use of the program but added considerable complexity to the original MATLAB M-File code. Because of the increased com-

plexity, only the Performance Analysis module of the program was modified. The use of several new features of MATLAB version 5.1, such as the GUIDE and Structure functions, simplified the construction of the Gul environment and enhanced the tie between the user interface and performance calculation routines.
DTIC
Graphical User Interface; Rotary Wings; Rotary Wing Aircraft; Design Analysis; Helicopter Design; Human-Computer Interface

19980209941 ESDU International Ltd., London UK
Static Aeroelasticity: A Formal Analysis Using Assumed Modes
Dec. 1997; 48p; In English; Included in the Dynamics Sub-series
Report No.(s): ESDU-97032; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97032 gives a formal analysis of the equilibrium behaviour of a flexible aeroplane of classical configuration in trim or in a quasi-steady pull-out maneuver. The aeroplane has a swept wing and tailplane, both flexible in bending and torsion about straight flexural axes, a rigid fuselage, and wing-mounted rigid nacelles. Two structural configurations are considered: with the wing and tailplane ribs normal to the swept flexural axis and with them aligned to the freestream direction. The bending and twist distributions of the wing and tailplane are assumed to be the sum of a set of individual modes, each mode consisting of an amplitude multiplied by its spanwise shape. The mode shapes used are an orthogonal set that satisfy the boundary conditions for a uniform elastic beam built-in at its root, taken here to be normal to the swept flexural axis. Expressions for overall static stability, given by the elevator trim margin, for static stability at constant speed, given by the elevator maneuver trim margin, and for aeroelastic static stability, are provided. The coefficients are given of the set of simultaneous equations that determine the unknown variables (incidence, elevator deflection, and wing and tailplane bending and twist deformations) in terms of speed and normal acceleration for the configuration with ribs normal to the relevant flexural axis.
Author
Aeroelasticity; Static Stability; Equilibrium Methods; Horizontal Tail Surfaces; Aerodynamic Stability; Data Structures

19980210223 ESDU International Ltd., London, UK
A Qualitative Introduction to Static Aeroelasticity: Controllability, Loads and Stability
Dec. 1996; 59p; In English; Included in the Dynamics Sub-series
Report No.(s): ESDU-96037; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96037 introduces some of the fundamental concepts relating to the effects of structural flexibility for aeroplanes of classical configuration (aspect ratios greater than 4 and sweep angles less than 35 degrees) in wholly subsonic flow either in steady flight or in a quasi-steady pull-out maneuver. Bending and twist deformations of the wing and tailplane are assumed to occur only in the spanwise direction about a straight elastic or flexural axis; chordwise deformations are ignored. Weight distribution changes due to deformation are neglected. In trimmed level flight expressions are developed for aeroplane incidence, elevator angle to trim and elevator trim margin. The steady pull-out maneuver is treated as a quasi-steady perturbation superimposed on the steady level trimmed state and expressions are developed for aeroplane maneuver incidence, elevator maneuver angle and elevator maneuver margin. An elevator trim divergence speed is found to depend on tailplane torsional stiffness and pitching moment due to elevator deflection and is unchanged for maneuvering flight. Finally, stability is considered in terms of overall static stability, constant speed static stability and overall structural mode static stability.
Author
Aeroelasticity; Static Stability; Loads (Forces); Structural Stability; Flexibility; Aerodynamic Balance; Aerodynamic Characteristics

19980210235 ESDU International Ltd., London UK
Similarity Rules for Application in Aircraft Performance Work
Sep. 1997; 12p; In English; Included in the Aircraft Performance Sub-series
Report No.(s): ESDU-97025; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97025 gives similarity rules for pressure coefficient. For subsonic and supersonic two- and three-dimensional flow over thin sections and for axisymmetric flow they are derived from linearized (potential) flow equations. For transonic flow they are derived from a non-linear equation for two- and three-dimensional flow only and no treatment for axisymmetric flow is given. Manipulation of the two-dimensional transonic rule to forms more readily applicable is illustrated. Such rules are valuable in providing a simple theoretical framework within which to work when formulating generalised

databases from ad hoc experimental data. The application of the rules to drag, lift and pitching moment coefficients is shown. to illustrate the value of the rules, they are applied in an illustrative example to correlate sets of experimental results for the pressure drag of a wedge in both subsonic and supersonic flow, collapsing the data into a family of curves well.
Author
Aircraft Performance; Pressure Ratio; Subsonic Flow; Three Dimensional Flow; Supersonic Flow; Aerodynamic Coefficients

19980210397 NASA Langley Research Center, Hampton, VA USA
Aerodynamic Parameters of High Performance Aircraft Estimated from Wind Tunnel and Flight Test Data
Klein, Vladislav, George Washington Univ., USA; Murphy, Patrick C., NASA Langley Research Center, USA; 1998; 20p; In English
Report No.(s): NASA/TM-1997-207993; NAS 1.15:207993; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A concept of system identification applied to high performance aircraft is introduced followed by a discussion on the identification methodology. Special emphasis is given to model postulation using time invariant and time dependent aerodynamic parameters, model structure determination and parameter estimation using ordinary least squares an mixed estimation methods, At the same time problems of data collinearity detection and its assessment are discussed. These parts of methodology are demonstrated in examples using flight data of the X-29A and X-31A aircraft. In the third example wind tunnel oscillatory data of the F-16XL model are used. A strong dependence of these data on frequency led to the development of models with unsteady aerodynamic terms in the form of indicial functions. The paper is completed by concluding remarks.
Author
Aerodynamic Characteristics; X-29 Aircraft; X-31 Aircraft; Unsteady Aerodynamics; Supersonic Aircraft; Fighter Aircraft

19980210560 Army Research Lab., Vehicle Technology Center, Hampton, VA USA
Development of a Rotor-Body Coupled Analysis for an Active Mount Aeroelastic Rotor Testbed
Wilbur, Matthew L., Army Research Lab., USA; Jun. 1998; 108p; In English
Contract(s)/Grant(s): RTOP 581-20-21-01; DA Proj. A-5008
Report No.(s): NASA/TP-1998-208433; L-17596; NAS 1.60:208433; ARL-TR-1313; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

At the Langley Research Center an active mount rotorcraft testbed is being developed for use in the Langley Transonic Dynamics Tunnel. This testbed, the second generation version of the Aeroelastic Rotor Experimental System (ARES-II), can impose rotor hub motions and measure the response so that rotor-body coupling phenomena may be investigated. An analytical method for coupling an aeroelastically scaled model rotor system to the ARES-II is developed in the current study. Models of the testbed and the rotor system are developed in independent analyses, and an impedance-matching approach is used to couple the rotor system to the testbed. The development of the analytical models and the coupling method is examined, and individual and coupled results are presented for the testbed and rotor system. Coupled results are presented with and without applied hub motion, and system loads and displacements are examined. The results show that a closed-loop control system is necessary to achieve desired hub motions, that proper modeling requires including the loads at the rotor hub and rotor control system, and that the strain-gauge balance placed in the rotating system of the ARES-II provided the best loads results.
Author
Rotary Wing Aircraft; Rotor Body Interactions; Rotors; Feedback Control; Airframes; Aeroelasticity; Impedance Matching

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments. For related information see also 19 Spacecraft Instrumentation and 35 Instrumentation and Photography.

19980209658 NASA Lewis Research Center, Cleveland, OH USA
Using Neural Networks for Sensor Validation
Mattern, Duane L., Scientific Monitoring, Inc., USA; Jaw, Link C., Scientific Monitoring, Inc., USA; Guo, Ten-Huei, NASA Lewis Research Center, USA; Graham, Ronald, Allison Engine Co., USA; McCoy, William, Allison Engine Co., USA; Jul. 1998; 14p; In English; 34th; Joint Propulsion Conference, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 519-30-53

Report No.(s): NASA/TM-1998-208483; E-11258; NAS 1.15:208483; AIAA Paper 98-3547; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the results of applying two different types of neural networks in two different approaches to the sensor validation problem. The first approach uses a functional approximation neural network as part of a nonlinear observer in a model-based approach to analytical redundancy. The second approach uses an auto-associative neural network to perform nonlinear principal component analysis on a set of redundant sensors to provide an estimate for a single failed sensor. The approaches are demonstrated using a nonlinear simulation of a turbofan engine. The fault detection and sensor estimation results are presented and the training of the auto-associative neural network to provide sensor estimates is discussed.
Author

Neural Nets; Sensors; Fault Detection; Redundancy; Real Time Operation; Models; Engine Monitoring Instruments; In-Flight Monitoring; Fail-Safe Systems

19980210485 Smiths Industries Aerospace and Defense Systems, Inc., Grand Rapids, MI USA

Navy F/A-18 Crash Survivable Flight Incident Recorder (CSFIR): Minutes of Technical Interchange Meeting (TIM) 17-18 March 1998

Apr. 06, 1998; 5p; In English

Contract(s)/Grant(s): N00019-98-F-0003

Report No.(s): AD-A346391; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

On 17-18 Mar 98, representatives from Boeing and Smiths Industries (SI) met in St. Louis for a Technical Interchange Meeting (TIM) in support of the Crash Survivable Flight Incident Recorder (CSFIR) integration into F/A-18C/D aircraft. A list of the TIM participants is in attachment #1. The objective of this meeting was to coordinate changes to the draft CSFIR Interface Control Document (ICD), ICD-F/A-18-075, Revision Preliminary #2. The ICD defines the CSFIR when installed on the F/A-18 C/D aircraft. The objective of the TIM was met. SI gained a better understanding of the DFIR emulation requirement. These understandings are listed below. However, in order for SI to scope the software development tasks necessary to integrate the VADR(trade name) on the F/A-18 aircraft further information is needed. A ”Preliminary #3” revision to the Interface Control Document was generated (authored by Boeing) based on inputs from the participants of this TIM and will be reviewed prior to the next TIM. The resulting action items from this TIM are indicated in the report.
DTIC

Flight Recorders; F-18 Aircraft; Systems Integration

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; 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.

19980206753 Arnold Engineering Development Center, Arnold AFS, TN USA

Transitioning Navy Aero Engine Test Capability

Boytos, Joseph F., Naval Air Warfare Center, USA; Lominac, John K., Arnold Engineering Development Center, USA; Jan. 1997; 12p; In English; 35th; Aerospace Sciences, 6-9 Jan. 1997, USA

Report No.(s): AD-A345893; AIAA Paper 97-0668; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The reduction in military force levels requires a corresponding decrease in the shore based infra-structure. Many bases and laboratories were selected for closure or realignment as part of the BRAC process. The Navy’s aeropropulsion test facility at Trenton, NJ, would transfer its large and medium propulsion engine test capability to the Air Force’s propulsion facility at Arnold Engineering Development Center, Arnold Air Force Base, TN. Two small altitude test cells will be disconnected and physically moved; the test capability of two large engine environmental test cells will be transferred by utilizing standard Air Force A/F32T-9 test cells as building blocks. The two T-9 cells will be modified to duplicate the ram air test capability of current Navy cells. The transition process is described from both technical and management viewpoints. Test facility requirements, funding, organizational responsibilities, partnering, and design and construction are discussed. Test cell scale model tests with engine simulators formed the basis for equipment modifications. Activation/validation efforts with appropriate engines will document the required test capability. Current program status and final test cell capabilities are presented. Criteria for engine performance measurement,

engine/cell operability, and acoustical requirements are discussed. Operational capability for the altitude chambers is late 1997, and the large environmental sea level cells in late 1998.
DTIC
Ramjet Engines; Turbines; Transferring; Aircraft Engines

19980209647 NASA Lewis Research Center, Cleveland, OH USA
General Aviation Light Aircraft Propulsion: From the 1940's to the Next Century
Burkardt, Leo A., NASA Lewis Research Center, USA; Jul. 1998; 16p; In English; 34th; Joint Propulsion Conference, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 523-12-13
Report No.(s): NASA/TM-1998-208411; NAS 1.15:208411; E-11246; AIAA Paper 98-3116; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Current general aviation light aircraft are powered by engines that were originally designed in the 1940's. This paper gives a brief history of light aircraft engine development, explaining why the air-cooled, horizontally opposed piston engine became the dominant engine for this class of aircraft. Current engines are fairly efficient, and their designs have been updated through the years, but their basic design and operational characteristics are archaic in comparison to modem engine designs, such as those used in the automotive industry. There have been some innovative engine developments, but in general they have not been commercially successful. This paper gives some insight into the reasons for this lack of success. There is now renewed interest in developing modem propulsion systems for light aircraft, in the fore-front of which is NASA's General Aviation Propulsion (GAP) program. This paper gives an overview of the engines being developed in the GAP program, what they will mean to the general aviation community, and why NASA and its industry partners believe that these new engine developments will bring about a new era in general aviation light aircraft.
Author
Propulsion System Configurations; Propulsion System Performance; Design Analysis; Aircraft Engines; Engine Design

19980210006 Garrett Turbine Engine Co., Phoenix, AZ USA
Small Engine Technology (Set) Task 8 Aeroelastic Prediction Methods ***Final Report***
Eick, Chris D., Garrett Turbine Engine Co., USA; Liu, Jong-Shang, Garrett Turbine Engine Co., USA; Jun. 1998; 60p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-27483; RTOP 538-06-13
Report No.(s): NASA/CR-1998-202328; NAS 1.26:202328; E-10674; Rept-21-9157; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

AlliedSignal Engines, in cooperation with NASA LeRC, completed an evaluation of recently developed aeroelastic computer codes using test cases from the AlliedSignal Engines fan blisk database. Test data for this task includes strain gage, light probe, performance, and steady-state pressure information obtained for conditions where synchronous or flutter vibratory conditions were found to occur. Aeroelastic codes evaluated include the quasi 3-D UNSFLO (developed at MIT and modified to include blade motion by AlliedSignal), the 2-D FREPS (developed by NASA LeRC), and the 3-D TURBO-AE (under development at NASA LeRC). Six test cases each where flutter and synchronous vibrations were found to occur were used for evaluation of UNSFLO and FREPS. In addition, one of the flutter cases was evaluated using TURBO-AE. The UNSFLO flutter evaluations were completed for 75 percent radial span and provided good agreement with the experimental test data. Synchronous evaluations were completed for UNSFLO but further enhancement needs to be added to the code before the unsteady pressures can be used to predict forced response vibratory stresses. The FREPS evaluations were hindered as the steady flow solver (SFLOW) was unable to converge to a solution for the transonic flow conditions in the fan blisk. This situation resulted in all FREPS test cases being attempted but no results were obtained during the present program. Currently, AlliedSignal is evaluating integrating FREPS with our existing steady flow solvers to bypass the SFLOW difficulties. ne TURBO-AE steady flow solution provided an excellent match with the AlliedSignal Engines calibrated DAWES 3-D viscous solver. Finally, the TURBO-AE unsteady analyses also matched experimental observations by predicting flutter for the single test case evaluated.
Author
Aeroelasticity; Computational Fluid Dynamics; Fan Blades; Performance Prediction; Evaluation; Computer Programs

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots. For related information see also 05 Aircraft Design, Testing and Performance.

19980210483 NASA Dryden Flight Research Center, Edwards, CA USA

Development and Flight Test of an Emergency Flight Control System Using Only Engine Thrust on an MD-11 Transport Airplane

Burcham, Frank W., Jr., NASA Dryden Flight Research Center, USA; Burken, John J., NASA Dryden Flight Research Center, USA; Maine, Trindel A., NASA Dryden Flight Research Center, USA; Fullerton, C. Gordon, NASA Dryden Flight Research Center, USA; Oct. 1997; 98p; In English

Contract(s)/Grant(s): RTOP 522-15-34

Report No.(s): NASA/TP-1997-206217; H-2170; NAS 1.60:206217; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

An emergency flight control system that uses only engine thrust, called the propulsion-controlled aircraft (PCA) system, was developed and flight tested on an MD-11 airplane. The PCA system is a thrust-only control system, which augments pilot flight-path and track commands with aircraft feedback parameters to control engine thrust. The PCA system was implemented on the MD-11 airplane using only software modifications to existing computers. Results of a 25-hr flight test show that the PCA system can be used to fly to an airport and safely land a transport airplane with an inoperative flight control system. In up-and-away operation, the PCA system served as an acceptable autopilot capable of extended flight over a range of speeds, altitudes, and configurations. PCA approaches, go-arounds, and three landings without the use of any normal flight controls were demonstrated, including ILS-coupled hands-off landings. PCA operation was used to recover from an upset condition. The PCA system was also tested at altitude with all three hydraulic systems turned off. This paper reviews the principles of throttles-only flight control, a history of accidents or incidents in which some or all flight controls were lost, the MD-11 airplane and its systems, PCA system development, operation, flight testing, and pilot comments.

Author

MD 11 Aircraft; Feedback Control; Flight Control; Thrust Control; Transport Aircraft; Emergencies

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands. For related information see also 14 Ground Support Systems and Facilities (Space).

19980206621 Los Alamos National Lab., NM USA

Megabar liner experiments on Pegasus 2

Lee, H., Los Alamos National Lab., USA; Bartsch, R. R., Los Alamos National Lab., USA; Bowers, R. L., Los Alamos National Lab., USA; 1997; 7p; In English; 11th; Pulsed Power Conference, 29 Jun. - 2 Jul. 1997, Baltimore, MD, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2412; CONF-9706113; DE97-008971; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Using pulsed power to implode a liner onto a target can produce high shock pressures for many interesting application experiments. With a Pegasus-2 facility in Los Alamos, a detailed theoretical analysis has indicated that the highest attainable pressure is around 2 Mbar for a best designed aluminum liner. Recently, an interesting composite liner design has been proposed which can boost the shock pressure performance by a factor 4 over the aluminum liner. This liner design was adopted in the first megabar (Megabar-1) liner experiment carried out on Pegasus last year to verify the design concept and to compare the effect of Rayleigh-Taylor instabilities on liner integrity with the code simulations. We present briefly the physical considerations to explain why the composite liner provides the best shock pressure performance. The theoretical modeling and performance of Megabar-1 liner are discussed. Also presented are the first experimental results and the liner design modification for our next experiment.

DOE

Linings; Aluminum; Pressure Gradients; Pulse Generators; Implosions; Shock Waves

19980209947 ESDU International Ltd., London, UK

Example of Statistical Techniques Applied to Analysis of Paved Runway Sizes (Bivariate Normal Distribution)

Sep. 1996; 16p; In English; Included in the Aircraft Performance Sub-series

Report No.(s): ESDU-96024; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96024 presents as an illustration of the use of the Bivariate Normal Distribution an analysis of data for the length and width of a sample of paved runways from two regions of the United States. The distribution of runways in terms of lengths and widths is of relevance to the operators of aircraft, for example in assessing the validity of airworthiness assumptions with respect to the probability of finding any particular width of runway. This can be relevant to the definition of minimum control speeds on the ground or the acceptable cross-wind limit. Transforms of the distributions of the length and width are found that are Normally distributed and simply correlated. The sample is then treated as a Bivariate Normal Distribution. The results are used, as an example, to assess the probabilities of runways being less than a particular length or width, or the probability that a runway of a particular width will be less than a particular length, or that a runway will be less than a particular width and length.

Author

Procedures; Runways; Statistical Analysis; Pavements; Data Structures

19980210390 Institute for Human Factors TNO, Soesterberg, Netherlands

Functional Simulator Requirements for the Chinook and the Cougar Transport Helicopters *Final Report Functionele simulatoreisen voor de Chinook en de Cougar transporthelikopters*

vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands; deVries, S. C., Institute for Human Factors TNO, Netherlands; Buitelaar, M., National Aerospace Lab., Netherlands; Ligthart, V., National Aerospace Lab., Netherlands; Brouwer, W., National Aerospace Lab., Netherlands; Roessingh, J. J. M., National Aerospace Lab., Netherlands; Verwey, W. B., Institute for Human Factors TNO, Netherlands; vanEmmerik, M. L., Institute for Human Factors TNO, Netherlands; Oct. 02, 1997; 96p; In English

Contract(s)/Grant(s): A95/KLu/357

Report No.(s): TNO-TM-97-A062; TD97-0245; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 DE Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

By the end of 1995 the Chinook CH-47D transport helicopter was introduced into the Royal Netherlands Air Force (RNLAF), In 1996 the AS 532 U2 Cougar MK2 transport helicopter has also entered service. Both helicopters are new to the RNLAF. The purpose of both helicopters is to provide the Dutch Airmobile Brigade with the required tactical mobility. It is the intention of the RNLAF to perform part of the helicopter-crew training in helicopter simulators. However, at the moment no specific plans exist delineating which part of the training should be done in a simulator. The RNLAF has commissioned the TNO Human Factors Research Institute and the National Aerospace Laboratory NLR to inventory and analyse the available information and to advise on the training and simulation requirements. In order to keep the choice of options as unrestricted as possible, a number of hierarchically layered training clusters has been specified, each leading to a specific simulator configuration. The training clusters range from simple and restricted to complex and comprehensive, where it is understood that each cluster includes all elements of its predecessors: (1) instrument-based procedural training; (2) procedure and simple maneuver training; (3) standard maneuver training and disturbances; (4) degraded mode maneuver training; (5) critical and sling maneuver training. Each of these clusters has been consecutively analysed with respect to its skill, cue, and simulation requirements according to a common systematic approach. In addition to the requirements that are associated with each of the training need clusters, requirements with respect to Night Vision Goggles (NVG) training and with respect to the Instructor Operator Station (IOS) have been specified. On the basis of the requirements that have been specified, cost assessments have been made. The report concludes with a number of recommendations with respect to the acquisition of the required training and simulation capability.

Author

Armed Forces; Training Simulators; CH-47 Helicopter; Functional Design Specifications; Goggles; Night Vision

19980210622 Institute for Human Factors TNO, Soesterberg, Netherlands

Low-Cost Simulators 1d: Generic Training Simulators for Military Applications *Interim Report Low-Cost Simulatoren 1d: Generieke Traingssimulatoren voor Militaire Toepassingen*

Korteling, J. E., Institute for Human Factors TNO, Netherlands; Helsdingen, A. S., Institute for Human Factors TNO, Netherlands; Dec. 30, 1997; 35p; In English

Contract(s)/Grant(s): A96/CO/363; Proj. 788.1

Report No.(s): TD97-0487; TM-97-A087; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kapmweg 5, 3769 De Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

To investigate the possibilities for application of low-cost simulators within military training courses, the research project called ELSTAR (European Low-cost Simulation Technology for the ARmed forces) is carried out under contract of the Ministries of Defence of the five participating countries of Research Technology Project (RTP) 11.8, viz. Belgium, France, Germany, Greece, and The Netherlands. In the first part of this investigation, i.e. workpackage la, a taxonomy constituting 100 military task domains (ELSTAR Taxonomy) was a.o. developed and these 1 00 domains were evaluated on 1 5 criteria relevant for low-cost simulator applications and R&D. This resulted in a concise set of 9 military training areas that represented 29 task domains that were selected for further study. These 9 training areas were then further investigated in workpackage lb and 1 c. This involved task- and cost-utility analyses on specific training courses that were considered representative for the 9 selected training areas. The present report describes the selection of 4 training areas out of these 9 training areas, and provides the global functional specifications of generic training simulators that could be applied in training programmes within these areas. This selection is based on scores on the ELSTAR taxonomy, the results of the task-, training-, and cost-utility analysis, and expert judgements on the generic value and complementarity of the knowledge that will be acquired. The results show that driver training, UAV crew training, infrared and image intensifier operation training, and mission management training will be most suitable for further research into the possibilities for the application of low-cost simulators. Functional specifications that are drawn up for training systems for these training areas, indicate the global simulator requirements and which task clusters may be simulated at low-cost. In subsequent workpackages, more detailed requirements for the selected training systems will be specified.

Author

Low Cost; Training Simulators; Cost Analysis; Education; Military Technology; Systems Simulation

19980210752 Fermi National Accelerator Lab., Batavia, IL USA

1400 Liter 1.8 K Test Facility

Peterson, T. J., Fermi National Accelerator Lab., USA; Rabehl, R. J., Fermi National Accelerator Lab., USA; Sylvester, C. D., Fermi National Accelerator Lab., USA; Aug. 1997; 10p; In English; Joint Cryogenic Engineering Conference and International Cryogenic Materials Conference, 27 Jul. - 1 Aug. 1997, Portland, OR, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/268; CONF-970758; DE97-054295; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A double bath superfluid helium dewar has been constructed and operated at Fermilab's Magnet Test Facility. The 1.8 K portion of the dewar is sized to contain a superconducting magnet up to 0.5 meters in diameter and 4 meters long in a vertical orientation in 0.12 MPa pressurized superfluid. The dewar can also provide a subcooled Helium I environment for tests; the entire temperature range from 4.4 K to 1. 8 K at 0.12 MPa is available. This paper describes the system design, lambda plate, heat exchanger, and performance.

DOE

Test Facilities; Environmental Tests; Heat Exchangers; Cryogenic Equipment; Design; Liquid Helium 2

13
ASTRODYNAMICS

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

19980210557 NASA Marshall Space Flight Center, Huntsville, AL USA

Interplanetary Mission Design Handbook: Earth-to-Mars Mission Opportunities and Mars-to-Earth Return Opportunities 2009-2024

George, L. E., Air Force Academy, USA; Kos, L. D., NASA Marshall Space Flight Center, USA; Jul. 1998; 162p; In English

Report No.(s): NASA/TM-1998-208533; M-881; NAS 1.15:208533; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This paper provides information for trajectory designers and mission planners to determine Earth-Mars and Mars-Earth mission opportunities for the years 2009-2024. These studies were performed in support of a human Mars mission scenario that will consist of two cargo launches followed by a piloted mission during the next opportunity approximately 2 years later. "Porkchop" plots defining all of these mission opportunities are provided which include departure energy, departure excess speed, departure declination arrival excess speed, and arrival declinations for the mission space surrounding each opportunity. These plots are intended to be directly applicable for the human Mars mission scenario described briefly herein. In addition, specific trajectories

and several alternate trajectories are recommended for each cargo and piloted opportunity. Finally, additional studies were performed to evaluate the effect of various thrust-to-weight ratios on gravity losses and total time-of-flight tradeoff, and the resultant propellant savings and are briefly summarized.
Author
Earth-Mars Trajectories; Trajectory Planning; Interplanetary Flight; Manned Space Flight; Mission Planning; Handbooks; Manned Mars Missions

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPAC

19980209733 Sverdrup Technology, Inc., Arnold AFS, TN USA
Experimentation Using the MIR Station as a Space Laboratory
Teslenko, V., RSC-Energia, Russia; Shvets, N., RSC-Energia, Russia; Karabadzhak, G. F., Central Research Inst. of Machine Building, Russia; Plastini, Yu., Central Research Inst. of Machine Building, Russia; Khmelinin, B., Central Research Inst. of Machine Building, Russia; Jan. 1998; 13p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA
Report No.(s): AD-A345778; AIAA-PAPER-98-0288; AIAA-PAPER-98-0288; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Collaboration is now underway to perform space-based experiments on the interactions of rocket plume exhausts and the ambient environment at an altitude of roughly 350 km. The key element in this experiment is the use of the Mir space station as a platform for optical instrumentation. A description is given of the modeling and instrumentation involved in the execution of this experiment, as well as a description of the experiment strategy and some experimental data already obtained. In particular, a hypothesized model of the OH(A-X) ultraviolet radiation is presented and evaluated.
DTIC
Mir Space Station; Ultraviolet Radiation; Plumes; Optical Measuring Instruments

15
LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles. For related information see also 20 Spacecraft Propulsion and Power.

19980210489 Communications Research Centre, Ottawa, Ontario Canada
ACCORD Broadband ATM Satellite Experiment (BASE): DS3 Ku-band channel
Labbe, Isabelle, Communications Research Centre, Canada; Gravel, Louis, Communications Research Centre, Canada; Nourry, Gerard, Communications Research Centre, Canada; Pike, Corey, Communications Research Centre, Canada; Butterworuth, John, Communications Research Centre, Canada; Bivens, Gretchen, Communications Research Centre, Canada; Spink, Brian, Communications Research Centre, Canada; Dec. 1997; 32p; In English
Report No.(s): AD-A346366; CRC-97-007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A Broadband ATM satellite Experiment (BASE) was carried out between the Communications Research Centre, Canada and Rome Laboratory, USA during the period of May 95 to March 96. The objective of the experiment was to perform a series of tests to characterize broadband ATM satellite bearers. This document reports on the first portion of the first phase of the experiment that was conducted in May 95 over the AnikE satellite (ku-band). Tests consisted in measurements of ATM Quality of Service (QoS) parameters such as Cell Loss Ratio (CLR) and Cell Error Ratio (CER) as a function of Bit Error Rate (BER). In this report, results are presented for two different modulations (QPSk and 8-PSK) and compared against theoretical curves. Results show good agreement with theory when PLCP framing is not mapped into DS-3 frames. The sub-channels have been found to be coherent with respect to each other. Experimental data further suggest that the broadband channel characteristics are similar to its embedded sub-channels. This implies that the characteristics of the sub-channels could be inferred from the broadband channel or that sub-channels results could be extrapolated to broadband channel results.
DTIC
Broadband; Artificial Satellites; Superhigh Frequencies; Telecommunication

16
SPACE TRANSPORTATION

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

19980209743 NASA Lewis Research Center, Cleveland, OH USA
Fire Safety in Extraterrestrial Environments
Friedman, Robert, NASA Lewis Research Center, USA; May 1998; 10p; In English; 6th; Exposition on Engineering, Construction, and Operations in Space, 26-30 Apr. 1998, Albuquerque, NM, USA; Sponsored by American Society of Civil Engineers, USA
Contract(s)/Grant(s): RTOP 962-22-00
Report No.(s): NASA/TM-1998-207417; NAS 1.15:207417; E-11171; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Despite rigorous fire-safety policies and practices, fire incidents are possible during lunar and Martian missions. Fire behavior and hence preventive and responsive safety actions in the missions are strongly influenced by the low-gravity environments in flight and on the planetary surfaces. This paper reviews the understanding and key issues of fire safety in the missions, stressing flame spread, fire detection, suppression, and combustion performance of propellants produced from Martian resources. Author

Fire Prevention; Safety; Extraterrestrial Environments; Procedures; Flame Propagation

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. 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.

19980206615 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
International Space Station: US Life-Cycle Funding Requirements. Report for Congressional Requesters
May 1998; 26p; In English
Report No.(s): GAO/NSIAD-98-147; B-279653; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA and its international partners-Japan, Canada, the European Space Agency, and Russia-are building the space station as permanently orbiting laboratory to conduct materials and life sciences research, earth observation and commercial utilization, and related uses under nearly weightless conditions. Each partner is providing station hardware and crew members and is expected to share operating cost and use of the station. The NASA space station program manager is responsible for the cost, schedule,and technical performance for the total program. The Boeing Corporation, the primer contractor, is responsible for development, integration, and on-orbit performance of the station. by the end of 1997, the USA and its partners had produced well over 358,000 pounds of space flight hardware, of which the prime contractor was responsible for about 260,000 pounds. Our report also noted that the program's funding reserves were limited and that the launch and assembly schedule would be difficult to achieve. Derived from text

Congressional Reports; International Space Station; Life Sciences; NASA Space Programs; Operating Costs; Schedules

19980209803 Communications Research Lab., Koganei, Japan
Optical Tracking Of Geostationary Satellites And Space Debris Using A Sensitive Ccd Camera
Arimoto, Yoshinori, Communications Research Lab., Japan; Takami, Hideki, Communications Research Lab., Japan; Hiromoto, Norihisa, Communications Research Lab., Japan; Sawada, Noritake, Communications Research Lab., Japan; Aruga, Tadashi, Communications Research Lab., Japan; Journal of the Communications Research Laboratory; Nov. 1994; ISSN 0914-9260; Volume 41, No. 3, pp. 195-207; In English; Copyright; Avail: Issuing Activity (Communications Research Laboratory, Ministry of Posts and Telecommunications, Nukui-Kitamachi, 4-chome, Koganei, Tokyo, 184 Japan), Hardcopy, Microfiche

This paper shows the results of a Communications Research Laboratory optical tracking experiment targeting geostationary satellites and space debris. This experiment used an optical tracking system consisting of a telescope 1.5 m in diameter and a sensitive CCD camera. Although tracking is presently limited to operational geostationary satellites, the technical feasibility of an operational debris tracking system is demonstrated by the geostationary satellite tracking experiment. The limiting magnitude of

the experimental system is about 19(sup m) when the integration time is 10 seconds and the tracking accuracy is 3-5 arc-seconds. These results are used to estimate the accuracy with which the orbit of the debris in a nearly geostationary orbit can be estimated, and it is shown that one night observation provides enough accuracy to continue the tracking of the debris. An operational system using a small aperture telescope and a highly sensitive CCD camera with a large format is also presented.
Author
CCD Cameras; Satellite Tracking; Optical Tracking; Space Debris; Synchronous Satellites; Image Processing

19980209858 Los Alamos National Lab., NM USA
Measurements of momentum transfer coefficients for H2, N2, CO and CO2 incident upon spacecraft surfaces
Cook, S. R., Los Alamos National Lab., USA; Hoffbauer, M. A., Los Alamos National Lab., USA; Jul. 16, 1997; 73p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2898; DE98-000885; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Measurements of momentum transfer coefficients were made for gas-surface interactions between the Space Shuttle reaction control jet plume gases and the solar panel array materials to be used on the International Space Station. Actual conditions were simulated using a supersonic nozzle source to produce beams of the gases with approximately the same average velocities as the gases have in the Shuttle plumes. Samples of the actual solar panel materials were mounted on a torsion balance that was used to measure the force exerted on the surfaces by the molecular beams. Measurements were made with H2, N2, CO, and CO2 incident upon the solar array material, Kapton, SiO2-coated Kapton, and Z93-coated Al. The measurements showed that molecules scatter from the surfaces more specularly as the angle of incidence increases and that scattering behavior has a strong dependence upon both the incident gas and velocity. These results show that for some technical surfaces the simple assumption of diffuse scattering with complete thermal accommodation is entirely inadequate. It is clear that additional measurements are required to produce models that more accurately describe the gas-surface interactions encountered in rarefied flow regimes.
DOE
Momentum Transfer; Coefficients; Hydrogen; Nitrogen; Carbon Dioxide; Incidence; Space Shuttles; Jet Control; Solar Arrays; Surface Reactions

19980210020 Sandia National Labs., Albuquerque, NM USA
TAOS/LS1 development ***Final Report***
Phipps, G. S., Sandia National Labs., USA; Gentry, S. M., Sandia National Labs., USA; Falls, J. M., Sandia National Labs., USA; Claassen, P. J., Sandia National Labs., USA; Alder, G. J., Sandia National Labs., USA; Dec. 1997; 98p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-1271; DE98-001737; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Laser Sensor No. 1 (LS1) is a system designed and built by Sandia to detect and report laser illumination of an orbiting satellite. It was launched March 1994 as part of the U.S. Air Force Phillips Laboratory, Technology for Autonomous Operational Survivability (TAOS) satellite program. The engineering details of the system are described in this report. Operation characteristics and results have been reserved for inclusion in a classified Air Force report prepared by the TAOS Program Office of Phillips Laboratory.
DOE
Autonomy; Lasers; Data Processing; Design Analysis; Laser Beams; Satellite Altimetry

19
SPACECRAFT INSTRUMENTATION

For related information see also 06 Aircraft Instrumentation and 35 Instrumentation and Photography.

19980209740 Canopus Systems, Inc., Ann Arbor, MI USA
OARE STS-87 (USMP-4) ***Final Report***
Rice, James E., Canopus Systems, Inc., USA; Jun. 1998; 28p; In English
Contract(s)/Grant(s): NAS3-26556; RTOP 963-60-0C
Report No.(s): NASA/CR-1998-207934; NAS 1.26:207934; E-11206; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report is organized into sections representing the phases of work performed in analyzing the STS-87 (USMP-4) results. Section 1 briefly outlines the OARE system features, coordinates, and measurement parameters. Section 2 describes the results from STS-87. The mission description, data calibration, and representative data obtained on STS-87 are presented. Finally, Section 3 presents a discussion of accuracy achieved and achievable with OARE. Appendix A discusses the calibration and data processing methodology in detail.
Author
Data Processing; Acceleration Measurement; Data Correlation; Accuracy; Procedures

20
SPACECRAFT PROPULSION AND POWER

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

19980206751 Sverdrup Technology, Inc., Arnold AFS, TN USA
Numerical Investigation of Twin-Nozzle Rocket Plume Phenomenology
Ebrahimi, Houshang B., Sverdrup Technology, Inc., USA; Levine, Jay, Phillips Lab., USA; Kawasaki, Alan, Sparta, Inc., USA; Jan. 1997; 12p; In English; 35th, 4-5 Jan. 1997, Reno, NV, USA
Report No.(s): AD-A345825; AIAA PAPER 97-0264; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Generalized Implicit Flow Solver (GIES) computer program, developed under sponsorship of the Air Force Phillips Laboratory, Edwards Air Force Base, CA, has been modified and used for three-dimensional reacting two-phase flow problems. The intent of the original GIFS development effort was to provide the JANNAF community with a standard computational methodology to simulate multiple nozzle/plume flow-field phenomena and other three-dimensional effects. Recent development efforts have concentrated on improving the run time and robustness of the algorithm. The GIFS computer program was originally released as an untested research version. Since that time, several corrections and enhancements have been made to the model. The Van Leer Flux Splitting option has been successfully implemented into the existing GIFS model and provides a more robust solution scheme. A Parabolized Navier-Stokes (PNS) version of the GIFS algorithm is currently under development and is intended to substantially improve the run-time requirements for flow fields dominated by supersonic flow regimes. These improvements and enhancements will foster the application of the GIFS model in the CFD community. This paper reports the significant results of several twin-nozzle/plume applications of the GIFS code. Six simulations of Titan II plume flow fields have been completed to assess the effects of three-dimensionality, turbulent viscosity, afterburning, near-field shock structure, finite-rate kinetic chemistry, intranozzle geometric spacing, and initial nozzle exit plane profile effects on the subsequent plume exhaust flow field. The results of these calculations indicate that the viscous stress model, kinetic chemistry, and nozzle exit profile are significant parameters that should be considered in analyses and interpretation of the calculations.
DTIC
Computational Fluid Dynamics; Exhaust Nozzles; Numerical Analysis; Plumes; Phenology; Rocket Vehicles; Exhaust Emission

19980206755 Arnold Engineering Development Center, Arnold AFS, TN USA
Numerical Investigation of Multi-Plume Rocket Phenomenology
Ebrahimi, Houshang B., Arnold Engineering Development Center, USA; Jul. 1997; 10p; In English; 33rd; Propulsion, 6-9 Jul. 1997, Seattle, WA, USA
Report No.(s): AD-A345900; AIAA Paper 97-2942; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Generalized Implicit Flow Solver (GIFS) computer program has been modified and used for three-dimensional reacting two-phase flow problems. The intent of the original GIFS development effort was to provide the JANNAF community with a standard computational methodology to simulate multiple nozzle/plume flow-field phenomena and other three-dimensional effects. Recent development efforts have concentrated on improving the run time and robustness of the algorithm. The GIFS computer program was originally released as an untested research version. Since that time, several corrections and enhancements have been made to the model. The Van Leer Flux Splitting option has been successfully implemented into the existing GIFS model and provides a more robust solution scheme, A Parabolized Navier-Stokes (PNS) version of the GIFS algorithm is currently under development and is intended to substantially improve the run-time requirements for flow fields dominated by supersonic flow regimes. This paper reports the significant results of several applications of the GIFS model. Specifically, three separate 3D calculations of the Minuteman III first and third stage solid rocket motors with and without the base region were completed to assess the effect of the base in multiple nozzle/plume flow-field simulations. One additional 2D and two 3D calculations simulating the

exhaust flow field of the Titan and the generic Ariane were completed to determine the three-dimensional effects and the impact of the single equivalent nozzle assumption in these flow environments. The results of these calculations indicate that the base region effect is significant for up to 14 nozzle exit diameters in axial plume length. In addition, three-dimensional effects are important in the plume near-field domain, and the equivalent single nozzle assumption is shown to be inaccurate in this region.
DTIC
Numerical Analysis; Phenomenology; Computer Programs; Computational Fluid Dynamics

19980209676 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Report to the Honorable Barbara Boxer, US Senate. Space Exploration: Power Sources for Deep Space Probes
May 1998; 20p; In English
Report No.(s): GAO/NSIAD-98-102; B-279348; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Cassini Program, sponsored by NASA, the European Space Agency, and Background the Italian Space Agency, began in fiscal year 1990. NASA's Jet Propulsion Laboratory (JPL), which is operated under contract by the California Institute of Technology, manages the Cassini Program. The spacecraft is expected to arrive at Saturn in July 2004 and begin a 4-year period of scientific observations to obtain detailed information about the composition and behavior of Saturn and its atmosphere, magnetic field, rings, and moons. Power for the Cassini spacecraft is generated by three Radioisotope Thermoelectric Generators (RTG) that convert heat from the natural radioactive decay of plutonium dioxide into electricity. The spacecraft also uses 117 radioisotope heater units to provide heat for spacecraft components. The spacecraft carries 72 pounds of radioactive plutonium dioxide in the RTGs and 0.7 pounds in the heater units. The Department of Energy (DOE) provided the RTGs and their plutonium dioxide fuel, and the Department of Defense (DOD) provided the Titan IV/Centaur rocket to launch the spacecraft.
Derived from text
Congressional Reports; Space Exploration; Electric Power Supplies; Deep Space; Cassini Mission; Thermoelectric Generators; Space Probes

19980209795 Sverdrup Technology, Inc., Arnold AFS, TN USA
Laser-Induced Fluorescence Measurements of OMS and LR91 Amine Rocket Exhausts
Brasier, C. W., Sverdrup Technology, Inc., USA; Drakes, J. A., Sverdrup Technology, Inc., USA; Anspach, K. M., Sverdrup Technology, Inc., USA; Porter, R. G., Sverdrup Technology, Inc., USA; Simmons, M. A., Sverdrup Technology, Inc., USA; Pruitt, D. W., Sverdrup Technology, Inc., USA; Jun. 1997; 17p; In English; Plasmadynamics and Lasers Meeting, 23-25 Jun. 1997, Atlanta, GA, USA
Report No.(s): AD-A345782; AIAA Paper 97-2378; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nonintrusive diagnostics are often sought to provide information on combustion exhaust flows due to the harsh environment of the flow. Laser-induced fluorescence (LIF) is one technique in which a chosen flow molecule or marker is probed to yield gross flow properties such as static temperature and flow velocities. The work presented herein describes application of LIF to the combustion exhausts of two full-scale liquid-propellant rocket engines, i.e., the Space Shuttle Orbital Maneuvering System (OMS) and the Titan second-stage LR91 rocket engines, as they undergo routine testing in simulated altitude test cells. The method is based upon the use of CW ring-dye lasers which scan in frequency over either the Na D1 or D2 line at 5896 and 5890 L'. Na is used as a basis for this approach since it occurs as a trace element in both hydrogen and amine rocket fuels. The generic apparatus is described, including a discussion of the collection and interpretation of the LIF signal to yield radial and temporal profiles of radial flow velocity and static temperature. CFD modeling of the plumes was used to provide baseline estimates of the exhaust flow properties. It was found that the CFD model does a fairly good job of predicting the gross behavior of the flow, although some items of fine spatial structure are not reproduced well. The OMS and LR91 rocket engine nozzles are drastically different in construction and cooling method. It was found that excellent LIF results were obtained with the radiation-cooled nozzle (OMS), while the fuel-film cooling (FFC) used for the LR91 nozzle generated an optically thick and particle-laden region which severely impeded the determination of static temperature from the Na LIF measurements. Ancillary optical scattering measurements were made on the LR91 which indicated the existence of an annulus of particles in the flow periphery.
DTIC
Laser Induced Fluorescence; Rocket Exhaust; Orbital Maneuvers; Charge Flow Devices; Orbital Maneuvering Vehicles; Titan 4 Launch Vehicle; Liquid Propellant Rocket Engines

19980209999 Oak Ridge National Lab., TN USA
Nuclear modules for space electric propulsion
Difilippo, F. C., Oak Ridge National Lab., USA; 1998; 7p; In English; Space Technology and Applications International Forum, 25-29 Jan. 1998, Albuquerque, NM, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-980103-1; DE97-009366; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Analysis of interplanetary cargo and piloted missions requires calculations of the performances and masses of subsystems to be integrated in a final design. In a preliminary and scoping stage the designer needs to evaluate options iteratively by using fast computer simulations. The Oak Ridge National Laboratory (ORNL) has been involved in the development of models and calculational procedures for the analysis (neutronic and thermal hydraulic) of power sources for nuclear electric propulsion. The nuclear modules will be integrated into the whole simulation of the nuclear electric propulsion system. The vehicles use either a Brayton direct-conversion cycle, using the heated helium from a NERVA-type reactor, or a potassium Rankine cycle, with the working fluid heated on the secondary side of a heat exchanger and lithium on the primary side coming from a fast reactor. Given a set of input conditions, the codes calculate composition. dimensions, volumes, and masses of the core, reflector, control system, pressure vessel, neutron and gamma shields, as well as the thermal hydraulic conditions of the coolant, clad and fuel. Input conditions are power, core life, pressure and temperature of the coolant at the inlet of the core, either the temperature of the coolant at the outlet of the core or the coolant mass flow and the fluences and integrated doses at the cargo area. Using state-of-the-art neutron cross sections and transport codes, a database was created for the neutronic performance of both reactor designs. The free parameters of the models are the moderator/fuel mass ratio for the NERVA reactor and the enrichment and the pitch of the lattice for the fast reactor. Reactivity and energy balance equations are simultaneously solved to find the reactor design. Thermalhydraulic conditions are calculated by solving the one-dimensional versions of the equations of conservation of mass, energy, and momentum with compressible flow.

DOE

Computerized Simulation; Fast Nuclear Reactors; Shielding; Thermal Analysis; Lithium Cooled Reactor Experiment; Hydraulic Fluids

19980210005 NASA Lewis Research Center, Cleveland, OH USA

RHETT/EPDM Performance Characterization

Haag, T., NASA Lewis Research Center, USA; Osborn, M., Naval Research Lab., USA; Jun. 1998; 12p; In English; 25th; International Electric Propulsion Conference, 24-28 Aug. 1997, Cleveland, OH, USA; Sponsored by Electric Rocket Propulsion Society, USA

Contract(s)/Grant(s): RTOP 632-1B-1B

Report No.(s): NASA/TM-1998-206222; NAS 1.15:206222; E-10958; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The 0.6 kW Electric Propulsion Demonstration Module (EPDM) flight thruster system was tested in a large vacuum facility for performance measurements and functional checkout. The thruster was operated at a xenon flow rate of 3.01 mg/s, which was supplied through a self-contained propellant system. All power was provided through a flight-packaged power processing unit, which was mounted in vacuum on a cold plate. The thruster was cycled through 34 individual startup and shutdown sequences. Operating periods ranged from 3 to 3600 seconds. The system responded promptly to each command sequence and there were no involuntary shutdowns. Direct thrust measurements indicated that steady state thrust was temperature sensitive, and varied from a high of 41.7 mN at 16 C, to a low of 34.8 mN at 110 C. Short duration thruster firings showed rapid response and good repeatability.

Author

Thrust Measurement; Thrustors; Models; Performance Tests

19980210253 Los Alamos National Lab., NM USA

Light-weight radioisotope heater impact tests

Reimus, M. A. H., Los Alamos National Lab., USA; Rinehart, G. H., Los Alamos National Lab., USA; Herrera, A., Los Alamos National Lab., USA; 1998; 9p; In English; Space Technology and Applications International Forum, 25 - 29 Jan. 1998, Albuquerque, NM, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3390; CONF-980103; DE98-001474; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The light-weight radioisotope heater unit (LWRHU) is a Pu-238O2-fueled heat source designed to provide one thermal watt in each of various locations on a spacecraft. Los Alamos National Laboratory designed, fabricated, and safety tested the LWRHU. The heat source consists of a hot-pressed Pu-238O2 fuel pellet, a Pt-30Rh vented capsule, a pyrolytic graphite insulator, and a fineweave-pierced fabric graphite aeroshell assembly. to compare the performance of the LWRHUs fabricated for the Cassini mis-

sion with the performance of those fabricated for the Galileo mission, and to determine a failure threshold, two types of impact tests were conducted. A post-reentry impact test was performed on one of 180 flight-quality units produced for the Cassini mission and a series of sequential impact tests using simulant-fueled LWRHU capsules were conducted respectively. The results showed that deformation and fuel containment of the impacted Cassini LWRHU was similar to that of a previously tested Galileo LWRHU. Both units sustained minimal deformation of the aeroshell and fueled capsule; the fuel was entirely contained by the platinum capsule. Sequential impacting, in both end-on and side-on orientations, resulted in increased damage with each subsequent impact. Sequential impacting of the LWRHU appears to result in slightly greater damage than a single impact at the final impact velocity of 50 m/s.
DOE
Impact Tests; Radioisotope Batteries; Evaluation; Deformation; Reentry

19980210302 Department of the Navy, Washington, DC USA
Portable Launcher
Yagla, Jon J., Inventor, Department of the Navy, USA; Miller, Robert E., Jr., Inventor, Department of the Navy, USA; Lowery, Robert W., Inventor, Department of the Navy, USA; Powers, John W., Inventor, Department of the Navy, USA; Apr. 30, 1998; 33p; In English
Patent Info.: Filed 30 Apr. 1998
Report No.(s): AD-D018884; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A launcher is disclosed having means for directing and concentrically spreading, as well as dispersing, exhaust gases created by an internal combustion of an object, such as a missile, that is operatively launch able therefrom. The concentric duct provides the directing, spreading and dispersing means and cooperates with a cup having means to arrange a port in operative relationship with an exhaust outlet of the object being launched. The cup which mates with the concentric duct has one of its ends open to the ambient so that the exhaust gases are lead into and out of the concentric duct so as to be concentrically dispersed into the atmosphere.
DTIC
Launchers; Launching; Spreading; Dispersing; Exhaust Gases; Combustion; Missiles; Portable Equipment

19980210311 Los Alamos National Lab., NM USA
Reducing the risk to Mars: The gas core nuclear rocket
Howe, S. D., Los Alamos National Lab., USA; DeVolder, B., Los Alamos National Lab., USA; Thode, L., Los Alamos National Lab., USA; Zerkle, D., Los Alamos National Lab., USA; 1998; 7p; In English; Space Technology and Applications International Forum, 25 - 29 Jan. 1998, Albuquerque, NM, USA
Contract(s)/Grant(s): W-7405-ENG-36; NASA Order H-28025-D
Report No.(s): LA-UR-97-3361; CONF-980103; DE98-001449; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche
The next giant leap for mankind will be the human exploration of Mars. Almost certainly within the next thirty years, a human crew will brave the isolation, the radiation, and the lack of gravity to walk on and explore the Red planet. However, because the mission distances and duration will be hundreds of times greater than the lunar missions, a human crew will face much greater obstacles and a higher risk than those experienced during the Apollo program. A single solution to many of these obstacles is to dramatically decrease the mission duration by developing a high performance propulsion system. The gas-core nuclear rocket (GCNR) has the potential to be such a system. The authors have completed a comparative study of the potential impact that a GCNR could have on a manned Mars mission. The total IMLEO, transit times, and accumulated radiation dose to the crew will be compared with the NASA Design Reference Missions.
DOE
Risk; Manned Mars Missions; Space Flight; Rocket Flight; Mars (Planet)

19980210501 NASA Dryden Flight Research Center, Edwards, CA USA
Linear Aerospike SR-71 Experiment (LASRE): Aerospace Propulsion Hazard Mitigation Systems
Mizukami, Masashi, NASA Dryden Flight Research Center, USA; Corpening, Griffin P., NASA Dryden Flight Research Center, USA; Ray, Ronald J., NASA Dryden Flight Research Center, USA; Hass, Neal, NASA Dryden Flight Research Center, USA; Ennix, Kimberly A., NASA Dryden Flight Research Center, USA; Lazaroff, Scott M., NASA Johnson Space Center, USA; Jul. 1998; 1p; In English; 34th; Joint Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 242-33-02-00-33

Report No.(s): NASA/TM-1998-206561; H-2268; NAS 1.15:206561; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A major hazard posed by the propulsion system of hypersonic and space vehicles is the possibility of fire or explosion in the vehicle environment. The hazard is mitigated by minimizing or detecting, in the vehicle environment, the three ingredients essential to producing fire: fuel, oxidizer, and an ignition source. The Linear Aerospike SR-71 Experiment (LASRE) consisted of a linear aerospike rocket engine integrated into one-half of an X-33-like lifting body shape, carried on top of an SR-71 aircraft. Gaseous hydrogen and liquid oxygen were used as propellants. Although LASRE is a one-of-a-kind experimental system, it must be rated for piloted flight, so this test presented a unique challenge. To help meet safety requirements, the following propulsion hazard mitigation systems were incorporated into the experiment: pod inert purge, oxygen sensors, a hydrogen leak detection algorithm, hydrogen sensors, fire detection and pod temperature thermocouples, water misting, and control room displays. These systems are described, and their development discussed. Analyses, ground test, and flight test results are presented, as are findings and lessons learned.

Author

Aerospike Engines; SR-71 Aircraft; Spacecraft Propulsion; Propulsion System Performance; Propulsion System Configurations; Liquid Oxygen; Lifting Bodies; Hypersonic Vehicles; Flight Tests

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CHEMISTRY AND MATERIALS (GENERAL)

19980206497 Oak Ridge National Lab., TN USA

Heat capacity of solid proteins by thermal analysis

Zhang, Ge, Oak Ridge National Lab., USA; Wunderlich, B., Oak Ridge National Lab., USA; 1997; 9p; In English, 7-9 Sep. 1997, Washington, DC, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464; NSF DMR-97-03692

Report No.(s): ORNL/CP-95001; CONF-9709121; DE98-001070; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In a continuing effort to better understand the thermodynamic properties of proteins, solid state heat capacities of poly(amino acid)s of all 21 naturally occurring amino 4 copoly(amino acid)s and about 10 proteins have been analyzed by now using the Advanced Thermal Analysis System, ATHAS. The experimental measurements were performed with adiabatic and differential scanning calorimetry from 10 to about 450 K. The heat capacities of the samples in their pure, solid states are linked to an approximate vibrational spectrum by making use of known group vibrations and a set of parameters, Theta(1) and Theta(3), of the Tarasov function for the skeletal vibrations. Good agreement is found between experiment and calculation with root mean square errors mostly within +/- 3%. The experimental data were analyzed also with an empirical addition scheme using data for the poly(amino acid)s. Based on this study, vibrational heat capacity can now be predicted for all proteins with an accuracy comparable to common experiments. Furthermore, gradual transitions, indicative of molecular motion prior to devitrification, melting, or decomposition, can be identified. The new experimental data compared here with the prior samples are: bovine beta-lactoglobulin, chicken lysozyme, and ovalbumin.

DOE

Proteins; Thermal Analysis; Specific Heat; Decomposition; Heat Measurement

19980206609 Sandia National Labs., Albuquerque, NM USA

Characterization of aging in organic materials on atomic-, meso- and macro-length scales by C-13 NMR spectroscopy

Assink, R. A., Sandia National Labs., USA; Jamison, G. M., Sandia National Labs., USA; Alam, T. M., Sandia National Labs., USA; Gillen, K. T., Sandia National Labs., USA; [1997]; 4p; In English; 21st; Aging, Compatibility, and Stockpile Stewardship, 30 Sep. - 2 Oct. 1997, Albuquerque, NM, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2065C; CONF-970982; DE98-000213; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A fundamental understanding of aging in an organic material requires that one understand how aging affects the chemical structure of a material, and how these chemical changes are related to the material's macroscopic properties. This level of understanding is usually achieved by examining the material on a variety of length scales ranging from atomic to meso-scale to macroscopic. The authors are developing and applying several C-13 nuclear magnetic resonance (NMR) spectroscopy experiments to

characterize the aging process of organic materials over a broad range of length scales. Examples of studies which range from atomic to macroscopic will be presented.
DOE
Aging (Materials); Organic Materials; Spectroscopy; Nuclear Magnetic Resonance; Chemical Composition

19980209946 ESDU International Ltd., London, UK
Thermal Conductivity of Branched Chain Liquid Aliphatic Esters
Oct. 1996; 78p; In English; Included in the Physical Data, Chemical Engineering Sub-series
Report No.(s): ESDU-96023; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96023 gives data for 61 compounds. Experimental results drawn from the literature for each compound were fitted with a four-term polynomial equation in reduced temperature. The coefficients were also faired with changing molecular structure to ensure the best correlation not only for the individual compounds but also as members of their chemical series. The coefficient correlations also allowed values to be predicted for compounds for which no measured data exist. The equations were used to tabulate thermal conductivity values from the melting point to about 0.9 critical temperature in SI units at 10 K and 10 degree Celsius intervals. The critical point, coefficients and sources of the data are given for each compound. The effect of pressure is briefly considered and the likely accuracy of the tabulated values is discussed.
Author
Thermal Conductivity; Esters; Data Acquisition; Experimentation; Molecular Structure

19980210084 ESDU International Ltd., London, UK
Viscosity of Liquids. Straight Chain Aliphatic Esters
Nov. 1996; 130p; In English; Included in the Physical Data, Chemical Engineering Sub-series
Report No.(s): ESDU-96020; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96020 tabulates the viscosity of 95 esters at saturation pressure for temperatures from just above the melting point to approximately 0.9 of the critical temperature. Experimental data extracted from the literature were fitted by an equation for the logarithm of dynamic viscosity as a function of reduced temperature. The equation contains four constants and the values determined for them from the correlation are tabulated for each compound. Viscosities are given at 10 K and 10 C intervals, together with an assessment of the uncertainty in each value. The sources of the data for each compound are listed, and the critical temperature is given. It is noted that viscosity increases by 1% for a pressure increase of 10 bar, and an equation is suggested for calculating the effect of pressure up to 500 bar.
Author
Viscosity; Liquids; Esters; Logarithms

19980210085 ESDU International Ltd., London, UK
Vapour Pressures and Critical Points of Liquids. Esters of Monobasic Acids, 2, Branched Chain Alkyl Alkanoates
Sep. 1996; 88p; In English; Included in the Physical Data, Chemical Engineering Sub-series
Report No.(s): ESDU-96021; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96021 presents vapour pressure data for 41 esters from C4 to C10 obtained by a critical evaluation of experimental results in the literature. The limited data available were extrapolated using a correlation developed relating the behaviour of the coefficients of the Wagner equation to the behaviour of the ideal gas and liquid heat capacities. The Wagner equation was fitted to the data from the melting point to close to the critical point (except for some compounds for which it was cut off around 0.9 critical) and the coefficients are given for each compound. Two tables of vapour pressure calculated using the equation are given: one in SI units at 5 K intervals and one in mm Hg or atmospheres at 5 C intervals. A table also gives saturation temperatures at various specified pressures and indicates the possible uncertainty in the calculated values. Values of acentric factor, normal melting and boiling points, and the slope of the saturation temperature versus vapour pressure curve at the normal boiling point are also given together with a list of the sources of data for each compound. Density data for the compounds are given in ESDU 96022 and the choice of critical point values gave the best correlation for both properties.
Author
Vapor Pressure; Critical Point; Liquids; Esters

19980210215 Department of the Navy, Washington, DC USA

Nanoparticle Phosphors Manufactured Using the Bicontinuous Cubic Phase Process

Yang, Jianping, Inventor, Department of the Navy, USA; Gray, Henry F., Inventor, Department of the Navy, USA; Ratna, Banahalli, Inventor, Department of the Navy, USA; Hsu, David S., Inventor, Department of the Navy, USA; Nov. 18, 1997; 16p; In English
Patent Info.: Filed 18 Nov. 1997; US-Patent-Appl-SN-972,402
Report No.(s): AD-D018859; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

Nanocrystalline phosphors are formed within a bicontinuous cubic phase. Accordingly, it is an object of the present invention to provide phosphors having a high light output level. It is another object of the present invention to provide nanocrystalline phosphors that have no or few bulk defects. These and additional objects of the invention are accomplished by forming doped nanocrystalline semiconductor particles within the mesoporous cavities of a bicontinuous cubic phase. The cavities contain at least one of the reactants required to form the semiconductor compound. Any other required reactants are diffused into the mesoporous cavities. Doped nanocrystals are produced by diffusing dopant or activation ions into the mesoporous cavities along with the other reactants or by including dopant or activation ions within the mesoporous cavities of the BCP under conditions such that the nanoparticles are doped with an average of one or less dopant ions per particle. For the purposes of the present specification and claims, the words 'dopant' and 'activator' are used interchangeably to describe the ion that, when placed within the interior of a nanocrystalline particle, provides the particles with phosphorescence.

DTIC

Nanocrystals; Semiconductors (Materials); Phosphorescence; Diffusion; Cavities

19980210224 ESDU International Ltd., London, UK

Orthobaric Densities and Molar Volumes of Liquids. Esters of Monobasic Acids, 2, Branched Chain Alkyl Alkanoates

Oct. 1996; 78p; In English; Included in the Physical Data, Chemical Engineering Sub-series
Report No.(s): ESDU-96022; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96022 tabulates from near the melting point to the critical point density in kg/cu m at 5 C intervals and molar volumes in cu cm/mol at 5 K intervals for 37 esters from C4 to CI0. For a few compounds the correlation is stopped at around 0.95 critical. Another table gives at specified Celsius temperatures the density, molar volume and their derivatives with respect to temperature. The critical density was calculated using the Rackett and Riedel equations, which were in close agreement, and critical temperature and pressure were adjusted to give the best correlation of experimental results extracted from the literature for both the density data given here and the vapour pressure data given for these compounds in ESDU 96021. The equation used to fit the density data related reduced density to a polynomial in reduced temperature. The coefficients in the equation are given for each compound together with estimates of the accuracy of the predictions using them and a list of sources of data used. Values at the critical point are also given together with normal boiling and melting points.

Author

Density (Mass/Volume); Esters; Liquids; Acids; Melting Points

19980210229 ESDU International Ltd., London, UK

Thermal Conductivity of Straight Chain Liquid Aliphatic Esters

Sep. 1996; 160p; In English; Included in the Physical Data, Chemical Engineering Sub-series
Report No.(s): ESDU-96018; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96018 gives data for 136 compounds. Experimental results drawn from the literature for each compound were fitted with a four-term polynomial equation in reduced temperature. The coefficients were also faired with changing molecular structure to ensure the best correlation not only for the individual compounds but also as members of their chemical series. The coefficient correlations also allowed values to be predicted for compounds for which no measured data exist. The equations were used to tabulate thermal conductivity values from the melting point to about 0.9 critical temperature in SI units at 10 K and 10 degree Celsius intervals. The critical point, coefficients and sources of the data are given for each compound. The effect of pressure is briefly considered and the likely accuracy of the tabulated values is discussed.

Author

Thermal Conductivity; Esters; Data Acquisition; Polynomials; Coefficients

19980210230 ESDU International Ltd., London, UK

Thermal Conductivity of Gaseous Aliphatic Esters

Oct. 1996; 57p; In English; Included in the Physical Data, Chemical Engineering Sub-series

Report No.(s): ESDU-96019; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96019 uses a third-order polynomial in reduced temperature to correlate data extracted from the literature for 44 compounds. The range is from below the boiling point to 700 K A prediction procedure based on similarity with the corresponding alkanes was used both to correlate and to extend the available information, and values were confirmed by an alternative method used in earlier ESDU documents. The coefficients of the equation are given for each compound, and the equation is used to tabulate thermal conductivity in SI units at both 20 K and 20 degree Celsius intervals. The sources of data used for each compound are listed and values that involve extrapolation of the available data are indicated. The likely accuracy of the values quoted is discussed and the effect of pressure on thermal conductivity is briefly considered.
Author

Thermal Conductivity; Esters; Data Reduction; Polynomials; Alkanes; Coefficients

19980210232 ESDU International Ltd., London, UK

Thermal Conductivity of Liquid Aliphatic Aldehydes and Ketones

Jun. 1997; 103p; In English; Supersedes ESDU-80014. Included in the Physical Data, Chemical Engineering Sub-series
Report No.(s): ESDU-97008; ESDU-80014; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97008 gives data for 17 alkyl aldehydes, 71 alkyl ketones and 5 other aldehydes and ketones. Experimental results drawn from the literature for each compound were fitted with a fourteen polynomial equation in reduced temperature. The coefficients were also faired with changing molecular structure to ensure the best correlation not only for the individual compounds but also as members of their chemical series. The coefficient correlations also allowed values to be predicted for compounds for which no measured data exist. The equations were used to tabulate thermal conductivity values from the melting point to about 0.9 critical temperature in SI units at 10 K and 10 degree Celsius intervals. The likely uncertainties at various temperatures are assessed and are indicated in the tables. The critical point, coefficients and sources of the data are given for each compound. The effect of pressure is briefly considered.
Author

Aldehydes; Ketones; Thermal Conductivity; Data Acquisition; Data Structures; Pressure Effects

19980210288 NASA Lewis Research Center, Cleveland, OH USA

Preliminary Tuft Testing of Metallic Bristles Versus PS212, PS300, and HVOF300

Fellenstein, James A., Ohio Aerospace Inst., USA; DellaCorte, Christopher, NASA Lewis Research Center, USA; Jun. 1998; 8p; In English, 17-21 May 1998, Detroit, MI, USA; Sponsored by Society of Tribologists and Lubrication Engineers, USA
Contract(s)/Grant(s): NCC3-440; RTOP 523-22-13
Report No.(s): NASA-TM-107522; NAS 1.15:107522; E-10835; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Turbine engine brush seals are designed with sacrificial brushes and hard shaft coatings to minimize shaft wear and reduce the cost of engine overhauls. Replacing a worm seal is more cost and time effective than refinishing an engine shaft. However, this tribological design causes excessive brush wear and reduces long term seal efficiency. An alternative approach is to coat the shaft with a solid lubricant and allow the bristles to wear into the shaft coating similar to traditional abradable labyrinth seals. This approach can result in reduced seal leakage by forcing the leakage to flow through the seal bristle pack or through a more tortuous shaft wear track. Key to this approach is limiting the shaft wear to an acceptable level were surface refinishing would not be required during every engine overhaul. Included in this paper are brush seal tuft test results for four metallic bristles (nickel-chrome or cobalt-chrome based superalloys) tested against three solid lubricant coatings (NASA's PS212, PS300, and HVOF300). These test results are also compared to previous baseline tests conducted with plasma sprayed chrome carbide. Compared to the baseline results, no tribological benefit was achieved with the metallic bristle/solid lubricant tribopairs tested. to improve the performance of the solid lubricant coatings, issues regarding lubricant phase sizes (homogeneity), and composition need to be addressed.
Author

Turbine Engines; Brush Seals; Coating; Heat Resistant Alloys; Abrasion

19980210289 NASA Lewis Research Center, Cleveland, OH USA

Evaluation of Advanced Solid Lubricant Coatings for Foil Air Bearings Operating at 25 and 500 C

DellaCorte, Christopher, NASA Lewis Research Center, USA; Fellenstein, James A., Ohio Aerospace Inst., USA; Benoy, Patricia A., Saint Louis Univ., USA; Jun. 1998; 14p; In English; 1998 International Tribology Conference and Exposition, 25-29 Oct. 1998, Toronto, Canada; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): NCC3-440; NCC3-330; RTOP 523-22-13
Report No.(s): NASA/TM-1998-206619; NAS 1.15:206619; E-11053; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The tribological properties of one chrome oxide and one chrome carbide based solid lubricant coating were evaluated in a partial-arc foil bearing at 25 and 500 C. Start/stop bearing operation up to 20,000 cycles were run under 10 kPa (1.5 psi) static deadweight load. Bearing friction (torque) was measured during the test. Specimen wear and SEM/EDS surface analyses were conducted after testing to understand and elucidate the tribological characteristics observed. The chrome oxide coating which contains both (Ag) and (BaF2/CaF2) for low and high temperature lubrication, exhibited low friction in sliding against Al2O3 coated foils at 25 and 500 C. The chrome carbide coating, which lacked a low temperature lubricant but contained BaF2/CaF2 as a high temperature lubricant, exhibited high friction at 25 C and low friction at 500 C against both bare and Al2O3 coated superalloy foil surfaces. Post test surface analyses suggest that improved tribological performance is exhibited when a lubricant film from the coating transfers to the foil surface.
Author
Evaluation; Solid Lubricants; Coatings; Foil Bearings; Temperature Gradients; Chromium Oxides; Carbides

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COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials. For ceramic materials see 27 Nonmetallic Materials.

19980206546 Los Alamos National Lab., Manuel Lujan Jr. Neutron Scattering Center, NM USA
Texture and residual strain in SiC/Ti-6-2-4-2 titanium matrix composites
Rangaswamy, P., Los Alamos National Lab., USA; Bennett, K., Los Alamos National Lab., USA; Bourke, M. A. M., Los Alamos National Lab., USA; Dreele, R. von, Los Alamos National Lab., USA; Roberts, J. A., Los Alamos National Lab., USA; Jayaraman, N., Cincinnati Univ., USA; [1997]; 17p; In English; 5th; Residual Stresses, 16 - 18 Jun. 1997, Linkoping, Sweden
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2954; CONF-970691; DE98-001154; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Residual strain and texture variations were measured in two Titanium matrix composites reinforced with Silicon Carbide fibers (Ti/SiC) having the same composition but fabricated by dramatically different processing routes. In both specimens the Titanium matrix comprised an (alpha)/(beta) alloy (Ti-6242) containing approximately 35% by volume of continuous SiC fibers. In one case the matrix was produced by a plasma spray (PS) route and the other by a Wire Drawing (WD) process. The resulting textures in the matrix differ significantly, from approximately random for the PS matrix to 6.25X random in the WD matrix. No significant differences in matrix residual strains between the composites prepared by the two procedures were noted. Plane-specific elastic moduli, measured in load tests on the unreinforced matrices also showed little difference.
DOE
Silicon Carbides; Titanium; Matrix Materials; Strain Rate; Composite Materials

19980206574 Oak Ridge National Lab., TN USA
Attempt to control the interfacial strength
Schneibel, J. H., Oak Ridge National Lab., USA; Subramanian, R., Westinghouse Power Generation, USA; 1997; 7p; In English; Materials Week '97, 14 - 18 Sep. 1997, Indianapolis, IN, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-94919; CONF-970980-; DE98-001060; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Composites consisting of a B2 iron aluminide matrix and 40 vol.% of TiB2 particles were processed by liquid phase sintering. In order to encourage segregation of B or Ti at the FeAl/TiB2 interfaces, the iron aluminide matrix was microalloyed with B or Ti, respectively. Additions of Ti degraded the mechanical properties. However, for composites microalloyed with B, room temperature flexure tests show slight increases in the maximum strength (from 1250 to 1380 MPa) and the fracture toughness. Interfacial segregation of B may have contributed to this result. Significantly improved processing of the composites would be required in order to verify the effect of B conclusively.
DOE
Aluminides; Fracture Strength; Iron; Liquid Phase Sintering

19980206688 Naval Postgraduate School, Dept. of Mechanical Engineering, Monterey, CA USA

Evaluation of Microstructure of a 6092 Al-17.5 Volume Percent SiC Particle Reinforced Composite Using Electron Backscatter Pattern (EBSP) Analysis Methods

Markovich, John J., Naval Postgraduate School, USA; Mar. 1998; 79p; In English

Report No.(s): AD-A343695; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Microtexture and grain boundary misorientation data were obtained for a 6092 Al-17.5 volume percent SiC particle reinforced material as a function of processing history. Computer aided electron backscatter pattern (EBSP) analysis methods in a scanning electron microscope were used to obtain grain-specific orientation measurements by traversing along a pattern of lines on the surface of a metallographic sample. As part of this project, it was necessary to develop ion milling methods to obtain a sufficiently strain free condition of the aluminum matrix to allow diffraction patterns to be obtained. These methods were applied to samples extruded at various strain rates and processing temperatures; the data revealed that recrystallization had occurred at all processing conditions. Analysis of crystal orientations and grain-to-grain misorientation data revealed random distributions consistent with predictions of the particle-stimulated nucleation theory of recrystallization. Additionally, spacing measurements were taken between orientation measurements, The result of this analysis indicated a very fine matrix micro structure.

DTIC

Metal Matrix Composites; Armor; Microstructure; Particle Theory; Backscattering; Grain Boundaries

19980206749 Pohang Univ. of Science and Technology, Center for Advanced Aerospace Materials, Pohang, Korea, Republic of

Processing of In-Situ Al-AlN Metal Matrix Composites via Direct Nitridation Method

Shin, Kwang S., Pohang Univ. of Science and Technology, Korea, Republic of; Kim, Yong-Seog, Pohang Univ. of Science and Technology, Korea, Republic of; Kim, Nack J., Pohang Univ. of Science and Technology, Korea, Republic of; Apr. 1998; 47p; In English

Contract(s)/Grant(s): F49620-96-1-0446

Report No.(s): AD-A344921; CAAM-98001F; AOARD-TR-96-05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary objective of the present research was to provide a fundamental understanding of the processing science necessary to fabricate the Aluminum Nitride (AlN) reinforced Aluminum (Al) composites via direct nitration of the Al alloy melt. From the thermodynamic considerations, it was found that reduction of oxygen content below the critical level in the reaction gas was crucial for the successful formation of AlN. It was possible to produce a considerable amount of AlN particles in the Al matrix at a reaction temperature as low as 900 ”C” utilizing the in-situ nitration reaction process developed in the present study. The volume fraction of AlN increase almost linearly with increasing the magnesium (Mg) content in the alloy and the reaction time. The shapes of AlN particles were found to be polygon, plate of rod-type, whose sizes were in the range from submicron to a few microns. From the present study, it is concluded that the new innovative in-situ nitridation process developed in the present study can be successfully applied for processing of high strength Al-AlN composites.

DTIC

Metal Matrix Composites; Nitration; Aluminum Nitrides; Fabrication; Technology Assessment

19980206756 Syracuse Univ., Dept of Mechanical and Aerospace Engineering, NY USA

A Predictive Methodology for Delamination Growth in Laminated Composites, Part 1, Theoretical Development and Preliminary Experimental Results *Final Report*

Davidson, Barry D., Syracuse Univ., USA; Apr. 1998; 50p; In English

Report No.(s): AD-A345902; DOT/FAA-AAR-431-Pt-1; DOT/FAA,XH-AR-97/87-Pt-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A methodology is presented for the prediction of delamination growth in laminated structures. The methodology is aimed at overcoming computational difficulties in the determination of energy release rate and mode mix. It also addresses the issue that many laminated composites exhibit large-scale crack tip damage zones and, as such, a singular field-based mode mix decomposition may not accurately account for the dependence of toughness on the loading. In the methodology, the toughness versus mode mix relation, and the definition of mode mix itself, is first determined experimentally. The definition of mode mix is found from the results of a series of delamination toughness tests and is obtained within the construct of a crack tip element analysis. Next, the structure of interest is analyzed using the crack tip element analysis and the experimentally determined definition of mode mix, and delamination growth assessments are performed. This approach also obviates the need for locally detailed two- and three-dimensional finite element analyses.

DTIC

Laminates; Technology Assessment; Delaminating; Graphite-Epoxy Composites

19980209650 College of William and Mary, Dept. of Applied Science, Williamsburg, VA USA

Preparation, Fabrication, and Evaluation of Advanced Polymeric and Composite Materials ***Final Report, 1991 - 31 Dec. 1997***

Orwoll, Robert A., College of William and Mary, USA; Dec. 31, 1997; 8p; In English

Contract(s)/Grant(s): NCC1-150; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The thesis titles are given below: physical and mechanical behavior of amorphous poly(arylene ether-co-imidasole)s and poly(arylene ether-co-imidasole) modification epoxies; the requirements of patentability as applied to the chemical arts; fabrication of thermoplastic polymer composite ribbon; blend of reactive diluents with phenylethynyl-terminated arylene ether oligomers; the synthesis, characterization, and application of ether-containing polyimides; the synthesis of reflective and electrically conductive polyimide films via an in-situ self-metalization procedure using silver (I) complexes; the thermal cure of phenylethynyl terminated polyimides and selected model compounds; and the synthesis, characterization, and molecular modeling of cyclic arylene ether oligomers.

CASI

Fabrication; Evaluation; Composite Materials; Amorphous Materials

19980209735 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

An Overview of a Continuum Mechanic Approach to a Thermodynamic Model of Failure

Palazotto, A. N., Air Force Inst. of Tech., USA; Naboulsi, S. K., Air Force Inst. of Tech., USA; Jan. 1998; 93p; In English

Report No.(s): AD-A345637; AFIT/ENY/TR-98-01; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report provides a prelude to the work developed by Smirnov et al considering the damage model of laminated composite materials. An overview of the thermodynamic definitions, concepts, and principles will be presented. This overview of the thermodynamics is necessary to provided the background needed to understand the damage model, which is based on thermodynamic principles. The essentials will be presented as follows: (1) concepts and definitions, (2) balancing laws, (3) thermodynamic equilibrium or thermostatic, and (4) the thermodynamic process. Furthermore, the essentials of thermodynamics will be used to illustrate the development of the model of failure given by Kiselev and Yumashev. The Kiselev and Yumashev model will be discussed prior to Smirnov's damage model since both are similar in their postulation of damage for structures undergoing impacts, and are based on thermodynamic principles. However, they are different in that the former is developed for elastoplastic isotropic homogeneous material, and the latter is developed for laminated composite materials based on viscoelastic constitutive laws. That is, the constitutive equations for an elastoplastic material will be discussed to illustrate the use of a thermodynamic model of failure first then the constitutive relations that incorporate a time dependent viscoelastic laminated composite materials will eventually be added in a subsequent report.

DTIC

Thermodynamics; Composite Materials; Continuum Mechanics; Models; Constitutive Equations; Damage; Failure Analysis; Laminates

19980209799 Oak Ridge National Lab., TN USA

Wet-filament winding fabrication of thick carbon fiber/polycyanate resin composite

Frame, B. J., Oak Ridge National Lab., USA; Dodge, W. G., Oak Ridge National Lab., USA; Jun. 1997; 47p; In English

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL-6917; DE98-051987; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Polycyanate resins offer advantages as composite matrices because of their high thermal stability, low outgassing, low water absorption and radiation resistance. This report describes the fabrication of a thick (nominal 1 in.) hoop-wound composite cylinder that is manufactured by the wet-filament winding method using Toray T1000G carbon fiber and YLA RS-14 polycyanate resin as the constituent materials. An analytical model used to evaluate the fabrication process, estimate composite residual stresses and provide input toward mandrel design is presented and the construction of the mandrel used to wet-wind the cylinder is described. The composite cylinder quality is evaluated by dimensional inspection and measurements of density and composition.

DOE

Fiber Composites; Fabrication; Filament Winding; Thermal Stability

19980209800 Oak Ridge National Lab., TN USA

Testing and performance evaluation of T1000G/RS-14 graphite/polycyanate composite materials

Starbuck, J. M., Oak Ridge National Lab., USA; Jan. 1997; 152p; In English

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL-6915; DE98-051986; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The performance of a graphite fiber/polycyanate matrix composite material system, T1000G/RS-14, was evaluated by performing an extensive mechanical property test program. The test program included both static strength and long-term tests for creep, fatigue, and stress rupture. The system was evaluated at both ambient temperature and elevated temperatures. The specimens were machined from composite cylinders that had a unidirectional layup with all the fibers oriented in the hoop direction. The cylinders were fabricated using the wet-filament winding process. In general, the T1000G/RS-14 system demonstrated adequate static strengths for possible aerospace structural applications. The results from the static tests indicated that very high composite hoop tensile strengths can be achieved with this system at both ambient and elevated temperatures as high as 350 F. However, in the long-term testing for compressive creep and tension-tension fatigue the results indicated a lower elevated temperature was required to minimize the risk of using this material system. Additional testing and analysis activities led to the selection of 275 F as the desired temperature for future performance evaluation. Subsequent testing efforts for determining the resin and composite transverse compressive creep responses at 275 F indicated that excessive creep strain rates may still be a weakness of this system. In the long-term tests, sufficient data was generated from impregnated strand and composite ring stress-life testing, and composite ring tension-tension fatigue to determine failure probabilities for a given set of design requirements. The statistical analyses of the test data, in terms of determining failure probability curves, will be reported on in a separate report. However, it is expected that this material system will have a very low failure probability for stress rupture based on the collected stress-life data. Material responses that will require further investigation and/or possible performance improvements are fiber- direction tension-tension fatigue, and both resin and transverse composite compressive creep. Improvements in the creep performance or dimensional stability of this material system may ultimately depend on the test and/or process environment.

DOE

Fiber Composites; Fabrication; Static Tests; Mechanical Properties; Performance Tests

19980209841 Syracuse Univ., Dept. of Mechanical, Aerospace and Manufacturing Engineering, NY USA

Predictive Methodology for Delamination Growth in Laminated Composites, Part 1, Theoretical Development and Preliminary Experimental Results ***Final Report***

Davidson, B. D., Syracuse Univ., USA; Apr. 1998; 58p; In English

Contract(s)/Grant(s): DTFAO1-94-G-00022

Report No.(s): PB98-146202; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A methodology is presented for the prediction of delamination growth in laminated structures. The methodology is aimed at overcoming computational difficulties in the determination of energy release rate and mode mix. It also addressed the issue that may laminated composites exhibit large-scale crack tip damage zones and, as such, a singular filed-based mode mix decomposition may not accurately account for the dependence of toughness on the loading.

NTIS

Structural Failure; Laminates; Prediction Analysis Techniques; Delaminating; Crack Tips; Graphite-Epoxy Composites; Finite Volume Method

19980209861 Sandia National Labs., Livermore, CA USA

Modeling the in-plane tension failure of composite plates

Trinh, K. V., Sandia National Labs., USA; Nov. 1997; 150p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-8001; DE98-050974; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This study developed a modeling method to predict the final failure load of laminated composite plates which may contain cutouts and are subjected to quasi-static in-plane tensile loads. This study focused on overcoming numerical problems often encountered in analyses that exhibit significant stable damage growth in the composite materials. to keep the computational cost at a reasonable level, the modeling method uses a quasi-static solution procedure to solve composite plate problems with quasi-static load. The numerical problems in the quasi-static analyses are nonconvergence problems caused by the discontinuous material behavior from brittle fiber failure. This study adds artificial damping to the material model to suppress the discontinuous material behavior. The artificial damping essentially changes the material behavior, and could adversely change the final failure load prediction. Thus, a selective scheme for adding the damping was developed to minimize adverse damping effects. In addition, this modeling method uses multiple analyses at different levels of artificial damping to determine damping effects on the failure load prediction. Fracture strength experimental data for small coupons with small cutouts and large panels with larger cutouts available in the literature were selected and used to verify failure predictions of the developed modeling method. Results show

that, without the artificial damping treatment, progressive damage analyses reasonably predicted the fracture strength of the small coupons, but severely underpredicted the fracture strength of the large panels. With the artificial damping treatment, the analyses predicted the failure load of both the small coupons and the large panels reasonably well.
DOE
Failure Analysis; Plates (Structural Members); Laminates; Composite Materials; Structural Failure; Static Loads

19980209972 Oak Ridge National Lab., TN USA
Chemical and sonochemical approaches to the formation of VO2 films and VO2-impregnated materials
Keppens, V., Oak Ridge National Lab., USA; Mandrus, D., Oak Ridge National Lab., USA; Boatner, L. A., Oak Ridge National Lab., USA; Nov. 1997; 6p; In English, 1-5 Dec. 1997, Boston, MA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95549; CONF-971201; DE98-001840; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A new chemical and chemical/ultrasonic approach to the preparation of VO(sub 2) films and VO(sub 2)-impregnated bulk materials has been developed. In this approach, a V(sub 2)O(sub 5) sol prepared by quenching is used to coat SiO(sub 2) substrates. The resulting gel-film is heat treated in a reducing atmosphere to form a film identified as VO(sub 2) from the results of X-ray diffraction and both optical and resistivity measurements, which reveal the phase transition characteristic of vanadium dioxide. The advantage of this approach to the formation of VO(sub 2) is that the V(sub 2)O(sub 5) sol can be used to impregnate porous materials, which are then heated treated to form an optically active composite material. The switching properties of the VO(sub 2) films are investigated using optical and resistivity measurements, and the results are compared to those obtained for VO(sub 2)-films prepared by more-conventional methods.
DOE
Composite Materials; Electrical Resistivity; Gels; Optical Measurement; Porous Materials; Vanadium

19980210272 Argonne National Lab., IL USA
Photorefractivity in liquid crystalline composite materials
Wiederrecht, G. P., Argonne National Lab., USA; Wasielewski, M. R., Northwestern Univ., USA; 1997; 9p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/CHM/CP-93908; CONF-970706; DE97-053819; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We report recent improvements in the photorefractive of liquid crystalline thin film composites containing electron donor and acceptor molecules. The improvements primarily result from optimization of the exothermicity of the intermolecular charge transfer reaction and improvement of the diffusion characteristics of the photogenerated ions. Intramolecular charge transfer dopants produce greater photorefractivity and a 10-fold decrease in the concentration of absorbing chromophores. The mechanism for the generation of mobile ions is discussed.
DOE
Photorefractivity; Thin Films; Liquid Crystals; Charge Transfer; Fluid Films; Molecular Interactions

19980210276 Los Alamos National Lab., NM USA
Critical current density enhancement in rolled multifilament Bi-2223 HTS composites
Li, Q., American Superconductor Corp., USA; Riley, G. N., Jr., American Superconductor Corp., USA; Parrella, R. D., American Superconductor Corp., USA; 1997; 5p; In English; 3rd; Superconductivity Workshop, 15-18 Jun. 1997, Big Island, HI, USA; Sponsored by Materials Research Corp., USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2628; CONF-9706119; DE98-000820; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

At 77 K and self-field, we report transport critical density (J(sub c)) of 58 kA/sq cm in rolled 19 and 85 filament Bi-2223 HTS tapes. For an 85-filament tape with transport J(sub c) of 50 kA/sq cm, transport J(sub c) of greater than 80 kA/sq cm electrical performance, increasing the number of the strong links between the 2223 colonies is believed to be the most important factor. Microstructure studies on these samples suggest that there is still great potential for further J(sub c) enhancement.
DOE
Current Density; Microstructure; Performance Tests; Bismuth

19980210423 Argonne National Lab., IL USA

A correlation of air-coupled ultrasonic and thermal diffusivity data for CFCC materials

Pillai, T. A. K., Wisconsin Univ., USA; Easler, T. E., Dow Corning Corp., USA; Szweda, A., Dow Corning Corp., USA; Jan. 1997; 9p; In English; 21st; Composites, Advanced Cermics, Materials and Structures, 12-16 Jan. 1997, Cocoa Beach, FL, USA

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/ET/CP-94666; CONF-970111; DE98-050022; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An air-coupled (non contact) through-transmission ultrasonic investigation has been conducted on 2D multiple ply Nicalon(trademark) SiC fiber/SiNC CFCC panels as a function of number of processing cycles. Corresponding thermal diffusivity imaging was also conducted. The results of the air-coupled ultrasonic investigation correlated with thermal property variations determined via infrared methods. Areas of delaminations were detected and effects of processing cycles were also detected. DOE

Imaging Techniques; Infrared Radiation; Thermodynamic Properties; Thermal Diffusivity; Silicon Carbides

19980210480 California Inst. of Tech., Graduate Aeronautical Labs., Pasadena, CA USA

Global Failure Modes in High Temperature Composite Structures ***Final Report***

Knauss, W. G., California Inst. of Tech., USA; Jul. 1998; 10p; In English

Contract(s)/Grant(s): NsG-1483; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Composite materials have been considered for many years as the major advance in the construction of energy efficient aerospace structures. Notable advances have been made in understanding the special design considerations that set composites apart from the usual ”isotropic” engineering materials such as the metals. As a result, a number of significant engineering designs have been accomplished. However, one shortcoming of the currently favored composites is their relatively unforgiving behavior with respect to failure (brittleness) under seemingly mild impact conditions and large efforts are underway to rectify that situation, much along the lines of introducing thermoplastic matrix materials. Because of their relatively more pronounced (thermo) viscoelastic behavior these materials respond with ”toughness” in fracture situations. From the point of view of applications requiring material strength, this property is highly desirable. This feature impacts several important and distinct engineering problems which have been’ considered under this grant and cover the 1) effect of impact damage on structural (buckling) stability of composite panels, the 2) effect of time dependence on the progression of buckling instabilities, and the 3) evolution of damage and fracture at generic thickness discontinuities in structures. The latter topic has serious implications for structural stability problems (buckling failure in reinforced shell structures) as well as failure progression in stringer-reinforced shell structures. This grant has dealt with these issues. Polymer ”toughness” is usually associated with uncrosslinked or thermo-plastic polymers. But, by comparison with their thermoset counterparts they tend to exhibit more pronounced time dependent material behavior; also, that time dependence can occur at lower temperatures which places restriction in the high temperature use of these ”newer and tougher” materials that are not quite so serious with the thermoset matrix materials. From a structural point of view the implications of this material behavior are potentially severe in that structural failure characteristics are no longer readily observed in short term qualification tests so characteristic for aerospace structures built from typical engineering metals.

Derived from text

Composite Structures; High Temperature; Failure Modes; Performance Tests; Structural Failure

19980210601 Argonne National Lab., IL USA

Critical current density and dissipation in sintered YBCO filaments

Cha, Y. S., Argonne National Lab., USA; Hull, J. R., Argonne National Lab., USA; Seol, S. Y., Chonnam National Univ., Korea, Republic of; 1997; 18p; In English; Cryogenic Engineering Cryogenic Materials, 27 Jul. - 1 Aug. 1997, Portland, OR, USA

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/ET/CP-94032; CONF-970758; DE97-053957; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Critical current density and dissipation of four sintered YBCO filaments were measured using a continuous DC power supply. Each sample exhibited somewhat different characteristics from the others even though 3 of the 4 samples are from the same batch. The data suggest that it is possible for the YBCO filament to be in a state of stable equilibrium when part of the filament is in the flux-flow state and part of the filament is in the normal state (local hot spots). This behavior may be advantageous for resistive fault current limiters because the intermediate state (partly flux-flow and partly normal) has an overall resistance much higher

than that of the flux-flow state but it does not lead to thermal runaway (burnout) or excessive heating compared to a YBCO filament driven into normal state over its entire length. Two of the samples were broken as a result of local burnout.
DOE
YBCO Superconductors; Current Density; Sintering

25
INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry. For related information see also 77 Thermodynamics and Statistical Physics.

19980206498 Oak Ridge National Lab., TN USA
Distillation under electric fields
Shah, V. M., Tennessee Univ., USA; Blankenship, K. D., Oak Ridge National Lab., USA; Tsouris, C., Oak Ridge National Lab., USA; 1997; 24p; In English; 10th; Separation Science and Technology for Energy Applications, 20-24 Oct. 1997, Gatlinburg, TN, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-94962; CONF-9710103; DE98-001053; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Distillation is the most common separation process used in the chemical and petroleum industry. Major limitations in the applicability and efficiency of distillation come from thermodynamic equilibria, that is, vapor-liquid equilibria (VLE), and heat and mass transfer rates. In this work, electric fields are used to manipulate the VLE of mixtures. VLE experiments are performed for various binary mixtures in the presence of electric fields on the order of a few kilovolts per centimeter. The results show that the VLE is changed by electric fields, with changes in the separation factor as high as 10% being observed. Batch distillation experiments are also carried out for binary mixtures of 2-propanol and water with and without an applied electric field. Results show enhanced distillation rates and separation efficiency in the presence of an electric field but decreased separation enhancement when the electric current is increased. The latter phenomenon is caused by the formation at the surface of the liquid mixture of microdroplets that are entrained by the vapor. These observations suggest that there should be an electric field strength for each system for which the separation enhancement is maximum.
DOE
Distillation; Electric Fields; Binary Mixtures; Liquid-Vapor Equilibrium

19980206571 Los Alamos National Lab., NM USA
Characterization of active sites in zeolite catalysts
Eckert, J., Los Alamos National Lab., USA; Bug, A., Swarthmore Coll., USA; Nicol, J. M., Moltech Corp., USA; [1997]; 15p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3079; DE98-001206; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). Atomic-level details of the interaction of adsorbed molecules with active sites in catalysts are urgently needed to facilitate development of more effective and/or environmentally benign catalysts. to this end the authors have carried out neutron scattering studies combined with theoretical calculations of the dynamics of small molecules inside the cavities of zeolite catalysts. The authors have developed the use of H2 as a probe of adsorption sites by observing the hindered rotations of the adsorbed H2 molecule, and they were able to show that an area near the four-rings is the most likely adsorption site for H2 in zeolite A while adsorption of H2 near cations located on six-ring sites decreases in strength as Ni (approximately) Co greater than Ca greater than Zn (approximately) Na. Vibrational and rotational motions of ethylene and cyclopropane adsorption complexes were used as a measure for zeolite-adsorbate interactions. Preliminary studies of the binding of water, ammonia, and methylamines were carried out in a number of related guest-host materials.
DOE
Catalysts; Zeolites; Research and Development; Absorption Spectra; Molecules

19980206605 Ohio State Univ., Dept. of Physics, Columbus, OH USA

Millimeter and Submillimeter Spectroscopy of Molecules of Atmospheric Importance ***Final Report***

DeLucia, Frank C., Ohio State Univ., USA; Helminger, Paul, Ohio State Univ., USA; 1995; 11p; In English

Contract(s)/Grant(s): NAG5-2639

Report No.(s): NASA/CR-95-207451; NAS 1.26:207451; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In our proposal we laid out work in three areas of relevance to atmospheric science: millimeter and submillimeter spectroscopy, variable temperature pressure broadening, and band and intensity measurements in the FIR. Below we will briefly discuss our progress during the second year of this project. In our millimeter and submillimeter (mm/submm) spectroscopic work, one of our goals has been to work towards the unification of the rotational (primarily obtained by mm/submm techniques) and rotational-vibrational (primarily obtained by infrared techniques) data sets in the context of theoretically well founded models which take advantage of the strengths of the data from each experimental technique. From the point of view of the development of the optimal data base for atmospheric observations, this is clearly a desirable goal. During the first year of this project we did an analysis of a weighted, mixed infrared and mm/submm data set of the n = 0, 1, and 2 torsional states of the ground vibrational state of HOOH. The purpose of this work is to provide a unified understanding of the spectrum, which is applicable in both the rotational and rotational - vibrational regimes. We have succeed in doing this in the context of a single weighted fit which accounts for both data sets to their respective experimental uncertainty (-0.1 and 10 MHz, respectively). Additionally, we have now done a similar analysis on the n = 0 torsional state of v(sub 3) and begun a similar analysis on v(sub 6). For several years we have been working on the mm/submm rotational spectra of the many excited vibrational states of HNO3, again with particular emphasis on the relationships between the mm/submm and infrared spectra. During the first year of this project we were able to use mm/submm spectroscopy to fully resolve the torsional splittings in 2 v(sub 9) and v(sub 5), establish a theoretically well founded quantitative relation between them, and show that both have their physical origin in the torsional motion of the v(sub 9) mode.This result has now been incorporated in a recent reanalysis of the infrared spectrum and has resulted in improved fits - eliminating what was in retrospect a systematic error associated with this previously unknown effect.

Derived from text

Millimeter Waves; Submillimeter Waves; Spectroscopy; Molecules; Atmospheric Chemistry; Atmospheric Physics

19980206689 Arkansas Univ., Dept. of Chemistry, Fayetteville, AR USA

Computationally Efficient Models for the Calculation of Structures and Properties of Materials ***Final Report, 15 Jan. 1994 - 14 Jul. 1997***

Pulay, Peter, Arkansas Univ., USA; Mar. 18, 1998; 17p; In English

Contract(s)/Grant(s): F49620-94-1-0072; AF Proj. 2303

Report No.(s): AD-A343620; AFRL-SR-BL-TR-98-0347; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this research was to develop efficient methods for the determination of structures of complex molecular systems. Both the optimization strategy (1), and the generation of accurate potential energy functions (2) were addressed. Under (1), the PI concentrated on the role of coordinates adapted to molecular potential surfaces. His coordinates are widely used for medium-sized molecules where their rapid convergence greatly outweighs their extra cost. However, for large systems they become expensive. A natural/redundant coordinate optimization was developed with favorable computational cost and storage requirements. An efficient optimization method in inverse distance coordinates was implemented for Van der Waals clusters and for supramolecular optimization. Under (2), the PI further developed the localized correlation technique. He created a new program which allows correlated ab initio calculations on asymmetric molecules of unprecedented size. He also parametrized distant (dispersion-like) pair correlation energies; their empirical inclusion greatly speeds up correlated calculations on large systems. Vibrational force fields were developed by scaling density functional force fields. These force fields accurately predict not only structures but also vibrational frequencies. A new definition of force constants in redundant coordinates was introduced, simplifying the parametrization and scaling of force fields.

DTIC

Molecular Structure; Computational Chemistry; Potential Energy; Molecules

19980206700 California Univ., Dept. of Materials Science and Engineering, Los Angeles, CA USA

Development of Quantum Dot Materials for Optical Devices by the Sol-Gel Method ***Final Report, 1 Jun. 1994 - 30 Jan. 1998***

Mackenzie, John D., California Univ., USA; Feb. 1998; 28p; In English

Contract(s)/Grant(s): F49620-94-1-0339; AF Proj. 1651

Report No.(s): AD-A341656; AFRL-SR-BL-TR-98-0319; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Final Technical Report presents a summary of the research conducted from June, 1994 to January, 1998 on the development of semiconductor quantum dot materials prepared by a sol-gel method. The process involved the preparation of a sol-gel liquid solution with a chemical composition corresponding to that of a sodium borosilicate glass, the addition of a cadmium salt to the solution, the formation of a porous gel, the conversion of the cadmium salt to CdS and the densification of the gel into a glass at around 500 deg C. by systematic variation of processing conditions OdS quantum dots (OD) of uniform size and size distribution were prepared. For the first time, optical gains were achieved at room temperature. by ion-exchange of K for Na, waveguides were fabricated. The OdS particles were shown to be single crystals of about 40A in dimension. Techniques were developed to prepare CdTe and PbS OD's in sodium borosilicate glass. Not only are the Bohr radii of PbS and OdTe much larger than that of OdS, which will give more efficient OD's samples, but the beginning of a systematic study of these three semiconductors would shed light on the presently unknown effects of the relatively large surface areas of QE's. A search of the literature revealed that the semiconductor SbSl is also a ferroelectric. It is theorized that an electric field induced dipole in SbSl would act to pin down the exciton created by a laser beam. Thus, longer life-times of the electron-hole pair are possible. Preliminary work has resulted in the successful preparation of SbSl OD's in the same sodium borosilicate glass. Verification of the behavior of SbSl now awaits further research.

DTIC

Optical Properties; Chemical Composition; Quantum Dots; Optical Equipment; Sol-Gel Processes; Semiconductors (Materials); Nonlinear Optics; Ferroelasticity

19980206722 Sandia National Labs., Albuquerque, NM USA

Catalyst technology roadmap report

Jackson, N. B., Sandia National Labs., USA; Jun. 1997; 48p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1424; DE97-009294; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report outlines the future technology needs of the Chemical Industry in the area of catalysis and is a continuation of the process that produced the report Technology Vision 2020: The U.S. Chemical Industry and the Council for Chemical Research's (CCR) Chemical Synthesis Team follow-up work in chemical synthesis. Vision 2020 developed a 25-year vision for the chemical industry and outlined the challenges to be addressed in order to achieve this vision. This report, which outlines the catalysis technology roadmap, is based on the output of the CCR's Chemical Synthesis Team, plus a workshop held March -20-21, 1997, which included about 50 participants, with catalysis experts from industry, academia, and government. It is clear that all participants view catalysis as a fundamental driver to the 0274 economic and environmental viability of the chemical industry. Advances in catalytic science and technology are among the most crucial challenges to achieving the goals of the chemical industry advanced in Vision 2020.

DOE

Catalysts; Chemical Engineering; Research and Development; Synthesis (Chemistry)

19980206750 California Univ., Dept. of Mechanical and Aerospace Engineering, Irvine, CA USA

Energetic Fuel Droplet Gasification with Liquid-Phase Reaction ***Final Report***

Sirignano, William A., California Univ., USA; Schiller, David N., California Univ., USA; May 15, 1998; 31p; In English

Contract(s)/Grant(s): N00014-93-1-0053

Report No.(s): AD-A345824; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An analytical and computational study of the gasification and oxidation of an energetic liquid fuel droplet is presented. Single-step, finite-rate. Arrhenius reaction rate expressions are used for exothermic liquid-phase decomposition and gas-phase oxidation. The liquid fuel is assumed to decompose to a gaseous product at a fixed number of bubble sites per unit mass (specified a priori) within the droplet. Decomposed gas escapes the droplet surface by: (1) decomposition (gasification) of the droplet surface, (2) decomposition at the surface of bubbles that connect with the droplet surface, and (3) escape of gas inside bubbles due to droplet surface regression. Without oxidation, results are compared between one model wherein gaseous fuel leaves the droplet due to decomposition of the droplet surface and bubbles that connect with the droplet surface when the void fraction exceeds a critical value (phi(sub c)), and another model wherein the droplet mass decreases due to discontinuous bubble bursting at the droplet surface. The models agree well (with the exception of oscillations in the droplet radius predicted by the latter model) in the limit of psi(c) approaches 1. The transient, two-phase governing equations are solid numerically for various values of the nondimensional reaction rate coefficients (for both decomposition and oxidation), heats of decomposition and oxidation, number of bubbles per unit mass (Nu/m), and ambient temperature and pressure. Consistent with simplified scaling for the limit of chemical rate control, the droplet lifetime eta(sub d) is strongly dependent on the nondimensional decomposition rate constant and activation energy,

and less strongly on the number of bubbles per unit mass, ambient pressure, and heat of decomposition. Increasing the ratio of gas-phase to liquid-phase thermal conductivities increases eta(sub d) slightly.
DTIC
Vapor Phases; Gases; Fuels; Liquid Phases; Numerical Analysis; Computation; Vaporizing; Drops (Liquids)

19980209738 Missouri Univ., Dept. of Physics, Columbia, MO USA
High Pressure Spectroscopic Studies of AlGaAs, GaAs, and II-VI Semiconductors and Heterostructures ***Final Report, 20 Jul. 1992 - 30 Aug. 1997***
Chandrasekhar, Meera, Missouri Univ., USA; Oct. 14, 1997; 7p; In English
Contract(s)/Grant(s): DAAL03-92-G-0367
Report No.(s): AD-A344911; ARO-30140.1-PH-EPS; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have conducted four studies on three different but related materials. The first is a temperature study of a pseudomorphic epilayer of ZnSe on GaAs, where we measured the temperature dependence of the interlayer biaxial strain. The measurement was performed via photomodulation spectroscopy, tracking the splitting of the heavy - light hole transition energies. This method provides an accurate and direct measure of the strain. In the second study we investigated the pressure dependence of the polarized modulated optical reflectivity in an ordered alloy of InGaP2 as a function of hydrostatic pressure, and determined the pressure coefficients of the direct transitions as well as observed the indirect crossover. In the third study we compared the pressure behaviour of ordered and random alloy quantum wells of ZnCdSe/ZnSe in order to understand the confinement of the wavefunction in the ordered vs. random alloy materials. Finally, we have studied the temperature dependence of deformation potentials related the GAMMA-X crossover in GaAs/AlAs superlattices.
DTIC
Spectroscopy; Quantum Wells; Gallium Arsenides; Aluminum Gallium Arsenides; High Pressure; Alloys; Semiconductors (Materials)

19980209794 Maryland Univ., Dept. of Fire Protection Engineering, College Park, MD USA
Correlations for Fire Plumes
Quintiere, J. G., Maryland Univ., USA; Grove, B. S., Maryland Univ., USA; Feb. 1998; 220p; In English
Contract(s)/Grant(s): NIST-60NANB6D0073
Report No.(s): PB98-144652; NIST-GCR-98-744; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This study began as a review of data and correlations for line plumes. In its attempt to develop a consistent set of correlations for that data set, it developed an analysis to account for the base geometry of the fuel source. Although point source models were used, the diameter or rectangular source dimensions were included in improved solutions for flame height and entrainment rate. The analysis also explicitly includes the effect of flame radiation. Theoretically developed equations for near field entrainment and flame height with empirical lead coefficients were found to fit a wide range of data including fuel base diameters of up to 0.5m. results are also presented for rectangular fires, and the theoretical basis for the correlation developed unifies data over a wide range of base dimensions ranging from a square to a line.
NTIS
Fires; Flames; Plumes; Flame Propagation; Ignition

19980209796 Sverdrup Technology, Inc., Arnold AFS, TN USA
Low Pressure Extrapolations for Soot Oxidation Rates
Hiers, Robert, Sverdrup Technology, Inc., USA; Jan. 06, 1997; 7p; In English; 35th; Aerospace Sciences, 6-10 Jan. 1997, Reno, NV, USA
Contract(s)/Grant(s): F40600-95-C-0017
Report No.(s): AD-A345785; AIAA-PAPER-97-0599; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The carbon oxidation rates of Nagle and Strickland-Constable are routinely applied in the flame community to determine 500 oxidation by molecular oxygen. These rates were experimentally determined at temperatures from 1000 to 2000 C (1273 to 2273 K) and at oxygen partial pressures from 0.1 to 0.6 atm and then curve fit. For typical laboratory flames, oxygen partial pressures may be significantly lower than 0.1 atm. Frequently, researchers will extrapolate the Nagle, Strickland-Constable (hereafter referred to as NSC) curve fits to these lower oxygen partial pressures to determine the molecular oxygen contribution to the overall soot oxidation rate. It is shown that the NSC curve fits exhibit nonphysical behavior at pressures 0.05 atm (depending on the temperature). This behavior is revealed when the oxidation rates are transformed to collision efficiencies. At at fixed temperature,

the oxidation rate drops faster than the collision rate as the pressure is reduced. At typical flame conditions, extrapolation of the NSC curve fits yields collision efficiencies that may be an order of magnitude too low.
DTIC
Partial Pressure; Extrapolation; Soot; Oxidation; Low Pressure; Collision Rates

19980209843 Westinghouse Savannah River Co., Aiken, SC USA
Analysis of cascade impactor and EPA method 29 data from the americium/curium pilot melter system
Zamecnik, J. R., Westinghouse Savannah River Co., USA; Nov. 1997; 41p; In English
Contract(s)/Grant(s): DE-AC09-96SR-18500
Report No.(s): WSRC-RP-97-00937; DE98-051509; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The offgas system of the Am/Cm pilot melter at TNX was characterized by measuring the particulate evolution using a cascade impactor and EPA Method 29. This sampling work was performed by John Harden of the Clemson Environmental Technologies Laboratory, under SCUREF Task SC0056. Elemental analyses were performed by the SRTC Mobile Laboratory. Operation of the Am/Cm melter with B2000 frit has resulted in deposition of PbO and boron compounds in the offgas system that has contributed to pluggage of the High Efficiency Mist Eliminator (HEME). Sampling of the offgas system was performed to quantify the amount of particulate in the offgas system under several sets of conditions. Particulate concentration and particle size distribution were measured just downstream of the melter pressure control air addition port and at the HEME inlet. At both locations, the particulate was measured with and without steam to the film cooler while the melter was idled at about 1450 Celsius. Additional determinations were made at the melter location during feeding and during idling at 1150 Celsius rather than 1450 Celsius (both with no steam to the film cooler). Deposition of particulates upstream of the melter sample point may have, and most likely did occur in each run, so the particulate concentrations measured do no necessarily reflect the total particulate emission at the melt surface. However, the data may be used in a relative sense to judge the system performance.
DOE
Americium; Curium; Boron Compounds; Particulates; Impactors

19980209844 Westinghouse Savannah River Co., Aiken, SC USA
Decomposition of triphenylborane with enhanced comprehensive catalyst under aerated and inert conditions
Wilmarth, W. R., Westinghouse Savannah River Co., USA; Crawford, C. L., Westinghouse Savannah River Co., USA; Peterson, R. A., Westinghouse Savannah River Co., USA; White, T. L., Westinghouse Savannah River Co., USA; Sep. 30, 1997; 22p; In English
Contract(s)/Grant(s): DE-AC09-89SR-18035
Report No.(s): WSRC-TR-97-0325; DE98-051505; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This work investigated the decomposition of triphenylborane in a statistically-designed set of tests to determine the effects of four process variables: temperature, hydroxide concentration, catalyst concentration, and atmosphere. Analysis of these tests provide the following conclusions: (1) The presence of tetraphenylborate solids facilitate a 10X increase in the rate of decomposition of triphenylborane. (2) The presence of oxygen slows the decomposition of triphenylborane. (3) The activation energy of the decomposition reaction in the presence of oxygen (59.88 + 27.73 kJ/mol) is statistically lower than inerted systems (99.11 + 10.14 kJ/mol). (4) Rate constants derived from the nitrogen inerted tests encompass the rate constants from previous tests with slurries. These rate constants agree reasonably with similar values obtained from Tank 48H operations at ambient temperatures. (5) For test conducted in air, the decomposition reaction rate constant correlated with the catalyst concentration. In tests inerted by nitrogen, the same correlation did not hold.
DOE
Decomposition; Boron Compounds; Aeration; Catalysts

19980209866 Istituto Nazionale di Fisica Nucleare, Lab. Nazionale di Frascati, Frascati, Italy
Frequency dependence of the higher harmonics susceptibilities of hydrogen loaded and unloaded melted YBCO samples
Tripodi, P., Istituto Nazionale di Fisica Nucleare, Italy; DiGioacchino, D., Istituto Nazionale di Fisica Nucleare, Italy; Celani, F., Istituto Nazionale di Fisica Nucleare, Italy; Spallone, A., Istituto Nazionale di Fisica Nucleare, Italy; Shi, D., Cincinnati Univ., USA; Mar. 1997; 4p; In English
Report No.(s): INFN-R-LNF-97-015; DE98-712216; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

They measured the first and higher components of ac susceptibilities of melted YBCO samples before and after hydrogenation by (mu)s pulsed electrolysis. First component was measured versus temperature at fixed frequency while higher harmonics were measured versus frequencies at fixed temperature near critical temperature. All measurements were performed at fixed amplitude of ac magnetic field and zero dc magnetic field. The frequency and temperature behaviour of the harmonic components before and after hydrogenation gave us information on possible dynamic losses in comparison to the flux pinning mechanism.
DOE
Harmonics; Frequencies; Hydrogen; YBCO Superconductors; Alternating Current; Direct Current; Magnetic Permeability

19980209971 Oak Ridge National Lab., TN USA
Atomic resolution Z-contrast imaging of ultradispersed catalysts
Nellist, P. D., Cambridge Univ., UK; Pennycook, S. J., Oak Ridge National Lab., USA; Nov. 1997; 5p; In English, 2-5 Sep. 1997, Cambridge, UK
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95454; CONF-970911; DE98-001839; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Using Z-contrast imaging in a 300 kV scanning transmission electron microscope, direct images of single metal atoms on a support material in industrial catalyst systems are formed. The simultaneously collected conventional bright-field images reveal orientational information about the support, which allows possible configurations of Pt atoms on a (gamma)-Al(sub 2)O(sub 3) support surface to be deduced. Image intensities also allow the three-dimensional configuration of a raft of Rh atoms on a (gamma)-Al(sub 2)O(sub 3) support to be determined.
DOE
Imaging Techniques; Scanning Electron Microscopy

19980209995 Los Alamos National Lab., NM USA
Self-diffusion measurements of methanol and 1-decanol in supercritical CO2 by C-13 pulsed field gradient NMR
Bai, S., Utah Univ., USA; Mayne, C. L., Utah Univ., USA; Grant, D. M., Utah Univ., USA; Taylor, C. M. V., Los Alamos National Lab., USA; 1997; 17p; In English; Symposium on Thermophysical Properties, 22-27 Jun. 1997, Boulder, CO, USA
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-UR-97-1869; CONF-970629-2; DE97-008161; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A small amount of a highly polar compound, such as methanol, is frequently added to supercritical fluid (SCF) carbon dioxide to enhance its ability to dissolve polar molecules in SCF separation technology. Few diffusion coefficients in SCF mixtures have been reported in the literature. The pulsed field gradient spin-echo technique (PGSE) has been used extensively to measure self-diffusion in neat monohydric alcohols under pressure. Hurle et al. and Luedemann et al. showed that the experimental diffusion coefficients of methanol may be explained by a rough hard-sphere model (RHS) with a roughness parameter, A. In this paper, diffusion measurements are reported for CO2-methanol and CO2-decanol mixtures in supercritical fluids. Since methanol in CO2 is primarily monomeric at low concentration, the RHS model, that is accurate for most simple, non-associated liquids, should apply. Previous nuclear spin-lattice relaxation studies in SCF CO2 suggest a large local solvent density enhancement, or solvent clustering, near a alcohol solute molecule under SCF conditions. If solvent clustering occurs in the vicinity of alcohol solute molecules, it should affect the diffusion coefficients. The authors have made the requisite measurements and found that they corroborate their previous spin-relaxation data.
DOE
Carbon Dioxide; Diffusion Coefficient; Self Consistent Fields; Additives; Mathematical Models; Self Diffusion (Solid State); Methyl Alcohol

19980210182 Sandia National Labs., Albuquerque, NM USA
Modeling aluminum etch chemistry in high density plasmas
Meeks, E., Sandia National Labs., USA; Ho, P., Sandia National Labs., USA; Buss, R., Sandia National Labs., USA; 1997; 8p; In English; 191st, 4-9 May 1997, Montreal, Canada
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-8585C; CONF-970517; DE97-053033; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The authors have assembled a chemical reaction mechanism that describes the BCl3/Cl2/Ar plasma etch of Al metallization layers. The reaction set for gas-phase and surface processes was derived either from literature data or estimated from data on

related systems. A well-mixed reactor model was used to develop the mechanism and test it against experimental measurements of plasma species and etch-rates in processing reactors. Finally, use of reduced chemistry mechanisms are demonstrated in 2-D simulations for a complex reactor geometry.
DOE
Aluminum; Mathematical Models; Metallizing; Chemical Reactions; Plasma Etching

19980210227 ESDU International Ltd., London, UK
Thermophysical Properties of Sulphur Hexafluoride
Dec. 1997; 38p; In English; Included in the Physical Data, Chemical Engineering Sub-series
Report No.(s): ESDU-97028; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97028 gives equations for the variation with temperature of the properties. It covers along the saturation line (for both the liquid and the vapour) density, enthalpy, heat capacity at constant pressure, dynamic viscosity and thermal conductivity together with vapour pressure, latent heat of vaporisation and surface tension. For the ideal gas, specific heat capacity at constant pressure and enthalpy are dealt with and, for the dilute gas, dynamic viscosity and thermal conductivity. For the gas at high pressure, density, enthalpy, entropy, compression factor and specific heat capacities at constant pressure and constant volume are treated. Values are tabulated in SI units calculated from the equations and for the transport properties are based on those data that are considered to be the best available while for the thermodynamic properties they are derived from an Equation of State. Along the saturation line the temperature range covered for the thermodynamic properties is from the triple point to the critical point, and for the transport properties it is up to approximately 0.9 of the critical temperature. For the ideal and dilute gas values are given for a temperature range up to 1000 K. For the high pressure data the temperature is from -50 to 100 C for pressures up to 10 MPa. Conversion factors to facilitate use of the data in British units are included, sources of the data are listed, and the accuracy of the results is discussed.
Author
Thermophysical Properties; Sulfur; Fluorides; Hexagons; Temperature Dependence; Enthalpy; Density (Mass/Volume); Vapor Pressure; Data Structures

19980210274 Argonne National Lab., IL USA
Parallel adaptive mesh refinement techniques for plasticity problems
Barry, W. J., Carnegie-Mellon Univ., USA; Jones, M. T., Virginia Polytechnic Inst. and State Univ., USA; Plassmann, P. E., Argonne National Lab., USA; 1997; 14p; In English; 4th; Large-scale Analysis and Design on High-performance Computers and Workstations, 15 - 17 Oct. 1997, Williamsburg, VA, USA; Sponsored by NASA, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/MCS/P-677-0797; CONF-9710135; DE97-054211; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The accurate modeling of the nonlinear properties of materials can be computationally expensive. Parallel computing offers an attractive way for solving such problems; however, the efficient use of these systems requires the vertical integration of a number of very different software components, we explore the solution of two- and three-dimensional, small-strain plasticity problems. We consider a finite-element formulation of the problem with adaptive refinement of an unstructured mesh to accurately model plastic transition zones. We present a framework for the parallel implementation of such complex algorithms. This framework, using libraries from the SUMAA3d project, allows a user to build a parallel finite-element application without writing any parallel code. to demonstrate the effectiveness of this approach on widely varying parallel architectures, we present experimental results from an IBM SP parallel computer and an ATM-connected network of Sun UltraSparc workstations. The results detail the parallel performance of the computational phases of the application during the process while the material is incrementally loaded.
DOE
Asynchronous Transfer Mode; Unstructured Grids (Mathematics); Parallel Processing (Computers); Grid Generation (Mathematics); Finite Element Method; Computational Grids

19980210296 Department of the Navy, Washington, DC USA
Catalyzed Preparation of Amorphous Chalcogenides
Bayya, Shyam S., Inventor, Department of the Navy, USA; Scotto, Cathy S., Inventor, Department of the Navy, USA; Sanghera, Jasbinder S., Inventor, Department of the Navy, USA; Aggarwal, Ishwar D., Inventor, Department of the Navy, USA; Jan. 30, 1998; 26p; In English
Patent Info.: Filed 30 Jan. 1998; US-Patent-Appl-SN-016334

Report No.(s): AD-D018894; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

Sol-gel process conducted under an inert gas in a solvent at a temperature up to the boiling points of the solvent and by-products by reacting a chalcogen source, a glass network former-intermediate metal in the form of an alkoxide or a non-alkoxide and a catalyst to form a homogeneous product having average particle size of below 100 nm with catalyst; if the catalyst is a catalyst dopant, uniformly dispersed in the particles.

DTIC

Glass; Catalysts; Catalysis; Amorphous Materials; Sol-Gel Processes; Alkoxides

19980210366 Aerospace Corp., Space and Environment Technology Center, Los Angeles, CA USA

Shock tube study of the reactions of the hydroxyl radical with combustion species and pollutants ***Final Report***

Cohen, N., Aerospace Corp., USA; Koffend, J. B., Aerospace Corp., USA; [1998]; 20p; In English

Contract(s)/Grant(s): DE-FG03-87ER-13812

Report No.(s): DOE/ER/13812-T3; DE98-003229; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Shock heating t-butyl hydroperoxide behind a reflected shock wave has proved to be as a convenient source of hydroxyl radicals at temperatures near 1000 K. We applied this technique to the measurement of reaction rate coefficients of OH with several species of interest in combustion chemistry, and developed a thermochemical kinetics/transition state theory (TK-TST) model for predicting the temperature dependence of OH rate coefficients.

DOE

Hydroxyl Radicals; Shock Waves; Shock Tubes; Reflected Waves; Reaction Kinetics; Thermochemistry

19980210563 Argonne National Lab., IL USA

Symmetry-related mutants in the quinone binding sites of the reaction center: The effects of changes in charge distribution

Hanson, D. K., Argonne National Lab., USA; Schiffer, M., Argonne National Lab., USA; [1997]; 14p; In English; Reaction Centers of Photosynthetic Purple Bacteria: Structure, Spectroscopy, Dynamics, 1-6 Jun. 1997, Cadarache, France

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/CMB/CP-94237; CONF-9706202; DE97-054049; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

To probe the structural elements that contribute to the functional asymmetries of the two ubiquinone(sub 10)binding pockets in the reaction center of Rhodobacter capsulatus, the authors targeted the L212Glu-L213Asp (near Q(sub B)) and the M246Ala-M247Ala (near Q(sub A)) pairs of symmetry-related residues for site-specific mutagenesis. They have constructed site-specific mutants that eliminate the sequence differences at these positions (L212Glu-L213Asp yields Ala-Ala or M246Ala-M247Ala yields Glu-Asp), and have reversed that asymmetry by constructing a quadruple-mutant strain, RQ (L212Glu-L213Asp-M246Ala-M247Ala yields Ala-Ala-Glu-Asp). The mutations were designed to change the charge distribution in the quinone-binding region of the reaction center; none of the strains is capable of photosynthetic growth. In photocomponent phenotypic revertants of the RQ strain, second-site mutations which affect Q(sub B) function are coupled to mutations in the Q(sub A) site which restore an Ala or substitute a Tyr at the M247 site; one strain carries an additional Met yields Glu substitution at M260 near Q(sub A). All of the RQ revertants retain the engineered M246Ala yields Glu mutation in the Q(sub A) site as well as the L212Ala-L213Ala mutations in the Q(sub B) site. Kinetic characterization of the RQ revertants will give them an idea of what structural and functional elements are important for restoring efficiency to electron and proton transfer pathways in the RQRC, which is far from native. to date, these preliminary results underscore the importance of an asymmetric distribution of polar amino acids in the quinone binding pockets and its influence on the functional properties of the reaction center.

DOE

Photosynthesis; Mutations; Quinones; Bacteria; Nucleogenesis

19980210721 Westinghouse Savannah River Co., Aiken, SC USA

Statistical Investigation into the Decomposition Rates of Tetraphenylborate and its Daughter Compounds

Peterson, R. A., Westinghouse Savannah River Co., USA; Edwards, T. B., Westinghouse Savannah River Co., USA; Dec. 17, 1997; 56p; In English

Contract(s)/Grant(s): DE-AC09-96SR-18500

Report No.(s): WSRC-TR-97-00403; DE98-052035; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This work performs a global statistical analysis of the data regarding the decomposition of tetraphenylborate and its daughter products.

DOE

Decomposition; Statistical Analysis; Organic Boron Compounds; Tetraphenyls

19980210732 Lawrence Livermore National Lab., Livermore, CA USA

Pathway and kinetic analysis on the iso-propyl radical + O(sub 2) reaction system

Bozzelli, J. W., New Jersey Inst. of Tech., USA; Pitz, W. J., Lawrence Livermore National Lab., USA; Apr. 07, 1997; 20p; In English; Western State Section of the Combustion Institute, 14-15 Apr. 1997, Livermore, CA, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-126375; CONF-970495-4; DE97-053394; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We analyze the isopropyl + 02 reaction system using thermochemical Transition State Theory (TST), molecular thermodynamic properties, analysis (quantum RRK) for k(E) and modified strong collision analyze Cyclic transition states for both hydrogen transfer and concerted propylene from isopropylperoxy are calculated using semi-empirical theory in addition to transition states for H02 elimination from hydroperoxy-isopropyl. Computed rate constants are compared to constant measurements of for isopropyl + H02.

DOE

Reaction Kinetics; Radicals; Propylene; Isopropyl Compounds

19980210806 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

Effective medium approximation of the optical properties of electrochromic cerium-titanium oxide compounds

Rottkay, K. von, California Univ., Lawrence Berkeley Lab., USA; Richardson, T., California Univ., Lawrence Berkeley Lab., USA; Rubin, M., California Univ., Lawrence Berkeley Lab., USA; Slack, J., California Univ., Lawrence Berkeley Lab., USA; Jul. 1997; 12p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): DE-AC03-76SF-00098

Report No.(s): LBNL-40668; CONF-970706; OM-369; DE98-052710; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Cerium titanium oxide samples derived from a solution have been compared against sputtered films over a wide range of different compositions. X-ray diffraction was used to investigate the structural properties of the compound material existing in a two-phase mixture M(A)O2-M(B)O2. The optical properties were evaluated over the whole solar spectrum by variable angle spectroscopic ellipsometry combined with spectrophotometry. The spectral complex refractive index was determined for CeO2 and TiO2, as well as for their compounds. To reduce the large number of permutations in composition of multi-component oxides it would be useful to be able to predict the properties of the mixtures from the pure oxide components. Therefore these results were compared to those obtained by effective medium theory utilizing the optical constants of CeO2 and TiO2. In order to investigate the performance as passive counter-electrode in Li(+) based electrochromic devices the films were tested by cyclic voltammetry with in-situ transmission control. Chemical composition was measured by Rutherford backscattering spectrometry. Surface morphology was analyzed by atomic force microscopy.

DOE

Optical Properties; Titanium Oxides; Cerium Oxides; Morphology; Electrochemistry; Thin Films

26
METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

19980206487 Westinghouse Electric Corp., West Mifflin, PA USA

Technical basis for the initiation and cessation of environmentally-assisted cracking of low-alloy steels in elevated temperature PWR environments

James, L. A., Westinghouse Electric Corp., USA; [1997]; 30p; In English; Flaw Evaluation, 12 Aug. 1997, Pittsburgh, PA, USA

Contract(s)/Grant(s): DE-AC11-93PN-38195

Report No.(s): WAPD-T-3168; CONF-9708111-1; DE97-008400; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Section 11 Working Group on Flaw Evaluation of the ASME B and PV Code Committee is considering a Code Case to allow the determination of the conditions under which environmentally-assisted cracking of low-alloy steels could occur in PWR primary environments. This paper provides the technical support basis for such an EAC Initiation and Cessation Criterion by reviewing the theoretical and experimental information in support of the proposed Code Case.

DOE

Crack Propagation; High Strength Steels; Defects

19980206491 General Electric Co., Schenectady, NY USA

Properties of near-net shape metallic components made by the directed light fabrication process

Lewis, G. K., General Electric Co., USA; Milewski, J. O., General Electric Co., USA; Thoma, D. B., General Electric Co., USA; Nemec, R. B., SyntheMet Corp., USA; 1997; 10p; In English; 8th; Solid Freeform Fabrication, 11 - 13 Aug. 1997, Austin, TX, USA

Contract(s)/Grant(s): DE-AC12-76SN-00052; W-7405-ENG-36

Report No.(s): LA-UR-97-3450; CONF-970888; DE98-000262; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Directed Light Fabrication (DLF) is a process invented at Los Alamos National Laboratory that can be used to fuse any metal powder directly to a fully dense, near-net shape component with full structural integrity. A solid model design of a desired component is first developed on a computer work station. A motion path, produced from the solid model definition, is translated to actual machine commands through a post-processor, specific to the deposition equipment. The DLF process uses a multi-axis positioning system to move the laser focal zone over the part cross section defined by the part boundaries and desired layer thickness. Metal powders, delivered in an argon stream, enter the focal zone where they melt and continuously form a molten pool of material that moves with the laser focal spot. Position and movement of the spot is controlled through the post-processor. Successive cross-sectional layers are added by advancing the spot one layer thickness beyond the previous layer until the entire part is deposited. The system has 4 powder feeders attached for co-deposition of multiple materials to create alloys at the focal zone or form dissimilar metal joint combinations by changing powder composition from one material to another. Parts produced by the DLF process vary in complexity from simple bulk solid forms to detailed components fabricated from difficult to process metals and alloys. Parts have been deposited at rates up to 33 cm(exp 3)/hr with 12 cm(exp 3)/hr more typical. Feasibility of processing any metal ranging in melting point from aluminium to tungsten has been demonstrated. Mechanical properties for bulk DLF deposits of three alloy powders were measured for this study. Ti-6Al-4V and 316 stainless steel powders were fabricated into retangular bar, and Inconel 690 powder was fabricated into a solid cylinder.

DOE

Shapes; Fabrication; Luminaires

19980206499 Oak Ridge National Lab., TN USA

Triple ion-beam studies of radiation damage in 9Cr2WVTa ferritic/martensitic steel

Lee, E. H., Oak Ridge National Lab., USA; Hunn, J. D., Oak Ridge National Lab., USA; Rao, G. R., Oak Ridge National Lab., USA; Klueh, R. L., Oak Ridge National Lab., USA; Mansur, L. K., Oak Ridge National Lab., USA; 1997; 21p; In English; 8th; Fusion Reactor Materials, 26-31 Oct. 1997, Sendai, Japan

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-94936; CONF-971090; DE98-001052; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

To simulate radiation damage under a future Spallation Neutron Source (SNS) environment, irradiation experiments were conducted on a candidate 9Cr-2WVTa ferritic/martensitic steel using the Triple Ion Facility (TIF) at ORNL. Irradiation was conducted in single, dual, and triple ion beam modes using 3.5 MeV Fe(++), 360 keV He(+), and 180 keV H(+) at 80, 200, and 350(degrees)C. These irradiations produced various defects comprising black dots, dislocation loops, line dislocations, and gas bubbles, which led to hardening. The largest increase in hardness, over 63 %, was observed after 50 dpa for triple beam irradiation conditions, revealing that both He and H are augmenting the hardening. Hardness increased less than 30 % after 30 dpa at 200 C by triple beams, compatible with neutron irradiation data from previous work which showed about a 30 % increase in yield strength after 27.2 dpa at 365 C. However, the very large concentrations of gas bubbles in the matrix and on lath and grain bound-

aries after these simulated SNS irradiations make predictions of fracture behavior from fission reactor irradiations to spallation target conditions inadvisable.
DOE
Radiation Damage; Chromium Compounds; Steels; Neutron Irradiation; Ion Beams; Ferrites

19980206507 Pennsylvania State Univ., University Park, PA USA
In Situ Strength Evolution in the Sintering of Bronze Powder Metal Compacts and Application to Thermal Cycle Design
Shoales, Gregory A., Pennsylvania State Univ., USA; May 15, 1998; 221p; In English
Report No.(s): AD-A344923; TR-98-010; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Powder metallurgy allows fabrication of complex net-shape components. Accurate design specification of these components requires precise prediction of their response to sintering process parameters. Nonuniform sintering responses, such as strain gradients, can result in process failures such as distortion and cracking. to avoid these types of process failures without costly trial and error design, the most important response to understand is the compact's strength as it evolves during the sintering process. A unique device and method have been developed to measure the in situ strength as a function of sintering process parameters. The specific strength parameter investigated and modeled in this work was transverse rupture. This strength was precisely determined for Cu-90-10 wt.% Cu prealloyed powder bronze compacts in response to sintering time, temperature and heating rate. At a sintering temperature of approximately 350 C the green strength of 10 MPa decreased 50% due to the annealing of the cold worked strength afforded during compaction At higher temperatures, a dramatic increase in strength (dependent also on time and heating rate) due to sintering was observed. As the compact was processed beyond approximately 600 C, thermal softening dominated sintering strengthening to cause an overall degradation in strength with respect to temperature. This first ever data made possible a model to predict the in situ evolution of strength during sintering. The consequence of this work is to identify the thermal cycles that maximize strength, thereby minimizing distortion and otherwise improving dimensional tolerances.
DTIC
Thermal Cycling Tests; Sintering; Powder Metallurgy; Bronzes; Compressive Strength

19980206536 Sandia National Labs., Albuquerque, NM USA
Microstructure of bulk and electro-formed Ni implanted with Ti and C
Follstaedt, D. M., Sandia National Labs., USA; Myers, S. M., Sandia National Labs., USA; Knapp, J. A., Sandia National Labs., USA; Dugger, M. T., Sandia National Labs., USA; Christenson, T. A., Sandia National Labs., USA; Oct. 13, 1997; 18p; In English; 10th; International Conference onBeams, 21 - 26 Sep. 1997, Gatlinburg, TN, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-1216C; CONF-9709107-; DE98-001189; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The microstructure of high-purity Ni implanted with overlapping concentration profiles of Ti and C was examined with transmission electron microscopy. An amorphous phase forms at concentrations of 15 - 18 at.% Ti and 22 at.% C, while a two-phase alloy (amorphous + fcc Ni) forms for (le) 16 at.% C. Electroformed layers with sub-micron fcc grains of Ni or Ni80Fe20 were also found to be amorphized by Ti + C implantation, a key requirement for applying this treatment to Ni-based micro-electromechanical systems to reduce their friction and wear.
DOE
Microstructure; Nickel; Titanium; Carbon; Electrodeposition

19980206643 Brookhaven National Lab., Upton, NY USA
Emerging terawatt picosecond CO2 laser technology
Pogorelsky, I. V., Brookhaven National Lab., USA; Sep. 1997; 8p; In English; 1st; Ultrashort-Pulse Ultrahigh-Power Lasers and Simulation for Laser-Plasma Interactions, 14-18 Jul. 1997, Kyoto, Japan
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-64790; CONF-9707120; DE98-000980; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The first terawatt picosecond (TWps) CO2 laser is under construction at the BNL Accelerator Test Facility (ATF). TWps-CO2 lasers, having an order of magnitude longer wavelength than the well-known table-top terawatt solid state lasers, offer new opportunities for strong-field physics research. For laser wakefield accelerators (LWFA) the advantage of the new class of lasers is due to a gain of two orders of magnitude in the ponderomotive potential. The large average power of CO2 lasers is important for the generation of hard radiation through Compton back-scattering of the laser off energetic electron beams. The authors discuss applications of TWps-CO2 lasers for LWFA modules of a tentative electron-positron collider, for gamma-gamma (or gamma-lep-

ton) colliders, for a possible table-top source of high-intensity x-rays and gamma rays, and the generation of polarized positron beams.
DOE
Carbon Dioxide Lasers; Laser Beams; Laser Applications; Elementary Particle Interactions; Electron Beams

19980206658 Los Alamos National Lab., NM USA
Directed light fabrication of refractory metals
Lewis, G. K., Los Alamos National Lab., USA; Thoma, D. J., Los Alamos National Lab., USA; Nemec, R. B., Los Alamos National Lab., USA; Milewski, J. O., Los Alamos National Lab., USA; [1997]; 9p; In English; Powder Metallurgy and Particulate Materials, 29 Jun. - 2 Jul. 1997, Chicago, IL, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3003; CONF-970655-; DE98-000992; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Directed Light Fabrication (DLF) is a metal, rapid fabrication process that fuses metal powders to full density into a solid replica of a computer modeled component. It has been shown feasible for forming nearly any metal and also intermetallics to near net shape with a single process. DLF of refractory pure metals is feasible, bypassing the extensive series of conventional processing steps used for processing these high melting point materials. Tungsten, tantalum, and rhenium were processed and show a continuous resolidified microstructure. Porosity was a problem for the tantalum and rhenium powders produced by chemical reduction processes but not for the tungsten powder spherodized in a plasma arc. Chemical analysis of powder compared to the DLF deposit showed reductions in carbon, oxygen and hydrogen, indicating that process parameters may also be optimized for evolution of residual gases in the deposits.
DOE
Technology Assessment; Powder Metallurgy; Computer Components; Plasmas (Physics); Chemical Reactions; Fabrication; Gas Evolution; Melting Points; Metal Powder

19980206709 Argonne National Lab., IL USA
Effects of He implantation on radiation induced segregation in Cu-Au and Ni-Si alloys
Iwase, A., Argonne National Lab., USA; Rehn, L. E., Argonne National Lab., USA; Baldo, P. M., Argonne National Lab., USA; Funk, L., Argonne National Lab., USA; Sep. 1997; 20p; In English; 8th; International Conference on Fusion Reactor Materials (ICFRM), 26 - 31 Oct. 1997, Sendai, Japan
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/MSD/CP-94538; CONF-971090; DE98-000640; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Effects of He implantation on radiation induced segregation (RIS) in Cu-Au and Ni-Si alloys were investigated using in-situ Rutherford backscattering spectrometry during simultaneous irradiation with 1.5-MeV He and low-energy (100 or 400-keV) He ions at elevated temperatures. RIS during single He ion irradiation, and the effects of pre-implantation with low-energy He ions, were also studied. RIS near the specimen surface, which was pronounced during 1.5-MeV He single-ion irradiation, and during simultaneous irradiation with 1.5-MeV He and low-energy He ions. A similar RIS reduction was also observed in the specimens pre-implanted with low-energy He ions. The experimental results indicate that the accumulated He atoms cause the formation of small bubbles, which provide additional recombination sites for freely migrating defects.
DOE
Ion Irradiation; Ion Implantation; Separation; Conferences

19980206710 Los Alamos National Lab., NM USA
Theoretical analysis of the shock-induced phase transition in iron
Wallace, D., Los Alamos National Lab., USA; Boettger, J., Los Alamos National Lab., USA; 1997; 15p; In English; New Models and Numerical Codes for Shock Wave Processes In Condensed Media, 15 - 19 Sep. 1997, Oxford, UK
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2892; CONF-9709108; DE98-000803; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We have studied the metastability and dynamics of the shock-induced (alpha) + (epsilon) phase transition in iron. Regarding metastability, it has long been known that the experimental Hugoniot does not agree with the theoretical equilibrium Hugoniot in the two-phase region above 13 GPa. We present a physically based construction of the metastable phase transition surface, and show that this surface is essentially the same in shocks as in quasistatic diamond-cell experiments. Regarding dynamics, we first

establish the correct irreversible thermodynamic basis for linear relaxation, then compare numerical wave propagation calculations with VISAR measurements of wave profiles. The phase transition relaxation time is found to depend weakly on sample thickness, implying some nonlinear relaxation must be present. This work provides two new insights in the theory of solid-solid phase transitions: (a) the metastable transition surface is given by a function of the (nonzero) difference in Gibbs energies of the two phases, and (b) the dynamics of the transition is expressed by relaxation toward the metastable surface, not toward equilibrium.
DOE
Iron; Phase Transformations; Metastable State; Thermodynamics; Shock Waves

19980206748 Japan Titanium Society, Tokyo, Japan
Fracture Toughness and Processing Routes Relations in Commercial Titanium Alloys for Developing Alternative Alloys for Ti-6Al-4V ***Final Report, 1 May 1996 - 30 Apr. 1998***
Niinomi, Mitsuo, Toyohashi Univ. of Technology, Japan; Jul. 31, 1997; 20p; In English
Contract(s)/Grant(s): F49620-96-1-0183
Report No.(s): AD-A344914; AOARD-96-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The static and dynamic fracture toughness, strength, and ductility of various titanium alloys were investigated. The crack propagation toughness and fatigue crack propagation rate under both static and dynamic conditions were also investigated an compared with that of T-6Al-4V at the elevated temperatures. The results showed that sudden decrease in strength, fracture toughness values or the stress intensity factors were noticeable at the elevated temperature of 1123K. The fracture toughness values evaluated from the load values (stress intensity factors) also decreased at a single annealing temperature of 1123K. The sudden decrease in strength was recovered by conducting duplex annealing. by duplex annealing, Widinanstatten alpha precipates in beta and then beta was able to stabilize the strength.
DTIC
Toughness; Titanium Alloys; Fatigue Tests; Fractures (Materials)

19980209656 Environmental Protection Agency, Office of Water, Washington, DC USA
Effect of Temperature on Corrosion Control
Dec. 1997; 86p; In English
Report No.(s): PB98-144777; EPA/815/B-97/004; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Contents include the following: Plumbosolvency Effects and Control in Hard Waters; Corrosion Control on the Basis of Utility Experience; Alkalinity, pH, and Copper Corrosion By-Products Release; Copper Corrosion and Iron Removal Plants; U.S. An Evaluation of the Secondary Effects of Enhanced Coagulation, With Emphasis on Corrosion Control; Seasonal Monitoring Revision; Effects of Inhibitors on Corrosion Rate and Metal Uptake.
NTIS
Potable Water; Temperature Effects; Corrosion Prevention; Pipes (Tubes)

19980209694 Lawrence Livermore National Lab., Livermore, CA USA
Ultrahigh carbon steels, Damascus steels, and superplasticity
Sherby, O. D., Stanford Univ., USA; Wadsworth, J., Lawrence Livermore National Lab., USA; Apr. 1997; 22p; In English; 9th; International Metallurgical and Materials Congress, 11 - 15 Jun. 1997, Istanbul, Turkey
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-127180; CONF-9706160-1; DE97-053447; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The processing properties of ultrahigh carbon steels (UHCSs) have been studied at Stanford University over the past twenty years. These studies have shown that such steels (1 to 2.1% C) can be made superplastic at elevated temperature and can have remarkable mechanical properties at room temperature. It was the investigation of these UHCSs that eventually brought us to study the myths, magic, and metallurgy of ancient Damascus steels, which in fact, were also ultrahigh carbon steels. These steels were made in India as castings, known as wootz, possibly as far back as the time of Alexander the Great. The best swords are believed to have been forged in Persia from Indian wootz. This paper centers on recent work on superplastic UHCSs and on their relation to Damascus steels.
DOE
Carbon Steels; Mechanical Properties; Superplasticity

19980209699 Argonne National Lab., IL USA

Fused-salt-liquid-metal corrosion of refractory alloys in the presence of hot cell impurities

Eberle, C. S., Argonne National Lab., USA; Raraz, A. G., Colorado School of Mines, USA; Mishra, B., Colorado School of Mines, USA; Olson, D. L., Colorado School of Mines, USA; [1997]; 4p; In English, 16 - 20 Nov. 1997, Albuquerque, NM, USA; Sponsored by American Nuclear Society, USA

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/ED/SUMM-93637; CONF-971125-10-Summ.; DE97-053539; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The pyrochemical conditioning of spent nuclear fuel for the purpose of final disposal is currently being demonstrated at Argonne National Laboratory (ANL). One aspect of this program is to develop a lithium preprocessing stage for the Fuel Conditioning Facility (FCF). Furthermore, a pilot scale of this preprocessing stage is being designed by ANL-W to demonstrate the in situ hot cell capability of this process. In this pilot scale system, fused lithium chloride salt is saturated with molten lithium to form a powerful fluxing compound with a vigorous reducing agent. During this stage of the fuel conditioning, the reduction will take place at a nominal temperature of 650 C in an argon-cell atmosphere contaminated with up to 10,000 ppm nitrogen, 100 ppm oxygen and 100 ppm of moisture. The maximum local temperature was calculated to be 725 C on the inner shell of the reduction vessel during operation. One of the significant concerns of this project is the system's corrosion response in the presence of irradiated commercial fuel as well as atmospheric impurities. The purpose of this work was to demonstrate the potential corrosivity of the salt matrix in a worse case environment as well as provide a boundary for allowable impurities in the system during operation.

DOE

Refractory Metal Alloys; Radioactive Wastes; Waste Disposal; Liquid Metals; Molten Salts; Contamination; Corrosion; Nuclear Fuels

19980209725 Georgia Inst. of Tech., School of Mechanical Engineering, Atlanta, GA USA

Modeling Temperature and Strain Rate History Effects in OFHC Cu

Tanner, Albert B., Georgia Inst. of Tech., USA; May 28, 1998; 427p; In English

Report No.(s): AD-A345850; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

Linking macro-scale material behavior with the evolution of microstructure has proven effective in obtaining an appropriate mathematical structure for constitutive relationships. Incorporation of strain rate, temperature, and deformation path history effects are especially critical to accurately predict material responses for arbitrary non isothermal, variable strain rate conditions. Material constitutive equations contain numerous parameters which must be determined experimentally, and often are not fully optimized. The goal of this research was to develop more physically descriptive kinematics and kinetics models for large strain deformation based on internal state variable (ISV) evolution laws which include strain rate and temperature history dependence. A unique and comprehensive set of experiments involving sequences of different strain rates, temperatures, and deformation paths, as well as, constant strain rate, isothermal and experiments characterizing restoration processes were conducted on OFHC Cu.

DTIC

Strain Rate; Copper; Isotherms; Models; Temperature Dependence

19980209730 Washington Univ., Materials Research Lab., Saint Louis, MO USA

Fatigue of Advanced In-Situ Composite Solders ***Final Report, 1 Sep. 1992 - 31 Aug. 1996***

Sastry, S. M., Washington Univ., USA; Jerina, K. L., Washington Univ., USA; Apr. 20, 1998; 46p; In English

Contract(s)/Grant(s): DAAL03-92-G-0361

Report No.(s): AD-A345807; ARO-30689.1-RT-EPS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Solder Joints used in surface mount technology experience thermomechanical fatigue due to the mismatches in coefficients of thermal expansion of the electrical component, the printed circuit board, and the solder itself, which during thermal cycles causes the solder Joint to undergo shear strains. The purpose of this study was to examine and explain the thermomechanical fatigue damage mechanisms of various types of solder compositions. Shear, creep, low cycle fatigue, and thermomechanical fatigue tests were conducted in this research. The development of cracks through heterogeneously coarsened, Sn-enriched bands was observed in Sn-Pb eutectic and solid solution strengthened alloys failed in thermomechanical fatigue. The dominant damage mechanism for these alloys was determined to be dislocation climb. Dispersion strengthening inhibited heterogeneous coarsening, and resulted in solders with greater thermomechanical fatigue lifetimes.

DTIC

Soldered Joints; Fatigue Life; Solders; Fatigue Tests

19980209834 Osaka Univ., Dept. of Materials Science and Engineering, Osaka, Japan

Tensile Deformation of an Aluminum Tricrystal with Parallel Grain Boundaries to Tensile Direction

Mizushima, Teruo, Chiba Inst. of Tech., Japan; Minegishi, Tomoya, Chiba Inst. of Tech., Japan; Saikawa, Hiroshi, Chiba Inst. of Tech., Japan; Yamane, Toshimi, Osaka Univ., Japan; Araki, Hideki, Osaka Univ., Japan; Saji, Shigeoki, Osaka Univ., Japan; Technology Reports of the Osaka University; Apr. 15, 1994; ISSN 0030-6177; Volume 44, Nos. 2163-2182, pp. 29-33; In English
Report No.(s): Rept-2166; Copyright; Avail: Issuing Activity (Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan), Hardcopy, Microfiche

An aluminum tricrystal of which constituent single crystals are parallel and have different orientations, was tensile-deformed in the direction parallel to grain boundaries. Flow stresses of the tricrystal are higher than those of constituent single crystals and the rule of mixture on flow stresses can not be applied. The influence of grain boundaries on deformation is very strong. The volume fraction of constituent single crystals influences flow stresses, and large volume ratio of a constituent single crystal having an orientation near [111] brings about the increase in flow stress.
Author

Tensile Deformation; Aluminum; Single Crystals; Grain Boundaries; Crystal Structure; Stress-Strain Relationships

19980209857 Kemp Development Corp., Houston, TX USA

Automated thermal treatment of metals with a mechanically fluidized vacuum machine ***Final Report***

Kemp, W. E., Kemp Development Corp., USA; Sep. 05, 1997; 8p; In English
Contract(s)/Grant(s): DE-FG01-95EE-15622
Report No.(s): DOE/EE/15622-T9; DE98-000945; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The ERIP project (open quotes) Automated Thermal Treatment of Metals with a Mechanically Fluidized Vacuum Machine (close quotes) produced more benefits in unintended areas than in the original intent of the program. The first project was directed to heat treating of solid parts using a retort half filled with fine powder. The treatment of metal powders was not originally envisioned at the time of proposal preparation. This second application, where the powder itself is being treated, has turned out to be multi-billion dollar market in which the Mechanical Fluidized Vacuum machine can create revolutionary changes. Consequently most efforts in recent years have been dedicated to further growth of the powder markets. These efforts procured a second ERIP grant titled (open quotes)Thermal Heat and Diffusion Treatment of Bulk Powders.(close quotes)
DOE

Metals; Vacuum; Vacuum Systems; Heat Treatment; Automation

19980209945 ESDU International Ltd., London, UK

Fracture Toughness (KIc) Values for Some Aluminium Alloys

Jun. 1996; 99p; In English; Included in the Stress and Strength Sub-series
Report No.(s): ESDU-96013; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96013 provides over 4000 values of plane strain fracture toughness for 23 US standard material specification aluminium alloys. The data are presented in tabular form, providing details of test temperature, crack orientation with respect to grain flow, proof stress, chemical composition and heat treatment. All data relate to non-corrosive environments at temperatures from - 253 to 149 C (- 423 to 300 F). Typical dependence of fracture toughness and proof stress on temperature is illustrated graphically. After a brief explanation of the importance of plane strain fracture toughness in design, test conditions, presentation of data and factors that affect fracture toughness are discussed. The method is explained by which statistical analysis is applied to the data to obtain with a chosen confidence design allowable values of fracture toughness, both from samples exceeding 30 values and from smaller samples of between 8 and 30 values. A worked example illustrates the use of results from that analysis with the data.
Author

Fracture Strength; Aluminum Alloys; Specifications; Data Structures; Tables (Data)

19980209954 Oak Ridge National Lab., TN USA

Embrittlement of austenitic stainless steel welds

David, S. A., Oak Ridge National Lab., USA; Vitek, J. M., Oak Ridge National Lab., USA; [1997]; 8p; In English; Welding, 11-14 Dec. 1997, Bangalore, India
Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-95330; CONF-971220; DE98-001430; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The microstructure of type-308 austenitic stainless steel weld metal containing (gamma) and (delta) and ferrite is shown. Typical composition of the weld metal is Cr-20.2, Ni-9.4, Mn-1.7, Si-0.5, C-0.05, N-0.06 and balance Fe (in wt %). Exposure of austenitic stainless steel welds to elevated temperatures can lead to extensive changes in the microstructural features of the weld metal. On exposure to elevated temperatures over a long period of time, a continuous network of M(sub 23)C(sub 6) carbide forms at the austenite/ferrite interface. Upon aging at temperatures between 550--850 C, ferrite in the weld has been found to be unstable and transforms to sigma phase. These changes have been found to influence mechanical behavior of the weld metal, in particular the creep-rupture properties. For aging temperatures below 550 C the ferrite decomposes spinodally into (alpha) and (alpha)(prime) phases. In addition, precipitation of G-phase occurs within the decomposed ferrite. These transformations at temperatures below 550 C lead to embrittlement of the weld metal as revealed by the Charpy impact properties.

DOE

Austenite; Austenitic Stainless Steels; Carbides; Charpy Impact Test; Creep Rupture Strength; Ferrites; Impact Resistance; Impact Strength; Mechanical Properties; Microstructure; Transformations (Mathematics)

19980209962 Sandia National Labs., Albuquerque, NM USA

Aspects of two corrosion processes relevant to military hardware

Braithwaite, J. W., Sandia National Labs., USA; Buchheit, R. G., Sandia National Labs., USA; Nov. 1997; 25p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2899; DE98-001595; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Corrosion is a leading material degradation mode observed in many military systems. This report contains a description of a small project that was performed to allow some of the important electrochemical aspects of two distinct and potentially relevant degradation modes to be better understood: environmentally assisted cracking (EAC) of aluminum alloys and corrosion in moist salt. Two specific and respective tasks were completed: (A) the characterization of the effect of aluminum microstructural variability on its susceptibility to EAC, and (B) the development of experimental and analytical techniques that can be used to identify the factors and processes that influence the corrosivity of moist salt mixtures. The resultant information constitutes part of the basis needed to ultimately predict component reliability and/or possibly to identify techniques that could be used to control corrosion in critical components. In Task A, a physical model and related understanding for the relevant degradation processes were formulated. The primary result from Task B included the identification and qualitative validation of a methodology for determining the corrosivity of salt mixtures. A detailed compilation of the results obtained from each of these two diverse tasks is presented separately in the body of this report.

DOE

Microstructure; Aluminum Alloys; Variability; Corrosion; Aluminum

19980209991 Sandia National Labs., Albuquerque, NM USA

Model determination and validation for reactive wetting processes

Yost, F. G., Sandia National Labs., USA; OToole, E. J., Sandia National Labs., USA; Sackinger, P. A., Sandia National Labs., USA; Swiler, T. P., New Mexico Univ., USA; Jan. 1998; 62p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-3122; DE98-002546; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

It is shown that dissolutive wetting initially yields a metastable equilibrium. A compact model for the kinetics of approach to this metastable state is described. The technique for constructing these kinetics stems from the early work of Onsager and begins with a relationship for the entropy production. From this, a coupled set of nonlinear, ordinary differential equations can be written directly. The equations are solved numerically for the wetted area and compared with experimental data. The model captures many of the subtle complexities of dissolutive wetting such as multiple metastable states. Sessile drop experiments involving a variety of Bi-Sn alloys on solid Bi substrates were performed. Substrates prepared from small and large-grained polycrystals and single crystals were used to measure equilibrium and metastable contact angles and estimate the surface tension and equilibrium contact angle of the solid-liquid interface. The substrates were also used to investigate the coupling of the dissolution and wetting processes and to investigate the effect of substrate grain size on wetting. It was determined that the equilibrium wetting geometry is independent of linear scale and that grain size has little influence on wetting or dissolution in the Bi-Sn system. to investigate the atomic behavior of liquids at interfaces during wetting, the authors simulated wetting in the Ag-Cu system using molecular dynamics with atomic potentials and observed both atomic dynamics and structural correlations of the liquid-solid interface. The

authors found that spreading is prompted by interactions between the liquid and the substrate surface that cause the liquid layer in contact with the substrate to take on some of the symmetry of the substrate surface and result in the formation of a liquid monolayer that extends beyond the major part of the liquid droplet.
DOE
Bismuth Alloys; Tin Alloys; Surface Properties; Wettability; Liquid-Solid Interfaces; Wetting

19980210099 Westinghouse Savannah River Co., Aiken, SC USA
Stainless Steel RSM Beneficial Reuse technical feasibility to business reality
Boettinger, W. L., Westinghouse Savannah River Co., USA; Mishra, G., Westinghouse Savannah River Co., USA; Aug. 1997; 30p; In English; 5th; Recycle and Reuse of Radioactive Scrap Metal, 5-7 Aug. 1997, Knoxville, TN, USA
Contract(s)/Grant(s): DE-AC09-96SR-18500
Report No.(s): WSRC-RP-97-292; CONF-970830; DE97-053832; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Stainless Steel Beneficial Reuse Program began in 1994 as a demonstration funded by the DOE Office of Science and Technology. The purpose was to assess the practicality of stainless steel radioactive scrap metal (RSM) recycle. Technical feasibility has been demonstrated through the production of a number of products made from recycled RSM. A solid business foundation is yet to be achieved. However, a business environment is beginning to develop as multiple markets and applications for RSM are surfacing around the Complex. The criteria for a successful business reality includes: affordable programs, a continuing production base from which to expand, real products needs, adequate RSM supply, and a multi-year program. This program currently sponsored by SRS and DOE-ORO to fabricate Defense Waste Processing Facility (DWPF) canisters from RSM provides an activity that satisfies these criteria. The program status is discussed. A comparison of the cost of DWPF canisters fabricated from recycled RSM and virgin metal is presented. The comparison is a function of several factors: disposal costs, the fabrication cost of virgin metal canisters, the fabrication cost of recycled RSM canisters, free release decontamination costs, and the cost to accumulate the RSM. These variables are analyzed and the relationship established to show the break-even point for various values of each parameter.
DOE
Radioactive Wastes; Research and Development; Stainless Steels; Reuse; Decontamination; Scrap

19980210124 Los Alamos National Lab., NM USA
YBCO/YSZ coated conductors on flexible Ni alloy substrates
Arendt, P. N., Los Alamos National Lab., USA; Foltyn, S. R., Los Alamos National Lab., USA; Groves, J. R., Los Alamos National Lab., USA; DePaula, R. F., Los Alamos National Lab., USA; 1997; 7p; In English; Cryogenic Engineering and Cryogenic Materials Conference, 27 Jul. - 1 Aug. 1997, Portland, OR, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3110; CONF-970758; DE98-001451; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A coating system for the deposition of in-plane oriented yttria-stabilized zirconia (YSZ) template films on 1 cm wide flexible metal substrates is presented. In static mode, the system is capable of producing high quality template films on 20 cm substrate lengths. In a continuous coating mode, the system is capable of producing good quality template films on 1.1 m substrate lengths. Superconducting YBa(sub 2)Cu(sub 3)O(sub 7-(delta)) (YBCO) films subsequently deposited onto these template films have demonstrated critical currents (I(sub c)) of 200 A (1.5 cm length), 70 A (12 cm length), and 4 A (1 m length).
DOE
YBCO Superconductors; Yttria-Stabilized Zirconia; Coatings; Conductors; Nickel Alloys; Deposition

19980210128 Los Alamos National Lab., NM USA
Preliminary lifetime predictions for 304 stainless steel as the LANL ABC blanket material
Park, J. J., Los Alamos National Lab., USA; Buksa, J. J., Los Alamos National Lab., USA; Houts, M. G., Los Alamos National Lab., USA; Arthur, E. D., Los Alamos National Lab., USA; Nov. 1997; 20p; In English
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-13337-MS; DE98-001868; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The prediction of materials lifetime in the preconceptual Los Alamos National Laboratory (LANL) Accelerator-Based Conversion of Plutonium (ABC) is of utmost interest. Because Hastelloy N showed good corrosion resistance to the Oak Ridge National Laboratory Molten Salt Reactor Experiment fuel salt that is similar to the LANL ABC fuel salt, Hastelloy N was origi-

nally proposed for the LANL ABC blanket material. In this paper, the possibility of using 304 stainless steel as a replacement for the Hastelloy N is investigated in terms of corrosion issues and fluence-limit considerations. An attempt is made, based on the previous Fast Flux Test Facility design data, to predict the preliminary lifetime estimate of the 304 stainless steel used in the blanket region of the LANL ABC.
DOE
Stainless Steels; Hastelloy (Trademark); Corrosion; Corrosion Resistance; Fluence

19980210134 Brookhaven National Lab., Upton, NY USA
Photochemical carbon dioxide reduction with metal complexes: Differences between cobalt and nickel macrocycles
Fujita, Etsuko, Brookhaven National Lab., USA; Brunschwig, B. S., Brookhaven National Lab., USA; Cabelli, D., Brookhaven National Lab., USA; Renner, M. W., Brookhaven National Lab., USA; Furenlid, L. R., Brookhaven National Lab., USA; Ogata, Tomoyuki, Brookhaven National Lab., USA; Wada, Yuji, Osaka Univ., Japan; Yanagida, Shozo, Osaka Univ., Japan; 1997; 10p; In English; 4th; Carbon Dioxide Utilization, 7-11 Sep. 1997, Kyoto, Japan
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-64734; CONF-970945; DE98-001861; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Problems related to increases of green house gases in the atmosphere and the depletion of fossil fuels have made the conversion of CO2 into useful chemicals and fuels an important area of research. However, CO2 reduction poses many scientific challenges. Despite intense interest in photochemical and electrochemical CO2 reduction, the kinetics and mechanism of the reduction remain unclear in many systems. This research focuses on mechanistic and kinetic studies of photochemical and electrochemical CO2 reduction that involves metal complexes as catalysts. This work makes use of UV-vis, NMR, and FTIR spectroscopy, flash photolysis, pulse radiolysis, X-ray diffraction, XANES (X-ray absorption near-edge spectroscopy) and EXAFS (extended X-ray absorption fine structure). Here the authors summarize their research on photochemical carbon dioxide reduction with metal macrocycles.
DOE
Carbon Dioxide; Complex Compounds; Cobalt; Nickel; Fossil Fuels; Reduction; Photolysis

19980210213 Department of the Navy, Washington, DC USA
Corrosion Detecting and Monitoring Method and Apparatus
Perez, Ignatio M., Inventor, Department of the Navy, USA; Agarwala, Vinod S.,, Inventor, Department of the Navy, USA; Jul. 08, 1997; 6p; In English
Patent Info.: Filed 14 Jul. 1995; US-Patent-Appl-SN-502,661; US-Patent-5,646,400
Report No.(s): AD-D018862; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A nondestructive method and apparatus for optical detection and monitoring corrosion in structures normally inaccessible to light and observation. An optical fiber coated with a corrosion sensitive compound is embedded in the structure. Tapped Bragg gratings of different Bragg periods are spaced along the fiber and refract a narrow bandwidth component of a broad beam tight pulse transmitted through the fiber. Due to corrosion the refracted components are reflected by the compound and their amplitudes are detected and displayed for each narrow bandwidth.
DTIC
Bandwidth; Visual Observation; Optical Measurement; Optical Fibers; Coatings; Bragg Gratings

19980210304 Department of the Navy, Washington, DC USA
Porous Materials by Powder Metallurgy
Everett, Richard, Inventor, Department of the Navy, USA; Apr. 30, 1998; 17p; In English
Patent Info.: Filed 30 Apr. 1998; US-Patent-Appl-SN-069932
Report No.(s): AD-D018882; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A porous material of desired porosity and pore size is made by mixing a particulate material and fungible beads that are thermally decomposable until the desired distribution is attained; compacting the mixed material and beads to form a green body that has sufficient strength to be handled where the beads are undecomposed; and compacting and heating the green body to fuse the material particles and to decompose the beads to gas.
DTIC
Porous Materials; Powder Metallurgy; Porosity

19980210403 Cleveland State Univ., Chemical Engineering Dept., Cleveland, OH USA

Macrosegregation in Directionally Solidified Pb-Sn Alloys ***Final Report, 24 May 1993 - 17 Oct. 1997***

Tewari, Surendra N., Cleveland State Univ., USA; Feb. 18, 1998; 19p; In English

Contract(s)/Grant(s): NCC3-299

Report No.(s): NASA/CR-1998-208245; NAS 1.26:208245; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thermosolutal convection in the dendritic mushy zone occurs during directional solidification of hypoeutectic lead tin alloys in a positive thermal gradient, with the melt on the top and the solid below. This results in macrosegregation along the length of the solidified samples. The extent of macrosegregation increases with increasing primary dendrite spacings for constant mushy zone length. For constant primary spacings, the macrosegregation increases with decreasing mushy zone length. Presence of convection reduces the primary dendrite spacings. However, convection in the interdendritic melt has significantly more influence on the spacings as compared with that in the overlying melt, which is caused by the solutal build up at the dendrite tips.
Author

Solidification; Tin Alloys; Lead Alloys; Chemical Fractionation

19980210542 Lawrence Livermore National Lab., Livermore, CA USA

Electrochemical and metallographic evaluation of alloys C-22 and 625

Roy, A. K., Framatome Cogema Fuels, USA; Fleming, D. L., Lawrence Livermore National Lab., USA; Lum, B. Y., Lawrence Livermore National Lab., USA; May 01, 1997; 13p; In English

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-ID-127355; DE98-051039; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Electrochemical cyclic potentiodynamic polarization (CPP) experiments were performed on Alloys C-22 and 625 to evaluate their susceptibility to localized corrosion in acidic brines of various salt content at 90(degrees)C. The microstructures of both tested and untested specimen's were evaluated by optical microscopy. This paper presents the results showing the effect of chloride ion concentration on the pitting and crevice corrosion behavior of these alloys, and the relationship of the observed microstructures to the resulting surface degradation modes.
DOE

Microstructure; Metallography; Degradation; Carbon Isotopes

19980210574 Los Alamos National Lab., NM USA

Alloy design and phase stability of the ternary alloy titanium-aluminum-niobium

Albers, R. C., Los Alamos National Lab., USA; Chen, Shao-Ping, Los Alamos National Lab., USA; Wills, J. M., Los Alamos National Lab., USA; [1998]; 6p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3150; DE98-001589; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The authors have used high-precision electronic-structure and cluster-variational method (CVM) techniques to study aspects of alloy design involving the phase stability and ordering tendencies of the ternary system Ti-Al-Nb, and the correlation with these to changes in the electronic structure of these materials. This system is of great interest for aerospace applications due to its desirable mechanical properties and low densities. Total energies were computed for 18 binary and ternary bcc superstructures in order to derive parameters for CVM calculations, which showed important strong ordering tendencies in the alloy phase diagram as a function of temperature and alloy concentration. Structural optimization calculations were used to analyze structural instabilities for bcc, fcc, hcp, O-phase, and omega-phase structures. The authors discovered the mechanism for the role of Nb in the structural stability of the O-phase of the ternary intermetallic Ti2AlNb. Calculations were also done to investigate the electronic properties associated with the structural stability of a related class of Laves Phase high-temperature structural materials NbCr2 and HfV2.
DOE

Intermetallics; Ternary Alloys; Titanium Alloys; Niobium Alloys; Aluminum Alloys; Atomic Structure; Refractory Materials; Phase Stability (Materials)

19980210758 Brookhaven National Lab., Upton, NY USA

Effect of Mo on pitting corrosion of ferritic steels in bromide and chloride solutions

Kaneko, M., Nippon Steel Corp., Japan; Isaacs, H. S., Brookhaven National Lab., USA; 1997; 5p; In English; 192nd; 48th, 31 Aug. - 5 Sep. 1997, Paris, Paris, France, France; Sponsored by Electrochemical Society, Inc., USA

Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-64153; CONF-970805; DE98-001622; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A model for pitting corrosion of stainless steels, independent of changes of passive film properties, was tested using Fe-18%Cr-x%Mo alloys in bromide and chlorine solutions. In 1M LiCl the pitting potential improved from -50 mV(sub sce) to about 1200 mV(sub sce) on increasing Mo from 2% to 10%. In 1M LiBr the pitting potential increased from 125 to only 560 mV(sub sce). Active dissolution kinetics of these steels in saturated solutions in a simulated pit were measured. Tafel lines for dissolution moved to more noble potentials with increases in Mo, indicating Mo inhibited dissolution rates. The potential increases were found to be equal to the increases in pitting potential for both halides. Agreement was interpreted in terms maintaining high halide concentrations in the pit by high rates of active metal dissolution. Bromide was less effective suggesting it interacted with Mo adsorbed on the dissolving surface.

DOE

Bromides; Corrosion; Stainless Steels; Lithium Chlorides

19980210809 Max-Planck-Inst. fuer Eisenforschung, Duesseldorf, Germany

Development of powder injection moulding (PIM) for the manufacture of turbine components from basic NiAl alloys. Part project: Development and characterisation of the structures and properties of basic NiAl alloys and reinforced silicides ***Final Report Entwicklung des Powder Injection Moulding (PIM) fuer die Herstellung von Turbinenkomponenten aus NiAl-Basislegierungen. Teilprojekt: Legierungstechnische Entwicklung und Charakterisierung der Strukturen und Eigenschaften von NiAl-Basislegierungen und***

Frommeyer, G., Max-Planck-Inst. fuer Eisenforschung, Germany; Schaefer, H. J., Max-Planck-Inst. fuer Eisenforschung, Germany; Klaus, S., Max-Planck-Inst. fuer Eisenforschung, Germany; Feb. 1997; 59p; In German

Contract(s)/Grant(s): Foerderkennzeichen BMBF 03M305

Report No.(s): ETDE-DE-647; DE98-743424; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The quasi-binary eutectic systems: NiAl-Cr, NiAl-(MoRe) represent two phase alloys whose structures consist of the inter-metallic NiAl(X) mixed crystal matrix and a finely divided mixed crystal phase with highly symmetrical cubic or hexagonal grid structure. Compared to conventional super-alloys, these systems are distinguished by low densities and good resistance to oxidation. NiAl-(Cr, Mo, Re) high temperature materials processed by PIM show appreciably improved ductility properties at room temperature and high temperatures. The ductility of NiAl-Cr27 alloys can be raised further by micro-alloying with magnesium and carbon. The strengths of PIM NiAl alloys are comparable to those of cast NiAl(X) materials. MoSi alloys modified with aluminium were also produced and their ductility was examined. The extremely high hardness (1030HV(0.3)) of MoSi(sub 2) was lowered to 830 HV(0.3) by the addition of 1.5% of aluminium. Sliding systems of Mo (Si, Al)2 which can be activated by hardness impression were shown by the formation of sliding lines. The optimized IP alloys with improved properties were made into components (guide vanes) by means of PIM technique. These represented an economically favourable ”near net shape” of structure components for the use of inter-metallic NiAl(X) and MoSi2 alloys. The aim of the project of developing inter-metallic phase material resistant to high temperature with sufficient toughness and strength properties for PIM technique to manufacture highly stressed engine parts was therefore reached.

DOE

Refractory Materials; Engine Parts; Aluminum Alloys; Nickel Alloys; Alloying; Mechanical Properties; Microstructure; Gas Turbines; Powder Metallurgy

19980210828 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of

Computer assisted alloy and process design of nuclear structural steels

Lee, Byeong Joo, Korean Atomic Energy Research Inst., Korea, Republic of; Jul. 1997; 57p; In Korean

Report No.(s): KAERI-CM-144/96; DE98-725030; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

Based on literature research and thermodynamic calculations, it was suggested that toughness of SA508 class 3 steels can be improved by grain refinement using pinning by AIN during forging if alloy contents of Al and N are adjusted. It was also pointed out that the temper embrittlement due to the coarsening of M(sub 2)C carbide may originate from phase transition to the more

stable (xi)-carbide. A necessity of experimental works to avoid such a transition by adjustment of alloy composition was claimed. An optimum temperature for the intercirtical heat treatment was derived by thermodynamic= calculation and was found to agree with experimentally derived one. The thermodynamic database and the present calculation scheme can be used as a powerful research tool in further study for design of next generation RPV steels of wide composition range, if combined with the current experimental technology.
DOE
Computer Techniques; Steels

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.

19980206486 Sandia National Labs., Albuquerque, NM USA
Single-monolayer in situ modulus measurements using a SAW device: Photocrosslinking of a diacetylenic thiol-based monolayer
Ricco, A. J., Sandia National Labs., USA; Staton, A. W., Sandia National Labs., USA; Crooks, R. M., Texas A&M Univ., USA; Kim, Taisun, Hallym Univ., Korea, Republic of; 1997; 20p; In English; Interaction of Acoustic Waves with Thin Films and Interfaces, 8 - 10 Sep. 1997, Leicester, UK
Contract(s)/Grant(s): DE-AC04-94AL-85000; NSF CHE-93-13441
Report No.(s): SAND-96-2614C; CONF-970997; DE98-000174; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We report direct measurement of the modulus change that accompanies the crosslinking of a single molecular monolayer. We measured a change in elastic modulus of 5 x 10(exp 10) dyn/sq cm as a result of ultraviolet-induced photocrosslinking of a single surface-confined monolayer of the conjugated diacetylenic thiol HS(CH2)(sub 10)C(triple bond)CC(triple bond)C(CH2)(sub 10)COOH, designated 'DAT' hereafter. The modulus measurement was made on a monolayer of DAT chemisorbed upon a gold film on the surface of a 97-MHz ST-quartz surface acoustic wave delay line. The ratio of the changes recorded in SAW velocity and attenuation, approximately 4:1, suggests that the measured effect is mainly a change in the elastic (real) component of the complex shear modulus, viscous changes playing a lesser role. In relation to typical polymer modulus values, the change of 5 x 10(exp 10) dyn/sq cm is consistent with a change from a rubbery material (G(prime) (approximately) 10(exp 7) - 10(exp 8) dyn/sq cm to a fairly rigid, glassy material (G(prime) (approximately) 10(exp 10) dyn/sq cm, reasonable for comparison of the monolayer in its as-adsorbed and crosslinked forms. This report of the direct SAW-based measurement of the modulus change associated with the crosslinking of a single molecular monolayer is complementary to and consistent with previous in-situ measurements of this process using thickness-shear mode resonators.
DOE
Shear Properties; Modulus of Elasticity; Metal Films; Crosslinking; Confinement; Chemisorption; Adsorption

19980206488 Sandia National Labs., Albuquerque, NM USA
Structure and optical properties of rare earth-doped zinc oxyhalide tellurite glasses
Sidebottom, D. L., New Mexico Univ., USA; Hruschka, M. A., New Mexico Univ., USA; Potter, B. G., Sandia National Labs., USA; Brow, R. K., Sandia National Labs., USA; 1997; 20p; In English; 14th; Glass Science, 18 - 20 Jun. 1997, Bethlehem, PA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-0551C; CONF-9706172; DE98-000202; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Zinc tellurite glasses appear to be excellent candidates for hosting rare earth ions since they provide a low phonon energy environment to minimize non-radiative losses as well as possess good chemical durability and optical properties. The optical behavior of the rare earth ion can be manipulated by modifying its local environment in the glass host. The authors report measurements of the emission lifetime, optical absorption, and vibrational density of states of the glass system (ZnO(x)(ZnF2)(sub y)(TeO2)(sub 1-x-y)doped (0.1 mol%) with a series of rare earths. Phonon sideband spectroscopy has been successfully employed

to probe vibrational structure in the immediate vicinity of the rare earth ion. The authors observe a significant increase in the emission lifetime (from approximately 150 microseconds to 250 microseconds) of Nd(3+) with increasing fluorine substitution.
DOE
Doped Crystals; Rare Earth Elements; Vibrational States; Electromagnetic Absorption; Optical Properties

19980206506 Argonne National Lab., IL USA
The incorporation of technetium into a representative low-activity waste glass
Ebert, W. L., Argonne National Lab., USA; Bakel, A. J., Argonne National Lab., USA; Bowers, D. L., Argonne National Lab., USA; Buck, E. C., Argonne National Lab., USA; Emery, J. W., Argonne National Lab., USA; [1997]; 11p; In English; 99th, 4-7 May 1997, Cincinnati, OH, USA; Sponsored by American Ceramic Society, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/CMT/CP-92096; CONF-970568; DE97-053352; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A glass that has been tested to understand the corrosion behavior of waste glasses with high soda contents for immobilizing Hanford incidental wastes has been made by melting crushed glass with either TcO2 or NaTcO4 at 1,100--1,300 C. Incorporation of technetium in the glass was affected by solubility or kinetic effects. Metallic technetium inclusions formed in all the TcO2-doped glasses. Inclusions also formed in glasses with added NaTcO4 that were melted at 1,100 C, but a glass melted at 1,200 C did not contain detectable inclusions. The presence of Tc-bearing inclusions complicates the interpretation of results from dissolution tests because of the simultaneous release of technetium from more than one phase, the unknown surface areas of each phase, and the possible incorporation of technetium that is released from one phase into another phase. A glass containing about 0.15 mass % Tc dissolved in the glass is being used in dissolution tests to study the release behavior of technetium.
DOE
Technetium Compounds; Radioactive Wastes; Glass; Corrosion

19980206610 Oak Ridge National Lab., TN USA
Scale-up of microwave nitridation of sintered reaction bonded silicon nitride parts ***Final Report***
Tiegs, T. N., Oak Ridge National Lab., USA; Kiggans, J. O., Oak Ridge National Lab., USA; Garvey, G. A., Oak Ridge National Lab., USA; [1997]; 21p; In English
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/M-6107; DE98-000101; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Scale-up were performed in which microwave heating was used to fabricate reaction-bonded silicon nitride and sintered reaction-bonded silicon nitride (SRBSN). Tests were performed in both a 2.45 GHz, 500 liter and a 2.45 GHz, 4000 liter multimode cavities. The silicon preforms processed in the studies were clevis pins for diesel engines. Up to 230 samples were processed in a single microwave furnace run. Data were collected which included weight gains for nitridation and sintering studies were performed using a conventional resistance-heated furnace.
DOE
Silicon Nitrides; Sintering; Fabrication; Heating

19980206611 Oak Ridge National Lab., TN USA
Gelcasting ceramic defense parts
Janney, M. A., Oak Ridge National Lab., USA; Jankiewicz, A. T., Oak Ridge National Lab., USA; [1997]; 10p; In English
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/M-6135; DE98-000100; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The goal of this work was to demonstrate an ability to gelcast and fire a particular defense-related part to net shape and to hold the required tolerances on size and shape with minimal or no post firing machining. The precision required represents a huge increase in the precision currently achievable by standard ceramic processing. The project has produced very promising results. While we did not achieve the degree of precision in as-fired parts that we had targeted (+/- 0.025%), we did improve our ability to hold tolerances to the +/- 0.25 level from our initial level of +/- 2.5 % on parts that were 5 to 10 inches in diameter. The progress to date makes us believe that the ultimate goal is achievable. We have demonstrated that gelcasting can be a viable precision forming technique for large articles. We are currently working with our industrial partner on a Statement of Work for a follow on project. This will be either a CRADA or a WFO project. The anticipated funding level is one person year in 1997 with funds coming from

the industrial partner. Assuming reasonable progress is made in 1997, additional projects of similar size are expected in 1998 and out years funded either by the industrial partner or by DOD.
DOE
Ceramics; Forming Techniques

19980206620 Los Alamos National Lab., NM USA
Next generation enhancement of cements by the addition of industrial wastes and subsequent treatment with supercritical CO2
Taylor, C. M. V., Los Alamos National Lab., USA; Rubin, J. B., Los Alamos National Lab., USA; Carey, J. W., Los Alamos National Lab., USA; Jones, R., Materials Technologies Corp., USA; Baglin, F. G., Nevada Univ., USA; [1997]; 5p; In English; 1997 Green Chemistry and Engineering Conference: Implementing Vision 2020 for the Environment, 23 - 25 Jun. 1997, Washington, DC, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2104; CONF-9706177; DE97-008975; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The natural curing reactions which occur in a standard portland cement involve the formation of portlandite, Ca(OH)2, and calcium silicate hydrates, CSH. Over time, the cured cement abstracts carbon dioxide, CO2, from the air, converting the portlandite and CSH to calcium carbonate, CaCO3. It turns out, however, that this secondary conversion results in the blockage and/or closure of pores, drastically slowing the reaction rate with time. by exposing a portland cement to supercritical CO2 (SCCO2), it is found that the carbonation reaction can be greatly accelerated. This acceleration is due to (1) the ability of the supercritical fluid to penetrate into the pores of the cement, providing continuous availability of fresh reactant, in hyper-stoichiometric concentrations; and (2) the solubility of the reaction product in the supercritical fluid, facilitating its removal. by accelerating the natural aging reactions, a chemically stable product is formed having reduced porosity, permeability and pH, while at the same time significantly enhancing the mechanical strength. The supercritical CO2 treatment process also removes a majority of the hydrogenous material from the cement, and sequesters large amounts of carbon dioxide, permanently removing it from the environment. The authors describe the general features of supercritical fluids, as well as the application of these fluids to the treatment of cements containing industrial waste. Some of the issues concerning the economic feasibility of industrial scale-up will be addressed. Finally, some initial results of physical property measurements made on portland cements before and after supercritical fluid CO2 treatment will be presented.
DOE
Cements; Calcium Carbonates; Industrial Wastes; Supercritical Fluids; Reaction Kinetics; Calcium Silicates; Curing

19980206648 Argonne National Lab., IL USA
Fractal analysis of granular activated carbons using isotherm data
Khalili, N. R., Illinois Inst. of Tech., USA; Pan, M., Illinois Inst. of Tech., USA; Sandi, G., Argonne National Lab., USA; 1997; 12p; In English; 214th, 7-13 Sep. 1997, Las Vegas, NV, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/ASD/CP-93245; CONF-970962; DE97-053357; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Utilization of adsorption on solid surfaces was exercised for the first time in 1785. Practical application of unactivated carbon filters, and powdered carbon were first demonstrated in the American water treatment plant, and a municipal treatment plant in New Jersey, in 1883 and 1930, respectively. The use of activated carbon became widespread in the next few decades. At present, adsorption on carbons has a wide spread application in water treatment and removal of taste, odor, removal of synthetic organic chemicals, color-forming organics, and desinfection by-products and their naturally occurring precursors. This paper presents an analysis of the surface fractal dimension and adsorption capacity of a group of carbons.
DOE
Activated Carbon; Adsorption; Filters; Solid Surfaces; Water Treatment

19980209657 Maryland Univ., Dept. of Mechanical Engineering, College Park, MD USA
Fire Protection Foam Thermal Physical Properties
Tafreshi, A. M., Maryland Univ., USA; diMarzo, M., Maryland Univ., USA; Floyd, R., Maryland Univ., USA; Wang, S., Maryland Univ., USA; Mar. 1998; 116p; In English
Contract(s)/Grant(s): NIST-60NANB6D0073
Report No.(s): PB98-146103; NIST-GCR-98-742; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This document contains the results of the work performed to evaluate properties of foams used for fire exposure protection. The scope of this effort is to establish a testing procedure to evaluate the relevant properties of fire exposure protection foams. There are many different types of foams on the market. Most of the foams are used for fire suppression, but this study focusses on those intended to be used for fire exposure protection. Five foams were selected, all commercially available. Each comes in a concentrated liquid which is diluted in water and mixed with air to form a protective coating. Four of the foams chosen are synthetic hydrocarbon based. The fifth is a protein based foam manufactured from raw animal protein sources. All five foams are generated and tested in identical manners to observe their individual fire exposure protection characteristics. The four synthetic foams are identified a Foams, A, B, C, and D and the protein based foam is identified as E. This study has systematically addressed the evaluation of the parameters that effect the foam performance. The progression of these efforts is outlined hereafter.
NTIS
Foams; Fire Prevention; Performance Tests; Thermodynamic Properties; Protective Coatings

19980209663 Swedish Water and Air Pollution Research Lab., Goeteborg, Sweden
Propylene Glycol Ethers for Degreasing and Cleaning Purposes ***Propylenglykoletrar som Avfettningsmedel***
Hansen, O., Swedish Water and Air Pollution Research Lab., Sweden; Dec. 1997; 80p; In Swedish
Report No.(s): PB98-147549; IVL-B-1282; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Propylene Glycol Ethers, (PGE's) have been brought up as an alternative to chlorinated solvents (e.g. trichloro ethylene) for degreasing and cleaning purposes. PGE's are colorless liquids that are soluble in water and several organic solvents. They are relatively non-volatile and have a sweet ether-like odor. The study indicates that the PGE's are a good alternative in those cases where degreasing based on water can not be used. The health and environmental risks of degreasing with PGE's are rather low. Five companies, four of which had earlier used trichloro-ethylene as a degreasing agent, were visited in this study. At each company, the degreasing equipment and methods of work were studied. interviews and air monitoring were carried out at every company. The goods were sprayed with or dipped in a solution of PGE's. The solution was regenerated at four of the companies using filtration or distillation. The general opinions of the companies about PGE's compared to trichloroethylene, were that the cleaning effect and consumption was about the same, the capacity lower (due to need for drying), and the workload slightly higher.
NTIS
Ethers; Alternatives; Solvents; Cleaners; Cleaning; Propylene; Glycols

19980209673 National Physical Lab., Teddington, UK
CEN/VAMAS Phase Volume Fraction Round Robin
Hendrix, M., National Physical Lab., UK; Bennett, E., National Physical Lab., UK; Morrell, R., National Physical Lab., UK; Dortmans, L. J. M. G., National Physical Lab., UK; deWith, G., National Physical Lab., UK; May 1998; 68p; In English; Sponsored in part by Versailles Project on Advanced Materials and Standards
Report No.(s): PB98-148471; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report describes the analysis of a round robin conducted under the auspices of CEN Technical Committee 184, Advanced Technical Ceramics. The objective was to evaluate the potential accuracy and repeatability of making manual or automatic image analysis characterizations of phase volume fraction in multiphase ceramic materials. Participants were provided with a series of micrographs, including one generated by computer, and a ceramic sample, of the same material used for some of the supplied micrographs, from which a further micrograph had to be prepared by the participant using his/her own methods. The micrographs were analyzed manually using a grid intersection counting method, and automatically using a grey level pixel counting method. It has been found that the conditions employed for the manual measurements gave acceptable and explainable scatter of results, and provided a suitable basis for preparation of a CEN standard. In contrast, the results obtained using AIA were less reliable and more widely scattered owing to factors involved in inputting the image (re-formatting, re-sizing, or analysis of part areas only) and the difficulties of assinging features to the count for particular phases due to the contrast variations across these phases.
NTIS
Ceramics; Standards; Image Analysis; Evaluation; Accuracy

19980209690 Department of the Navy, Washington, DC USA
Adhesive Shear Strength Test Apparatus
Nickerson, Earl S., Inventor, Department of the Navy, USA; Tucker, Wayne C., Inventor, Department of the Navy, USA; Nov. 25, 1997; 6p; In English; Supersedes US-Patent-Appl-SN-682898, AD-D018184.
Patent Info.: Filed 11 Jul. 1996; US-Patent-Appl-SN-682,898; US-Patent-5,691,482

Report No.(s): AD-D018842; No Copyright; Avail: US Patent and Trademark Office, Microfiche

All apparatus for testing adhesive shear strength having a cylindrical adhesive bond between test specimens which is subjected to pure shear. The test specimens are two cylindrical rods. One rod has a bore and counterbore reamed into one end along its longitudinal axis. The other rod has a diameter essentially equal to the diameter of the bore. The adhesive to be tested is placed within the bore and counterbore and the smaller diameter rod is inserted into and seated at the base of the bore. The adhesive fills the space between the smaller rod and the counterbore, creating a uniform, cylindrical layer of adhesive between the exterior surface of the smaller rod and the inner surface of the counterbore. When the adhesive cures, the assembly is subjected to a tensile load along its longitudinal axis, tending to pull the inserted rod from the bore and subjecting the cylindrical adhesive bond to a pure shear load.

DTIC

Adhesion Tests; Cylindrical Bodies; Shear Strength; Loads (Forces); Adhesion

19980209742 NASA Lewis Research Center, Cleveland, OH USA

The Improvement of Ion Plated Ag and Au Film Adherence to Si3N4 and SiC Surfaces for Increased Tribological Performance

Spalvins, Talivaldis, NASA Lewis Research Center, USA; Jun. 1998; 12p; In English

Contract(s)/Grant(s): RTOP 523-22-13

Report No.(s): NASA/TM-1998-207415; NAS 1.15:207415; E-11169; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A modified dc-diode plating system, utilizing a metallic screen cage as a cathode and referred as SCREEN CAGE ION PLATING (SCIP), is used to deposit Ag and Au lubricating films on Si3N4 and SiC surfaces. When deposition is performed in Ar or N2, glow discharge, the surface displays poor adhesive strength (less than 5 MPa). A dramatic increase in adhesive strength (less than 80 MPa) is achieved when plating is performed in a reactive 50% 02 + 50% Ar glow discharge. The excited/ionized oxygen species (O2(+)/O(+) in the glow discharge contribute to the oxidation of the Si3N4 or SiC surfaces as determined by X-ray Photoelectron Spectroscopy (XTS) depth profiling. The reactively sputter-oxidized S3N4 or SiC surfaces and the activated-oxidized-metastable Ag or Au species formed in the plasma cooperatively contribute to the increased adherence. As a result, the linear thermal expansion coefficient mismatch at the interface is reduced. These lubricating Ag and Au films under sliding conditions reduce the friction coefficient by a factor of 2-1/2 to 4.

Author

Silver; Gold; Superconducting Films; Ion Plating; Plating; Silicon Nitrides

19980209828 Osaka Univ., Dept. of Civil Engineering, Osaka, Japan

Environmental Deterioration of Paint on Welded Structures

Matsui, Shigeyuki, Osaka Univ., Japan; Fukumoto, Yuhshi, Osaka Univ., Japan; Kanemoto, Keiji, Osaka Univ., Japan; Ohnishi, Hiroshi, Osaka Univ., Japan; Technology Reports of the Osaka University; Apr. 15, 1994; ISSN 0030-6177; Volume 44, Nos. 2163-2182, pp. 89-100; In English

Report No.(s): Rept-2173; Copyright; Avail: Issuing Activity (Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan), Hardcopy, Microfiche

In steel structures, coating systems should be put on steel surfaces to protect corrosion of steel. But durability of the coatings is not constant on all parts of structural elements. to investigate the deterioration characteristics and the rate of these parts along welding points, environmental acceleration tests were carried out with specimens having welded joints. The environmental conditions were three kinds: normal- considering temperature oscillations; ultraviolet- simulating the sunshine; and coastal- having greater salt effects. As the test results confirm, earlier corrosion and deterioration have been observed along welding zones due to penetration of water into the coating and cracks of the coating.

CASI

Metal Surfaces; Welded Structures; Steel Structures; Paints; Environment Effects; Penetration; Accelerated Life Tests

19980209832 Osaka Univ., Dept. of Electronic Engineering, Osaka, Japan

Property of Poly(3-alkylthiophene-co-1,2-dithienylethylene) and Its Doping Effect

Nakazono, Masahiro, Osaka Univ., Japan; Kawai, Tsuyoshi, Osaka Univ., Japan; Onoda, Mitsuyoshi, Himeji Inst. of Tech., Japan; Yoshino, Katsumi, Osaka Univ., Japan; Technology Reports of the Osaka University; Apr. 15, 1994; ISSN 0030-6177; Volume 44, Nos. 2163-2182, pp. 43-52; In English

Report No.(s): Rept-2168; Copyright; Avail: Issuing Activity (Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan), Hardcopy, Microfiche

Chemical copolymerizations of 3-dodecylthiophene and 1,2-dithienylethylene with different ratios of each monomer have been carried out. The obtained copolymers are dark red in color and soluble in various organic solvents, and show weak solvatochromism. The bandgap of the copolymer has been evaluated to be about 2.0 eV, which is the intermediate value between poly(3-dodecylthiophene) and poly(1,2-dithienylethylene). The effect of the geometrical isomer of the 1,2-dithienylethylene has been also investigated. Isomerization of the cis- to the trans-vinylene group has been induced during the copolymerization. Electrochemical, optical, and magnetic properties upon electrochemical p-type doping have been also studied in detail. Changes in ESR and in situ optical absorption spectra suggest the formation of polaron and bipolaron upon doping, and considerable amounts of the newly derived species upon doping is concluded to change into p-type spinless bipolarons, even at lightly doped state. Energy levels of doped and undoped copolymer are also discussed.
Author
Copolymerization; Isomerization; Ethylene Compounds; Alkyl Compounds; Thiophenes; Polarons; Energy Gaps (Solid State); Additives; Electromagnetic Absorption

19980209838 Oak Ridge National Lab., TN USA
Microwave processing of materials ***Final Report***
McMillan, A. D., Oak Ridge National Lab., USA; Lauf, R. J., Oak Ridge National Lab., USA; Garard, R. S., Oak Ridge National Lab., USA; [1997]; 11p; In English
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/M-5941; DE98-000895; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A Cooperative Research and Development Agreement (CRADA) between Lockheed Martin Energy Systems, Inc. (LMES) and Lambda Technologies, Inc. (Lambda) of Raleigh, N.C., was initiated in May 1995. [Lockheed Martin Energy Research, Corp. (LMER) has replaced LMES]. The completion data for the Agreement was December 31, 1996. The purpose of this work is to explore the feasibility of several advanced microwave processing concepts to develop new energy-efficient materials and processes. The project includes two tasks: (1) commercialization of the variable-frequency microwave furnace (VFMF); and (2) microwave curing of polymer composites. The VFMF, whose initial conception and design was funded by the Advanced Industrial Concepts (AIC) Materials Program, will allow us, for the first time, to conduct microwave processing studies over a wide frequency range. This novel design uses a high-power traveling wave tube (TWT) originally developed for electronic warfare. by using this microwave source, one can not only select individual microwave frequencies for particular experiments, but also achieve uniform power densities over a large area by the superposition of many different frequencies.
DOE
Microwaves; Commercialization; Energy Technology; Curing; Microwave Equipment

19980209860 Sandia Labs., Livermore, CA USA
Fabrication and evaluation of uniform and gradient density epoxies
Domeier, L. A., Sandia Labs., USA; Skala, D. M., Sandia Labs., USA; Goods, S. H., Sandia Labs., USA; Nov. 1997; 30p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-98-8204; DE98-050975; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Filled epoxy materials which vary in density in a designed manner have been fabricated and their mechanical properties evaluated. Density variations were produced by incorporating different volume fractions of either glass microballoons (GMB) or alumina. Several different sample types were evaluated including uniform density (0.8 g/cm(exp 3) less than rho less than 2.0 g/cm(exp 3)) samples and gradient density samples (GMB only, 0.8 g/cm(exp 3) less than rho less than 1.2 g/cm(exp 3)). The uniform density specimens were evaluated for the effects of filler type and concentration on modulus and toughness. Results indicated that addition of alumina filler significantly increased the resulting modulus while addition of GMB had little measurable effect. These differences could be understood in terms of the differing moduli of the additives relative to that of the epoxy matrix. In the former case the alumina particulates had a modulus much greater than that of the epoxy while in the latter case, the modulus of the GMB additive was only slightly greater than that of the matrix. Addition of either filler significantly degraded the toughness of the composite specimens and precluded the use of gradients to enhance toughness performance. Discontinuous (open quotes) block (close quotes) gradients used for testing were fabricated by simple sequential pours of formulations with different GMB loadings and were evaluated for modulus, strength and ductility. Continuous gradients were fabricated in process studies by programmed shifts in the peristaltic pumping/mixing ratio of epoxies filled with either alumina or GMB. None of the continuous gradient materials were mechanically tested. These results suggest that applications utilizing gradient materials containing alu-

mina and similar high modulus fillers to provide designed stiffness rather than improved toughness are the most appropriate targets for future investigation.
DOE
Fabrication; Gradients; Epoxy Matrix Composites; Epoxy Resins; Epoxy Compounds

19980209930 Texas Research Inst., Inc., Austin, TX USA
Correlation of Chemical and Physical Test Data For the Environment Ageing of Coflon (PVDF)
Morgan, G. J., Texas Research Inst., Inc., USA; Campion, R. P., Texas Research Inst., Inc., USA; Feb. 28, 1997; 32p; In English
Contract(s)/Grant(s): NAG10-153
Report No.(s): NASA/CR-1997-207630; NAS 1.26:207630; CAPP/M.10-Rev-A; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report aims to identify correlations between mechanical property changes and chemical/morphological structure changes for Coflon. It is intended both to illustrate the overall methodology and to indicate the testing that needs to be undertaken in order to obtain correlations. Many fluid exposures have now been carried out on Coflon during the project and many data generated as a result. The report summarises the changes observed in mechanical and physical properties and relates these as well as possible to the chemistry thought to be occurring during ageing. For this purpose, data have been collated from already-issued MERL and TRI technical and progress reports. Most of the mechanical testing of aged testpieces has been performed soon after the completion of the exposure; however, there is of necessity a delay in obtaining chemical analysis of the same testpieces, so that more physical than chemical data are shown. Three fluids have so far caused measurable deterioration of Coflon, these being: methanol (Fluid A), a methanol and amine mixture (Fluid G), and a mixture of methane, carbon dioxide gas and hydrogen sulphide gas plus aqueous amine (Fluid F). Only the effects of these fluids will be dealt with in any detail in this report, although other fluids are assessed to give relevant background information. Relevant test data collated here include: tensile modulus and related properties, mode of sample failure at break, fracture toughness, fatigue crack growth rate and resistance, stress relaxation rate, permeation coefficients, % crystallinity and molecular weight distributions together with changes in fluorine levels, and other observations where appropriate. However, not all of these were obtained for every ageing condition. Because of the wide range of tests employed, and the different ways in which their results are obtained, the following section has been included to serve as a background for making comparisons.
Derived from text
Chemical Analysis; Fracture Strength; Fatigue (Materials); Morphology; Procedures; Data Acquisition; Correlation

19980209931 Texas Research Inst., Inc., Austin, TX USA
Correlation of Chemical and Physical Test Data for the Environmental Ageing of Tefzel (ETFE)
Morgan, G. J., Texas Research Inst., Inc., USA; Campion, R. P., Texas Research Inst., Inc., USA; Feb. 25, 1997; 24p; In English
Contract(s)/Grant(s): NAG10-153
Report No.(s): NASA/CR-1997-207624; NAS 1.26:207624; CAPP/M.13-Rev-A; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In a similar approach to that used for the previously issued correlation report for Coflon (CAPP/M.10), this report aims to identify any correlations between mechanical property changes and chemical/morphological changes for Tefzel, using information supplied in other MERL and TRI project reports. Differences identified with Coflon behaviour will be of scientific interest as well as appropriate to project applications, as Tefzel and Coflon are chemical isomers. Owing to the considerable chemical resistance of Tefzel, much of its testing so far has been based on mechanical properties. Where changes have occurred, chemical analysis can now be targeted more effectively. Relevant test data collated here include: tensile modulus and related properties, permeation coefficients, % crystallinity, some crack growth resistance measurements, and other observations where significant. Fluids based on methanol and amine (Fluid G), a mixture of methane, carbon dioxide and hydrogen sulphide gases plus an aqueous amine solution (Fluid F), and an aromatic oil mix of heptane, cyclohexane, toluene and 1-propanol (Fluid I) have affected Tefzel to varying degrees, and are discussed in some detail herein.
Derived from text
Evaluation; Carbon Dioxide; Chemical Analysis; Correlation; Crack Propagation; Fracture Strength; Sulfides; Toluene

19980209961 Sandia National Labs., Albuquerque, NM USA
Synthetic molecular receptors for phosphates and phosphonates in sol-gel materials
Sasaki, D. Y., Sandia National Labs., USA; Alam, T. M., Sandia National Labs., USA; Assink, R. A., Sandia National Labs., USA; Dec. 1997; 22p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1156; DE98-001585; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Synthetic receptors for phosphates and phosphonates have been generated in SiO2 xerogels via a surface molecular imprinting method. The monomer 3-trimethoxy silylpropyl-1-guanidinium chloride (1) was developed to prepare receptor sites capable of binding with substrates through a combination of ionic and hydrogen bond interactions. HPLC studies and adsorption isotherms performed in water have found that molecular imprinting affords a significant improvement in K(sub a) for phosphate and phosphonate affinity over a randomly functionalized xerogel. Affinities for these materials offer about an order of magnitude improvement in affinity compared to analogous small molecule receptors reported in the literature. The xerogel matrix appears to participate in host-guest interactions through anionic charge buildup with increasing pH.

DOE

Phosphates; Liquid Chromatography; Adsorption; Hydrogen Bonds; Silicon Dioxide; Chlorides

19980209966 Sandia National Labs., Albuquerque, NM USA

Electrochemical and spectroscopic evaluation of lithium intercalation in tailored polymethacrylonitrile carbons

Zavadil, K. R., Sandia National Labs., USA; Guidotti, R. A., Sandia National Labs., USA; Even, W. R., Sandia National Labs., USA; [1997]; 6p; In English; 1997 Fall Meeting of the Materials Research Society, 1 - 5 Dec. 1997, Boston, MA, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-3143C; CONF-971201; DE98-001703; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Disordered polymethacrylonitrile (PMAN) carbon monoliths have been studied as potential tailored electrodes for lithium ion batteries. A combination of electrochemical and surface spectroscopic probes have been used to investigate irreversible loss mechanisms. Voltammetric measurements show that Li intercalates readily into the carbon at potentials 1V positive of the reversible Li potential. The coulometric efficiency rises rapidly from 50% for the first potential cycle to greater than 85% for the third cycle, indicating that solvent decomposition is a self-limiting process. Surface film composition and thickness, as measured by x-ray photoelectron spectroscopy (XPS) and secondary ion mass spectrometry (SIMS), does not vary substantially when compared to more ordered carbon surfaces. Li(sup +) profiles are particularly useful in discriminating between the bound states of Li at the surface of solution permeable PMAN carbons.

DOE

Secondary Ion Mass Spectrometry; Carbon; X Ray Spectroscopy; Metal Ions; Composition (Property); Order-Disorder Transformations

19980209975 Oak Ridge National Lab., TN USA

Time domain response of electrical ceramics: Micro to megaseconds

Modine, F. A., Oak Ridge National Lab., USA; Nov. 1997; 11p; In English; 1997 Fall Meeting of the Materials Research Society, 1 - 5 Dec. 1997, Boston, MA, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-95630; CONF-971201; DE98-001846; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The electrical properties of ceramics can be measured in either the time domain or in the frequency domain. But for electrically nonlinear ceramics such as varistors, time-domain measurements provide insights that are different and more relevant to material performance as well as being more physically incisive. This article focuses specifically on the electrical properties of ZnO varistors, but much of it is of relevance for other materials, in particular those materials with grain-boundary barriers and disordered ceramics or glasses. The interpretation of electrical measurements in the time domain is profoundly influenced by such practical matters as source impedance and waveform characteristics. Experimental results are presented for both high and low source impedance relative to that of a test varistor, and the different in experimental difficulty and ease of interpretation is described. Time-domain measurements of capacitance and of the inductive response of varistors to large, fast electrical pulses are presented and their implications for varistor theory are given. Experimental evidence is given of short- and long-term memory in varistors. These memory phenomena are ascribed respectively to the life time of holes that become trapped in barriers and to polarization currents originating from deep electron traps. Polarization current measurements are presented for a wide range of time and temperature. The power-law time dependence and universal behavior of these currents is discussed. The exponent that describes the power law behavior is seen to change with temperature, and the change is interpreted as a double transition from diffusive to dispersive transport that originates with current from two different electron traps.

DOE

Ceramics; Electrical Measurement; Electrical Properties; Grain Boundaries; Frequencies; Capacitance

19980209984 Oak Ridge National Lab., TN USA

Nanoindentation of soft films on hard substrates: Experiments and finite element simulations

Pharr, G. M., Rice Univ., USA; Tsui, T. Y., Rice Univ., USA; Bolshakov, A., Baker Hughes Inteq, USA; Hay, J. C., Oak Ridge National Lab., USA; 1997; 12p; In English, 1-5 Dec. 1997, Boston, MA, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-95750; CONF-971201; DE98-001937; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Experiments and finite element simulations have been performed to examine error measurement of hardness and elastic modulus caused by pile-up when soft films deposited on hard substrates are tested by nanoindentation methods. Pile-up is exacerbated in soft-film/hard-substrate systems by the constraint imposed on plastic deformation in the film by the relatively non-deformable substrate. to experimentally examine pile-up effects, soft aluminum films with thicknesses of 240, 650, and 1700 nm were deposited on hard soda-lime glass substrates and tested by nanoindentation techniques. This system is attractive because the elastic modulus of the film and the substrate are approximately the same, but the substrate is harder than the film by a factor of about ten. Consequently, substrate influences on the indentation load-displacement behavior are manifested primarily by differences in the plastic flow characteristics alone. The elastic modulus of the film/substrate system, as measured by nanoindentation techniques, exhibits an increase with indenter penetration depth which peaks at a value approximately 30% greater than the true film modulus at a penetration depth close to the film thickness. Finite element simulation shows that this unusual behavior is caused by substrate-induced enhancement of pile-up. Finite element simulation also shows that the amount of pile-up increases with increasing penetration depth, and that the pile-up geometry depends on the work-hardening characteristics of the film. Because of these effects, nanoindentation techniques overestimate the true film hardness and elastic modulus by as much as 68% and 35%, respectively, depending on the work-hardening behavior of the film and the indenter penetration depth. The largest errors occur in non-work-hardening materials at penetration depths close to the film thickness, for which substrate-induced enhancement of pile-up is greatest.

DOE

Finite Element Method; Computerized Simulation; Thin Films; Elastic Properties; Plastic Deformation; Aluminum; Hardness

19980210022 Oak Ridge National Lab., TN USA

Critical issues in measuring the mechanical properties of hard films on soft substrates by nanoindentation techniques

Hay, J. C., Oak Ridge National Lab., USA; Pharr, G. M., Rice Univ., USA; [1997]; 6p; In English; 1997 Fall Meeting of the Materials Research Society, 1 - 5 Dec. 1997, Boston, MA, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-95655; CONF-971201; DE98-001932; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

This study explores the difficulties encountered when using conventional nanoindentation techniques to measure the Young's modulus and hardness of hard films on soft substrates. In general, the indentation measurement of film/substrate systems is affected by four material properties: the Young's modulus and hardness of the film, and the Young's modulus and hardness of the substrate. For the particular case of a hard film on a soft substrate, there is a tendency for the material around the hardness impression to sink-in which results from the large difference in yielding of the two materials. In this study, a model system consisting of NiP on annealed Cu was used to explore the behavior. This system is interesting because the film and substrate have similar Young's moduli, minimizing the elastic behavior as a variable. In contrast, the hardness of NiP is approximately 7--8 GPa, and that of the annealed copper is less than 1 GPa, providing a factor of 10 difference in the plastic flow characteristics. Experimental results indicate that standard analytical methods for determining the contact depth, hardness and Young's modulus do not work well for the case of a hard film on a soft substrate. At shallow contact depths, the measured indentation modulus is close to that of the film, but at larger depths sink-in phenomena result in an overestimation of the contact area, and an indentation modulus which is less than the Young's modulus of both the film and substrate. Atomic force microscopy (AFM) and scanning electron microscopy (SEM) provide critical details of the physical processes involved, and illustrate how the standard data analyses overestimate the true contact area.

DOE

Atomic Force Microscopy; Hardness; Scanning Electron Microscopy; Mechanical Properties; Data Reduction

19980210092 Lawrence Livermore National Lab., Livermore, CA USA

Thermal decomposition of polystyrene in the high temperature fabrication technology of hollow microspheres

Dorogotovtsev, V. M., Academy of Sciences (USSR), USSR; Akunets, A. A., Academy of Sciences (USSR), USSR; Merkuliev, Y. A., Academy of Sciences (USSR), USSR; Turivnoy, A. P., Academy of Sciences (USSR), USSR; Reibold, R., Lawrence Liver-

more National Lab., USA; Fearon, E., Lawrence Livermore National Lab., USA; Cook, R., Lawrence Livermore National Lab., USA; Mar. 26, 1997; 10p; In English; 11th; Target Fabrication Specialist Meeting, 8 - 12 Sep. 1996, Orcas Island, WA, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-125232-Rev.1; CONF-9609225-2; DE97-053408; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The degree and nature of polymer degradation that occurs in the high temperature microshell formation process developed at the Lebedev Physical Institute has been examined experimentally. We find that significant mass degradation occurs during the final stages of shell formation. This manifests itself both in terms of mass loss and molecular weight degradation as measured by gel permeation chromatography. This decrease in the molecular weight may be in part responsible for the relatively fragile nature of the shells produced by this high temperature process.
DOE
Thermal Decomposition; High Temperature; Polystyrene; Microballoons

19980210093 Lawrence Livermore National Lab., Livermore, CA USA
Luminescent studies of fluorescent chromophore-doped silica aerogels for flat panel display applications
Glauser, S. A. C., California Univ., USA; Lee, H. W. H., Lawrence Livermore National Lab., USA; Apr. 1997; 8p; In English, 31 Mar. - 4 Apr. 1997, San Francisco, CA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-127206; CONF-970302-25; DE97-053411; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The remarkable optical and electronic properties of doped and undoped silica aerogels establish their utility as unique, mulTI-functional host materials for fluorescent dyes and other luminescent materials for display and imaging applications. We present results on the photoluminescence, absorption, and photoluminescence excitation spectra of undoped silica aerogels and aerogels doped with Er(sup 3+), rhodamine 6G (R6G), and fluorescine.
DOE
Absorption Spectra; Photoluminescence; Optical Properties; Doped Crystals; Chromophores; Aerogels

19980210181 Lawrence Livermore National Lab., Livermore, CA USA
Aerogels: A new material for emissive display applications
Glauser, S. A. C., California Univ., USA; Lee, H. W. H., Lawrence Livermore National Lab., USA; Mar. 1997; 10p; In English; Society for Information Display Conference, 11 - 16 May 1997, Boston, MA, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-126784; CONF-9705170-1; DE97-053390; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The remarkable optical and electronic properties of doped and undoped silica aerogels establish their utility as unique, multi-functional host materials for fluorescent dyes and other luminescent materials for display and imaging applications. We present results on the photoluminescence and absorption of undoped silica aerogels and aerogels doped with Er(sup 3+), rhodamine 6G (R6G), and fluorescein. We also demonstrate evidence of Fowler-Nordheim tunneling of electrons in aerogels.
DOE
Aerogels; Electrons; Imaging Techniques; Optical Properties; Photoluminescence; Silicon Dioxide

19980210184 Oak Ridge National Lab., TN USA
Process study of polycyanate resin for wet-filament wound high-strength composites
Frame, B. J., Oak Ridge National Lab., USA; [1997]; 74p; In English
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/TM-13387; DE98-051990; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Polycyanate (or cyanate ester) resins offer advantages as composite matrices because of their high thermal stability, low outgassing, low water absorption and radiation resistance. This report describes the results of a processing study to develop high-strength hoop-wound composite by the wet-filament winding method using Toray T1000G carbon fiber and YLA RS-14 polycyanate resin as the constituent materials. T1000G/RS-14 composite cylinders were wet-wound and cured using different process schedules and then evaluated for hoop tensile strength and modulus, transverse flexural strength and short beam shear

strength. The results of material characterization tests performed on the T1000G carbon fiber and RS-14 resin constituents used in this study are also presented.
DOE
Cyanates; Flexural Strength; Matrix Materials; Resins; Esters; Procedures

19980210216 Texas Research Inst., Inc., Austin, TX USA
Effects of Applied Strain on Rates of Ageing: Project Overview
Campion, R. P., Texas Research Inst., Inc., USA; Apr. 17, 1997; 15p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG10-153
Report No.(s): NASA/CR-1997-207625; NAS 1.26:207625; CAPP/M.15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the stated intents of this project has been to make some assessment of effects of strain on rates of ageing of project thermoplastics exposed to project fluids. to this end, certain straining jigs which apply in various modes - tensile, four-point bending and crack growth using compact tension samples - were designed and made for holding samples during fluid exposures. During testing, features of the thermoplastics have been observed which have tended to confuse apparent strain effects on the polymers' aged performance, but recent assessments of the topic and its data have led to considerable progress being made in identifying test procedures necessary for strain and related effects on chemical deterioration to manifest themselves. It is the intent of this report to provide a summary of what has been determined on strain and related effects thus far, and provide recommendations for clarifying them in Phase 2 by means of further test procedures which will increase and focus the severity of the conditions applying. The choice of flexible pipe rather than umbilicals service for assessing service strain conditions reflects the major interest of project members. However, Tefzel data are still provided.
Derived from text
Strain Rate; Aging (Materials); Thermoplastic Resins; Deterioration

19980210363 Sandia National Labs., Albuquerque, NM USA
Analysis of gallium arsenide deposition in a horizontal chemical vapor deposition reactor using massively parallel computations
Salinger, A. G., Sandia National Labs., USA; Shadid, J. N., Sandia National Labs., USA; Hutchinson, S. A., Sandia National Labs., USA; Jan. 1998; 32p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-98-0242; DE98-003218; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A numerical analysis of the deposition of gallium from trimethylgallium (TMG) and arsine in a horizontal CVD reactor with tilted susceptor and a three inch diameter rotating substrate is performed. The three-dimensional model includes complete coupling between fluid mechanics, heat transfer, and species transport, and is solved using an unstructured finite element discretization on a massively parallel computer. The effects of three operating parameters (the disk rotation rate, inlet TMG fraction, and inlet velocity) and two design parameters (the tilt angle of the reactor base and the reactor width) on the growth rate and uniformity are presented. The nonlinear dependence of the growth rate uniformity on the key operating parameters is discussed in detail. Efficient and robust algorithms for massively parallel reacting flow simulations, as incorporated into our analysis code MPSalsa, make detailed analysis of this complicated system feasible.
DOE
Gallium Arsenides; Vapor Deposition; Numerical Analysis; Finite Element Method; Heat Transfer; Grid Generation (Mathematics)

19980210392 Texas Research Inst., Inc., Materials Engineering Research Lab., Austin, TX USA
International Research Project on the Effects of Chemical Ageing of Polymers on Performance Properties: Chemical and Thermal Analysis ***Interim Report***
Bulluck, J. W., Texas Research Inst., Inc., USA; Rushing, R. A., Texas Research Inst., Inc., USA; Nov. 12, 1996; 59p; In English
Contract(s)/Grant(s): NAG10-153
Report No.(s): NASA/CR-1996-207616; NAS 1.26:207616; CAPP/T.6; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Work during the past six months has included significant research in several areas aimed at further clarification of the aging and chemical failure mechanism of thermoplastics (PVDF or Tefzel) pipes. Among the areas investigated were the crystallinity changes associated with both the Coflon and Tefzel after various simulated environmental exposures using X-ray diffraction anal-

ysis. We have found that significant changes in polymer crystallinity levels occur as a function of the exposures. These crystallinity changes may have important consequences on the fracture, fatigue, tensile, and chemical resistance of the materials. We have also noted small changes in the molecular weight distribution. Again these changes may result in variations in the mechanical and chemical properties in the material. We conducted numerous analytical studies with methods including X-ray Diffraction, Gel Permeation Chromatography, Fourier Transform Infrared Spectroscopy, Ultra- Violet Scanning Analysis, GC/Mass Spectrometry, Differential Scanning Calorimetry and Thermomechanical Analysis. In the ultra-violet analysis we noted the presence of an absorption band indicative of triene formation. We investigated a number of aged samples of both Tefzel and Coflon that were forwarded from MERL. We also cast films at SWT and subjected these films to a refluxing methanol 1% ethylene diamine solution. An updated literature search was conducted using Dialog and DROLLS to identify any new papers that may have been published in the open literature since the start of this project. The updated literature search and abstracts are contained in the Appendix section of this report.
Derived from text
Aging (Materials); Chemical Analysis; Thermal Analysis; Thermoplastic Resins; Failure; Research and Development; Ferroelectric Materials

19980210424 Argonne National Lab., IL USA
Development of electrically insulating coatings on vanadium alloys for lithium-cooled blankets
Smith, D. L., Argonne National Lab., USA; Natesan, K., Argonne National Lab., USA; Park, J. H., Argonne National Lab., USA; Mattas, R., Argonne National Lab., USA; Reed, C., Argonne National Lab., USA; 1997; 7p; In English; Liquid Metal Blanket Experimental Activities, 16-18 Sep. 1997, Paris, France
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/ET/CP-93895; CONF-9709165; DE98-050038; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The self-cooled lithium blanket concept with a vanadium structure offers a potential for high performance with attractive safety and environmental features. Based on blanket design studies, it became apparent that electrically insulating duct walls would be required to reduce the magnetohydrodynamic (MHD) pressure drop for liquid metal-cooled blankets for high magnetic field fusion devices. As a result, development of insulator coatings was recommended as the most appropriate approach for resolving this issue. Oxides such as CaO, Y2O3, BeO, MgO, MgAl2O4, and Y3Al2O12 and nitrides such as AlN, BN and Si3N2 were initially considered potential candidate coating materials. Based on results of scoping studies, CaO and AlN have been selected as primary candidates for further development. Progress on the development of CaO and AlN coatings, including in-situ formation and electrical properties measurements, are summarized in this paper.
DOE
Beryllium Oxides; Magnetohydrodynamics; Electrical Properties; Vanadium Alloys; Pressure Reduction; Nitrides; Magnesium Oxides; Lithium

19980210497 Energia Nucleare e Delle Energie Alternative, Dipt .Energia, Rome, Italy
The development of heat exchangers with advanced thermomechanical materials *Sviluppi e prospettive degli scambiatori di calore ceramici per l'impiantistica energetica ad alta temperatura*
Capra, Marcello, Energia Nucleare e Delle Energie Alternative, Italy; Jul. 1997; ISSN 0393-6317; 33p; In Italian
Report No.(s): ENEA-RT-ERG-97-05; DE98-728535; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

Current metallurgical limitations necessarily impose a number of restrictions on the efficiency of power plant and combustion systems. These limitations include both temperature and corrosion resistance. If significant improvements can be made in these areas, then not only will it be possible to obtain higher system efficiencies, but it will also be possible to further exploit new technologies. Consequently, there is appreciable interest in the development of ceramic tubes for heat exchangers. Such tubes would offer the potential of operation at much higher temperatures combined with a much improved resistance to chemical attack. They are unlikely to be suitable for high pressure operation, at least in the foreseeable future, and hence their use would be limited generally to gas to gas exchangers. In spite of the limitations on details and specific technological solutions imposed by industrial property conditions, this report provides an overview on the development of these components, which is in charge of all the major international industrial companies of the field, in consideration of the relevant benefits coming from their large industrialization. After an analysis of the industrial situation of the product, in terms both of possible applications and economical impacts on the market,

an overview of major on-going R and D programmes is carried out. At present, these programmes are mostly within the general frame of the study of advanced thermomechanical components and the related manufacturing technologies development.
DOE
Research and Development; Product Development; Heat Exchangers; Mechanical Properties; Manufacturing

19980210567 Argonne National Lab., IL USA
RBS analysis of the diffusion of nano-size spheres in a polymer matrix
Cole, D. H., Argonne National Lab., USA; Shull, K. R., Northwestern Univ., USA; Rehn, L. E., Argonne National Lab., USA; Baldo, P. M., Argonne National Lab., USA; Aug. 1997; 17p; In English; 13th; Ion Beam Analysis, 27 Jul. - 1 Aug. 1997, Lisbon, Portugal
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/MSD/CP-92654; CONF-970785; DE97-054141; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Rutherford Backscattering Spectrometry (RBS) with 1.5-MeV He ions was employed to measure the depth distribution of gold particles sandwitched between two poly(tert-butyl acrylate) layers following various isothermal annealing treatments; temperatures were kept below 170 C to prevent degradation of the polymer. Since PTBA also degrades when the ion beam impinges the sample, it was necessary to quantify the mass loss in order to obtain accurate diffusion coefficients. Although the total mass loss was substantial (40-60%), a simple expansion of the energy-to-depth scale was sufficient to account for the beam-induced shrinkage. This result is attributed to the fact that the mass loss occurs very rapidly, and is uniformly distributed through the depth of the sample. The data reveal that the diffusion of the nanometer-size gold particles is substantially slower than is predicted by a simple physical model (Stokes-Einstein) for noninteracting particles. This slowdown is attributed to polymer bridging interactions, in which polymer strands bind to individual metal particles, thereby retarding their diffusion.
DOE
Metal Particles; Gold; Diffusion; Spectroscopy; Acrylates; Ion Beams

19980210576 Los Alamos National Lab., NM USA
Microwave processing of ceramic oxide filaments ***Annual Report, 1997***
Vogt, G. J., Los Alamos National Lab., USA; [1998]; 16p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3224; DE98-001591; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The objective of the microwave filament processing project is to develop microwave techniques to manufacture continuous ceramic oxide filaments. Microwave processing uses the volumetric absorption of microwave power in oxide filament tows to drive off process solvents, to burn out organic binders, and to sinter the dried fibers to produce flexible, high-strength ceramic filaments. The technical goal is to advance filament processing technology by microwave heating more rapidly with less energy and at a lower cost than conventional processing, but with the same quality as conventional processing. The manufacturing goal is to collaborate with the 3M Company, a US manufacturer of ceramic oxide filaments, to evaluate the technology using a prototype filament system and to transfer the microwave technology to the 3M Company. Continuous ceramic filaments are a principal component in many advanced high temperature materials like continuous fiber ceramic composites (CFCC) and woven ceramic textiles. The use of continuous ceramic filaments in CFCC radiant burners, gas turbines, waste incineration, and hot gas filters in U.S. industry and power generation is estimated to save at least 2.16 quad/yr by year 2010 with energy cost savings of at least $8.1 billion. by year 2010, continuous ceramic filaments and CFCC's have the potential to abate pollution emissions by 917,000 tons annually of nitrous oxide and 118 million tons annually of carbon dioxide (DOE Report OR-2002, February, 1994).
DOE
Ceramics; Microwaves; Manufacturing; Ceramic Fibers

19980210586 Risoe National Lab., Roskilde, Denmark
Nordic ceramics '97
Soerensen, B. F., Editor, Risoe National Lab., Denmark; 1997; 75p; In English, 26-27 May 1997, Roskilde, Denmark
Report No.(s): NEI-DK-2683; CONF-9705177; DE98-703973; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Abstracts of 36 papers, presented at the Nordic Ceramics '97 symposium, cover the fields of surface chemistry, topochemistry, fuel cells, oxygen sensors, composites, porous ceramics etc.
DOE
Ceramics; Composite Materials; Surface Reactions

19980210708 Lawrence Livermore National Lab., Livermore, CA USA
Polyimide capsules may hold high pressure DT fuel without cryogenic support for the National Ignition Facility indirect-drive targets
Sanchez, J. J., Lawrence Livermore National Lab., USA; Letts, S. A., Lawrence Livermore National Lab., USA; Mar. 26, 1997; 9p; In English; 11th; Target Fabrication Specialist Meeting, 8-12 Sep. 1996, Orcas Island, WA, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-127114; CONF-9609225-3; DE97-053409; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

New target designs for the Omega upgrade laser and ignition targets in the National Ignition Facility (NIF) require thick (80 - 100 micro-m) cryogenic fuel layers. The Omega upgrade target will require cryogenic handling after initial fill because of the high fill pressures and the thin capsule walls. For the NIF indirectly driven targets, a larger capsule size and new materials offer hope that they can be built, filled and stored in a manner similar to the targets used in the Nova facility without requiring cryogenic handling.
DOE
Deuterium; Tritium; Encapsulating; Fabrication; Thermonuclear Reactions; Cryogenics; Polyimides

19980210770 NASA Lewis Research Center, Cleveland, OH USA
Structures and Mechanical Properties of Natural and Synthetic Diamonds, Chapter 8
Miyoshi, Kazuhisa, NASA Lewis Research Center, USA; Jun. 1998; 24p; In English
Contract(s)/Grant(s): RTOP 523-22-13
Report No.(s): NASA/TM-1998-107249/CHAP8; E-9863/CHAP8; NAS 1.15:107249/CHAP8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A revolution in diamond technology is in progress as the low-pressure process becomes an industrial reality. It will soon be possible to take advantage of the demanding properties of diamond to develop a myriad of new applications, particularly for self-lubricating, wear, and superhard coatings. The production of large diamond films or sheets at low cost, a distinct possibility in the not-too-distant future, may drastically change tribology technology, particularly solid lubricants and lubricating materials and systems. This chapter reviews the structures and properties of natural and synthetic diamond to gain a better understanding of the tribological properties of diamond and related materials to be described in the following chapters. Atomic and crystal structure, impurities, mechanical properties, and indentation hardness of diamond are described.
Author
Mechanical Properties; Atomic Structure; Crystal Structure; Diamond Films; Lubrication; Solid Lubricants; Tribology

19980210771 NASA Lewis Research Center, Cleveland, OH USA
A Comparison of Space and Ground Based Facility Environmental Effects for FEP Teflon
Rutledge, Sharon K., NASA Lewis Research Center, USA; Banks, Bruce A., NASA Lewis Research Center, USA; Kitral, Michael, Cleveland State Univ., USA; Jul. 1998; 18p; In English; 4th; Protection of Materials and Structures from LEO Space Environment, 23-24 Apr. 1998, Toronto, Canada; Sponsored by Toronto Univ., Canada
Contract(s)/Grant(s): RTOP 632-1A-1E
Report No.(s): NASA/TM-1998-207918/REV1; E-11194/REV1; NAS 1.15:207918/REV1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fluorinated Ethylene Propylene (FEP) Teflon is widely used as a thermal control material for spacecraft, however, it is susceptible to erosion, cracking, and subsequent mechanical failure in low Earth orbit. One of the difficulties in determining whether FEP Teflon will survive during a mission is the wide disparity of erosion rates observed for this material in space and in ground based facilities. Each environment contains different levels of atomic oxygen, ions, and vacuum ultraviolet (VUV) radiation in addition to parameters such as the energy of the arriving species and temperature. These variations make it difficult to determine what is causing the observed differences in erosion rates. This paper attempts to narrow down which factors affect the erosion rate of FEP Teflon through attempting to change only one environmental constituent at a time. This was attempted through the use of a single simulation facility (plasma asher) environment with a variety of Faraday cages and VUV transparent windows. Isolating one factor inside of a radio frequency (RF) plasma proved to be very difficult. Two observations could be made. First,

it appears that the erosion yield of FEP Teflon with respect to that of polyimide Kapton is not greatly affected by the presence or lack of VUV radiation present in the RF plasma and the relative erosion yield for the FEP Teflon may decrease with increasing fluence. Second, shielding from charged particles appears to lower the relative erosion yield of the FEP to approximately that observed in space, however it is difficult to determine for sure whether ions, electrons, or some other components are causing the enhanced erosion.
Author
Spacecraft Construction Materials; Kapton (Trademark); Teflon (Trademark); Environment Effects; Temperature Control; Ethylene; Low Earth Orbits; Plasma Interactions; Shielding

19980210772 NASA Lewis Research Center, Cleveland, OH USA
Ground Laboratory Soft X-Ray Durability Evaluation of Aluminized Teflon FEP Thermal Control Insulation
Banks, Bruce A., NASA Lewis Research Center, USA; deGroh, Kim K., NASA Lewis Research Center, USA; Stueber, Thomas J., NYMA, Inc., USA; Sechkar, Edward A., NYMA, Inc., USA; Hall, Rachelle L., Ohio Aerospace Inst., USA; Jul. 1998; 10p; In English; 43rd, 31 May - 4 Jun. 1998, Anaheim, CA, USA; Sponsored by Society for Advancement of Materials and Process Engineering, USA
Contract(s)/Grant(s): RTOP 632-1A-1E
Report No.(s): NASA/TM-1998-207914/REV1; E-11186/REV1; NAS 1.15:207914/REV1; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Metallized Teflon fluorinated ethylene propylene (FEP) thermal control insulation is mechanically degraded if exposed to a sufficient fluence of soft x-ray radiation. Soft x-ray photons (4-8 A in wavelength or 1.55 - 3.2 keV) emitted during solar flares have been proposed as a cause of mechanical properties degradation of aluminized Teflon FEP thermal control insulation on the Hubble Space Telescope (HST). Such degradation can be characterized by a reduction in elongation-to-failure of the Teflon FEP. Ground laboratory soft x-ray exposure tests of aluminized Teflon FEP were conducted to assess the degree of elongation degradation which would occur as a result of exposure to soft x-rays in the range of 3-10 keV. Tests results indicate that soft x-ray exposure in the 3-10 keV range, at mission fluence levels, does not alone cause the observed reduction in elongation of flight retrieved samples. The soft x-ray exposure facility design, mechanical properties degradation results and implications will be presented.
Author
Hubble Space Telescope; X Rays; Temperature Control; Propylene; Insulation; Durability; Aluminum

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PROPELLANTS AND FUELS

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

19980206478 Los Alamos National Lab., NM USA
Hydrogen as a zero-emission, high-efficiency fuel: Uniqueness, experiments and simulations
Johnson, N. L., Los Alamos National Lab., USA; 1997; 12p; In English; Ice97: 3Rd International Combustion Engines: Experiments and Modeling, 17 - 19 Sep. 1997, Naples, Italy
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2300; CONF-970995-; DE97-008752; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The planned use of hydrogen as the energy carrier of the future introduces new challenges and opportunities, especially to the engine design community. Hydrogen is a bio-friendly fuel that can be produced from renewable resources and has no carbon dioxide combustion products; and in a properly designed ICE, almost zero NO(sub x) and hydrocarbon emissions can be achieved. Because of the unique properties of hydrogen combustion - in particular the highly wrinkled nature of the laminar flame front due to the preferential diffusion instability - modeling approaches for hydrocarbon gaseous fuels are not generally applicable to hydrogen combustion. This paper reports on the current progress to develop an engine design capability based on the KIVA family of codes for hydrogen-fueled, spark-ignited engines in support of the National Hydrogen Program. A turbulent combustion model, based on a modified eddy-turnover model in conjunction with an intake flow valve model, is found to describe well the efficiency and NO(sub x) emissions for an experimental engine over a wide range of ignition timings. The NO(sub x) emissions of this engine satisfy the Equivalent Zero Vehicle (EZEV) standard established by the California Resource Board.
DOE
Carbon Dioxide; Combustion Products; Hydrogen Engines; Turbulent Combustion; Uniqueness; Hydrocarbon Fuels

19980206594 National Renewable Energy Lab., Golden, CO USA
The ethanol heavy-duty truck fleet demonstration project
Jun. 1997; 71p; In English
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/SR-540-22110; DE97-006927; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This project was designed to test and demonstrate the use of a high-percentage ethanol-blended fuel in a fleet of heavy-duty, over-the-road trucks, paying particular attention to emissions, performance, and repair and maintenance costs. This project also represents the first public demonstration of the use of ethanol fuels as a viable alternative to conventional diesel fuel in heavy-duty engines.

DOE
Ethyl Alcohol; Fuels; Trucks

19980206601 Research Inst. of National Defence, Weapons and Protection Div., Tumba, Sweden
Inductance of an Explosive Generator
Seth, Marten, Research Inst. of National Defence, Sweden; Jan. 1998; ISSN 1104-9154; 56p; In English
Report No.(s): PB98-147515; FOA-R-98-00676-612-SE; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This project report describes an accurate measurement of the inductance of the current-carrying structure in a helical Explosive Magnetic Generator (EMG) as a function of time. With knowledge of how the inductance varies in time, it is possible to solve for the current as a function of time, thus estimating the performance of a generator design. The electrical characteristics of an exploding EMG is modelled by a series of static copper cores which are inserted into the generator. The inductance is then measured by incorporating the inductive generator coil into a resonant LC-circuit and studying the transient response. by processing a sampled transient response in a computer program and taking into consideration both the resonant frequency and the attenuation of the waveform, a high precision inductance value is obtained. Total uncertainty in the measurements is below one tenth percent for large inductance values and around one percent for small inductance values.

NTIS
Explosives; Magnetic Compression; Pulse Generators; Chemical Explosions; Inductance; Electric Current

19980206793 Bienz, Kummer and Partner Ltd., Safety Planning, Risk Management, Zollikerberg, Switzerland
Swiss Safety Concept, Regulations and Organisation in the Field of Military Explosives Safety
Bienz, Andreas F., Bienz, Kummer and Partner Ltd., Switzerland; Jun. 1997; 20p; In English
Report No.(s): PB98-147408; TM-021-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the second half of the 60's a number of problems in the field of ammunition storage arose in Switzerland which could no longer be solved reasonably and economically by means of the existing safety regulations. In addition, the ammunition factories of the Department of Defense should have been renewed and extended at that time, but adequate safety regulations did not exist. Consequently, the quantitative risk analysis approach was introduced and applied to the urgent problems. The quantitative risk approach is embedded in a fully functioning concept which has improved safety and induced a significant number of benefits over the years. The main characteristics of this concept are explained and the reasons which led to it are shown. The concept is illustrated with various applications. The important safety regulations are introduced and the main safety organizations and their duties and responsibilities are presented. Finally, the benefits of the concept are outlined.

NTIS
Regulations; Safety Management; Safety; Organizations; Ammunition; Defense Program

19980209667 Research Inst. of National Defence, Stockholm, Sweden
Annual Report 1997 for the Research Program Environmental Studies *Annual Report, 1997 Aersrapport 1997 foer FoT -Omraedet: Miljoefraegor*
Ahlberg, M., Research Inst. of National Defence, Sweden; Jan. 1998; 30p; In Swedish; In English
Report No.(s): PB98-147648; FOA-R-98-00685-222-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report summarizes the results of the research program 'Environmental studies' at the Defense Research Establishment (FOA) for the fiscal year 1997. A proposal for guidelines concerning how to choose defence materials taking into account their

environmental impact 1 has been prepared. FOA has participated in a cooperative project with the USA concerning 'Environmental strategies in defence materials acquisition' which will result in an international handbook.
NTIS
Disposal; Environmental Surveys; Handbooks; Explosions; Environment Effects

19980209846 Sandia National Labs., Livermore, CA USA
Coupling experimental data and a prototype model to probe the physical and chemical processes of 2,4-dinitroimidazole solid-phase thermal decomposition
Behrens, R., Sandia National Labs., USA; Minier, L., Sandia National Labs., USA; Bulusu, S., Army Armament Research and Development Command, USA; [1998]; 19p; In English; Propulsion Systems Hazards, 27-31 Oct. 1997, West Palm Beach, FL, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-98-8412C; CONF-9710108; DE98-051315; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The time-dependent, solid-phase thermal decomposition behavior of 2,4-dinitroimidazole (2,4-DNI) has been measured utilizing simultaneous thermogravimetric modulated beam mass spectrometry (STMBMS) methods. The decomposition products consist of gaseous and non-volatile polymeric products. The temporal behavior of the gas formation rates of the identified products indicate that the overall thermal decomposition process is complex. In isothermal experiments with 2,4-DNI in the solid phase, four distinguishing features are observed: (1) elevated rates of gas formation are observed during the early stages of the decomposition, which appear to be correlated to the presence of exogenous water in the sample; (2) this is followed by a period of relatively constant rates of gas formation; (3) next, the rates of gas formation accelerate, characteristic of an autocatalytic reaction; and (4) finally, the 2,4-DNI is depleted and gaseous decomposition products continue to evolve at a decreasing rate. A physicochemical and mathematical model of the decomposition of 2,4-DNI has been developed and applied to the experimental results. The first generation of this model is described in this paper. Differences between the first generation of the model and the experimental data collected under different conditions suggest refinements for the next generation of the model.
DOE
Pyrolysis; Nitro Compounds; Chemical Reactions; Thermogravimetry

19980209977 National Renewable Energy Lab., Golden, CO USA
Assessment of methods for hydrogen production using concentrated solar energy
Blake, D., National Renewable Energy Lab., USA; Showalter, S., Sandia National Labs., USA; Jan. 1998; 24p; In English
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/TP-570-23629; DE98-001924; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The purpose of this work was to assess methods for hydrogen production using concentrated solar energy. The results of this work can be used to guide future work in the application of concentrated solar energy to hydrogen production. Specifically, the objectives were to: (1) determine the cost of hydrogen produced from methods that use concentrated solar thermal energy, (2) compare these costs to those of hydrogen produced by electrolysis using photovoltaics and wind energy as the electricity source. This project had the following scope of work: (1) perform cost analysis on ambient temperature electrolysis using the 10 MWe dish-Stirling and 200 MWe power tower technologies; for each technology, sue two cases for projected costs, years 2010 and 2020 the dish-Stirling system, years 2010 and 2020 for the power tower, (2) perform cost analysis on high temperature electrolysis using the 200 MWe power tower technology and projected costs for the year 2020, and (3) identify and describe the key technical issues for high temperature thermal dissociation and the thermochemical cycles.
DOE
Ambient Temperature; Windpower Utilization; Solar Energy Conversion; Photovoltaic Conversion; Hydrogen Production; Electrolysis; Energy Technology; Solar Energy

19980210123 National Renewable Energy Lab., Golden, CO USA
Liquefied natural gas as a transportation fuel for heavy-duty trucks, Volume I
Dec. 1997; 149p; In English
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/SR-540-23094; DE98-001773; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This document contains Volume 1 of a three-volume manual designed for use with a 2- to 3-day liquefied natural gas (LNG) training course. Transportation and off-road agricultural, mining, construction, and industrial applications are discussed. This volume provides a brief introduction to the physics and chemistry of LNG; an overview of several ongoing LNG projects, economic considerations, LNG fuel station technology, LNG vehicles, and a summary of federal government programs that encourage conversion to LNG.
DOE
Liquefied Natural Gas; Transportation; Trucks

19980210592 Los Alamos National Lab., NM USA
Dynamic measurement of temperature in detonating PBX 9502 using neutron resonance spectroscopy
Funk, D. J., Los Alamos National Lab., USA; Rabie, R., Los Alamos National Lab., USA; Mace, J., Los Alamos National Lab., USA; 1997; 8p; In English; Detonation, 31 Aug. - 4 Sep. 1997, Snowmass, CO, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2926; CONF-970874-1; DE97-008321; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Accurate temperature measurements in dynamic systems have been pursued for decades and have usually relied on optical techniques. These approaches are generally hampered by insufficient information regarding the emissivity of the system under study, particularly when looking at detonating energetic materials. This results from the complex chemical change that the detonating system is undergoing, from neat organic crystals with discrete set of electronic states and molecular vibrations embedded in a binder, to gas phase products, with a different set of discrete states. Typically, when making an optical measurement, one makes the grey body approximation and measures the photon flux at a few discrete bands to extract a temperature from the light emission. We are developing NRS techniques to measure temperature in dynamic systems and overcome the limitations of optical systems. Many elements have neutron resonances with narrow enough intrinsic Breit-Wigner (Lorentzian) widths such that the resonance is substantially broadened by atomic motion even at room temperature. Thus, accurate measurement of the Doppler contribution allows one to infer the material temperature, and for the conditions achieved using standard high explosives, the probe itself is not perturbed by the high temperature and pressure. Moreover, since the opacity of energetic materials to neutrons is much less than it is to infrared, visible, or ultraviolet light, we probe the internal temperature, in contrast to measuring the surface temperature through a laser or an emission technique. Also, NRS is much less affected by the opacity of soot or other particulate than are optical methods.
DOE
Detonation; Temperature Measurement; Research Management; Materials Handling; Neutron Spectrometers; Procedures; Fissionable Materials

19980210644 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Hydrogen Transport to Mars Enables the Sabatier/Electrolysis Process
Mueller, P. J., Utah State Univ., USA; Rapp, D., Jet Propulsion Lab., California Inst. of Tech., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 29; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Sabatier/Electrolysis (S/E) process is an attractive approach to in situ propellant production (ISPP), and a breadboard demonstration of this process at Lockheed Martin Astronautics funded by JPL performed very well, with high conversion efficiency, and reliable diurnal operation. There is a net usage of hydrogen in the S/E process, and this has been the principal problem for this approach to ISPP.
Derived from text
Propellants; Sabatier Reaction; Electrolysis; Breadboard Models; Hydrogen Fuels; Mars (Planet); Propellant Storage

19980210645 Science Applications International Corp., Schaumburg, IL USA
Mars In Situ Propellant Production (ISPP) Assessment
Stancati, Michael L., Science Applications International Corp., USA; Niehoff, John C., Science Applications International Corp., USA; Jacobs, Mark K., Science Applications International Corp., USA; German, Darla, Science Applications International Corp., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 31; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

This study investigates the benefits of various in situ propellant production (ISPP) implementation strategies for near-term Mars missions to support an integrated Mars exploration program. Missions included in this assessment are a 2005 Mars Sample Return (MSR) without ISPP, 2007 MSR with ISPP, and a 2011 HEDS cargo flight. For each mission, three to seven ISPP imple-

mentation options are investigated, varying propellant, primary ISPP processing system, and power source selections. Evaluation criteria include cost, ISPP-imposed complexity, and technology development requirements. Costs are assessed based on detailed mission performance estimates accounting for mission phase durations, propulsion system design, propellant storage and boiloff, ISPP system design, and other flight system mass and performance properties. ISPP-imposed complexity separates three major areas impacted by ISPP system selection: (1) the primary ISPP processing system development, (2) the supporting power system, and (3) the propulsion engine, tankage, and storage system design. ISPP processing candidates include Zirconia Solid Oxide Electrolysis (SOE) to generate oxygen and Sabatier/Water Electrolysis (S/E) to produce oxygen and methane (consuming hydrogen supplied from Earth). Propellant candidates considered include NTO/MMH, LOX/N2H4, LOX/C3H8, and LOX/CH4 (at various mixture ratios). Advanced technology requirements are compared based on the estimated magnitude of all required technology developments for each of the three missions, taking into account schedule impacts to ensure readiness prior to need. Study results include a benefits comparison of ISPP implementation options for the 2005-2011 Mars mission set, identification of technology needs, and recommendations for a Mars ISPP technology development roadmap.
Author
Propellants; Mars Exploration; Manned Mars Missions; Liquid Oxygen; Electrolysis

19980210647 Pacific Northwest National Lab., Richland, WA USA
Insitu propellant production based on micro chemical systems
Wegeng, R. S., Pacific Northwest National Lab., USA; TeGrotenhuis, W. E., Pacific Northwest National Lab., USA; Tonkovich, A. L. Y., Pacific Northwest National Lab., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 35-36; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The development of compact processing hardware for the production of propellant fuels and oxygen from available resources on Mars or elsewhere presents a number of technical challenges including process miniaturization and thermal energy integration. Our approach to this problem consists of developing integrated reactors, heat exchangers, and separations units using microfabrication techniques that have the potential of realizing very compact systems with high throughputs and high thermal efficiency.
Derived from text
Miniaturization; Propellants; Oxygen Production; Thermodynamic Efficiency; Heat Exchangers; Heat Transfer; Microchannels; Chemical Reactors

19980210649 Pioneer Astronautics, Lakewood, CO USA
Report on the construction and operation of a Mars in situ propellant production unit utilizing the reverse water gas shift
Zubrin, R., Pioneer Astronautics, USA; Kito, T., Pioneer Astronautics, USA; Frankie, B., Pioneer Astronautics, USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 41; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report describes work accomplished on a Mars in situ propellant production project utilizing the reverse water gas shift (RWGS) reaction. During the project, Pioneer successfully built and operated two chemical synthesis units representing the cores of machines capable of manufacturing oxidizers and a variety of fuels out of primarily indigenous Martian material. The units include a Reverse Water Gas Shift (RWGS) unit and a Methanol Synthesis (MEOH) unit.
Derived from text
Propellants; Chemical Reactions; Synthesis (Chemistry); Liquid Hydrogen; Carbon Dioxide; Carbon Monoxide; Water; Oxygen Production

19980210808 Wuppertal Univ., Lehregebiet Physikalische Chemie, Germany
Product analyses and kinetic studies on gas phase oxidation of the fuel additive ethyl tert-butyl ether and its products ***Produktanalysen und Kinetikuntersuchungen der Gasphasenoxidation des Kraftstoffadditivs Ethyl-tert-butylether und seiner Produkte***
Becker, K. H., Wuppertal Univ., Germany; Thuener, L., Wuppertal Univ., Germany; Apr. 1997; 67p; In German
Report No.(s): ETDE-DE-649; DE98-743139; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The widespread use of the additive ETBE in gasoline leads to an increased release of this compound into the atmosphere via evaporation or exhaust fumes. In order to determine the influence of this additive on trace gas cycles it is first necessary to carry out studies on the degradation mechanisms and pertinent kinetic properties of this substance. The aim of the present study was to examine the degradation mechanisms of the fuel additive t-butyl ethyl ether under atmospheric conditions. The reactions of the main degradation products (t-butyl formiate and t-butyl acetate, together ca. 80%) were also studied in order to obtain as com-

plete a picture of the degradation paths as possible. This was to permit an assessment of the influence of ETBE and its products on tropospheric trace gas cycles and ozone formation.
DOE
Atmospheric Composition; Ethers; Trace Contaminants; Gasoline; Ethyl Compounds; Additives; Oxidation

29
MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications. For biological materials see 55 Space Biology.

19980206463 NASA Marshall Space Flight Center, Huntsville, AL USA
Advanced Gradient Heating Facility (AGHF)
Life and Microgravity Spacelab (LMS); Feb. 1998, pp. 1-87; In English; Also announced as 19980206462; No Copyright; Avail: CASI; A05, Hardcopy; A06, Microfiche

This section of the publication includes papers entitled: (1) Coupled growth in hypermonotectics; (2) Directional solidification of refined Al-4 wt.% Cu alloys; (3) Effects of convection on interface curvature during growth of concentrated ternary compounds; (4) Directional solidification of Al-1.5 wt.% Ni alloys; (5) Interactive response of advancing phase boundaries to particles; (6) INTeractive Response of Advancing Phase boundaries to Particles-INTRAPP; and (7) Particle engulfment and pushing by solidifying interfaces.
CASI
Crystal Growth; Directional Solidification (Crystals); Monotectic Alloys; Gravitational Effects; Aluminum Alloys; Solid-Solid Interfaces; Spaceborne Experiments; Microgravity; Space Processing

19980206464 NASA Marshall Space Flight Center, Huntsville, AL USA
Advanced Protein Crystallization Facility (APCF)
Life and Microgravity Spacelab (LMS); Feb. 1998, pp. 89-235; In English; Also announced as 19980206462; No Copyright; Avail: CASI; A07, Hardcopy; A06, Microfiche

This section of the Life and Microgravity Spacelab (LMS) publication contains articles entitled: (1) Crystallization of EGFR-EGF; (2) Crystallization of Apocrustacyanin C1; (3) Crystallization and X-ray Analysis of 5S rRNA and the 5S rRNA Domain A; (4) Growth of Lysozyme Crystals at Low Nucleation Density; (5) Comparative Analysis of Aspartyl tRNA-synthetase and Thaumatin Crystals Grown on Earth and In Microgravity; (6) Lysosome Crystal Growth in the Advanced Protein Crystallization Facility Monitored via Mach-Zehnder Interferometry and CCD Video; (7) Analysis of Thaumatin Crystals Grown on Earth and in Microgravity; (8) Crystallization of the Nucleosome Core Particle; (9) Crystallization of Photosystem I; (10) Mechanism of Membrane Protein Crystal Growth: Bacteriorhodopsin-mixed Micelle Packing at the Consolution Boundary, Stabilized in Microgravity; (11) Crystallization in a Microgravity Environment of CCDB, a Protein Involved in the Control of Cell Death; and (12) Crystallization of Sulfolobus Solfataricus
CASI
Protein Crystal Growth; Crystallization; Protein Synthesis; Space Processing; Microgravity; Gravitational Effects; Lysozyme; Lysosomes; Bacteria; Ribonucleic Acids; Bioprocessing; Spaceborne Experiments

19980206465 NASA Marshall Space Flight Center, Huntsville, AL USA
Bubble, Drop and Particle Unit (BDPU)
Life and Microgravity Spacelab (LMS); Feb. 1998, pp. 237-318; In English; Also announced as 19980206462; No Copyright; Avail: CASI; A05, Hardcopy; A06, Microfiche

This section of the Life and Microgravity Spacelab (LMS) publication includes the following articles entitled: (1) Oscillatory Thermocapillary Instability; (2) Thermocapillary Convection in Multilayer Systems; (3) Bubble and Drop Interaction with Solidification Front; (4) A Liquid Electrohydrodynamics Experiment; (5) Boiling on Small Plate Heaters under Microgravity and a Comparison with Earth Gravity; (6) Thermocapillary Migration and Interactions of Bubbles and Drops; and (7) Nonlinear Surface Tension Driven Bubble Migration
CASI
Microgravity; Space Processing; Spaceborne Experiments; Gravitational Effects; Single Crystals; Crystal Growth; Liquid Crystals; Solidification; Bubbles; Drops (Liquids); Liquid-Solid Interfaces

19980206469 NASA Marshall Space Flight Center, Huntsville, AL USA

Plant Growth Facility (PGF)

Life and Microgravity Spacelab (LMS); Feb. 1998, pp. 589-605; In English; Also announced as 19980206462; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

In a microgravity environment aboard the Space Shuttle Columbia Life and Microgravity Mission STS-78, compression wood formation and hence altered lignin deposition and cell wall structure, was induced upon mechanically bending the stems of the woody gymnosperms, Douglas fir (Pseudotsuga menziesii) and loblolly pine (Pinus taeda). Although there was significant degradation of many of the plant specimens in space-flight due to unusually high temperatures experienced during the mission, it seems evident that gravity had little or no effect on compression wood formation upon bending even in microgravity. Instead, it apparently results from alterations in the stress gradient experienced by the plant itself during bending under these conditions. This preliminary study now sets the stage for long-term plant growth experiments to determine whether compression wood formation can be induced in microgravity during phototropic-guided realignment of growing woody plant specimens, in the absence of any externally provided stress and strain.

Author

Microgravity; Conifers; Gravitational Effects; Spacecraft Environments; Stems; Plants (Botany); Plant Stress; Vegetation Growth; Spaceborne Experiments

19980210013 IIT Research Inst., Chicago, IL USA

Development of Tailorable Electrically Conductive Thermal Control Material Systems ***Final Report, Apr. 1995 - Apr. 1997***

Deshpande, M. S., IIT Research Inst., USA; Harada, Y., IIT Research Inst., USA; Jun. 1998; 308p; In English

Contract(s)/Grant(s): NAS8-40580

Report No.(s): NASA/CR-1998-208474; M-875; NAS 1.26:208474; IITRI-C06804-97; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The optical characteristics of surfaces on spacecraft are fundamental parameters in controlling its temperature. Passive thermal control coatings with designed solar absorptance and infrared emittance properties have been developed and been in use for some time. In this total space environment, the coating must be stable and maintain its desired optical properties for the course of the mission lifetime. The mission lifetimes are increasing and in our quest to save weight, newer substrates are being integrated which limit electrical grounding schemes. All of this has already added to the existing concerns about spacecraft charging and related spacecraft failures or operational failures. The concern is even greater for thermal control surfaces that are very large. One way of alleviating such concerns is to design new thermal control material systems (TCMS) that can help to mitigate charging via providing charge leakage paths. The object of this program was to develop two types of passive electrically conductive TCMS.

Author

Product Development; Electrical Resistivity; Optical Properties; Thermal Control Coatings

31
ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

19980206474 Los Alamos National Lab., NM USA

An experimental investigation of airflow-induced vibrations within the multiplicity and vertex detector

Bernardin, J. D., Los Alamos National Lab., USA; Bosze, E., Los Alamos National Lab., USA; Boissevain, J., Los Alamos National Lab., USA; Simon-Gillo, J., Los Alamos National Lab., USA; Jul. 1997; 12p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-13319-MS; DE97-008403; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report summarizes an experimental investigation of vibrations within the multiplicity and vertex detector (MVD). In particular, the maximum displacements of several MVD components were determined from accelerometer measurements of vibrations induced by an electronics air-cooling system. For an MVD inlet air volumetric flow rate of 0.022 cu m/s, maximum displacements of several MVD components including a multi-chip module, the Rohacell inlet air plenum, and an aluminum structural cross support, were found to be on the order of 1.5 micrometers. Consequently, it was concluded that air induced vibrations will not significantly interfere with the MVD's long-term structural integrity or operating performance.

DOE

Flow Velocity; Structural Failure; Accelerometers; Air Cooling; Air Flow

19980206607 Los Alamos National Lab., NM USA

Rapid fabrication of materials using directed light fabrication

Thoma, D. J., Los Alamos National Lab., USA; Lewis, G. K., Los Alamos National Lab., USA; Milewski, J. O., Los Alamos National Lab., USA; Chen, K. C., Los Alamos National Lab., USA; Nemec, R. B., Los Alamos National Lab., USA; 1997; 9p; In English; Thermec 1997, 7 - 11 Jul. 1997, Wollonging, Australia

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-1385; CONF-9707101; DE98-000267; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Directed light fabrication (DLF) is a rapid fabrication process that fuses gas delivered metal powders within a focal zone of a laser beam to produce fully dense, near-net shape, 3-dimensional metal components from a computer generated solid model. Computer controls dictate the metal deposition pathways, and no preforms or molds are required to generate complex sample geometries. The focal zone of the laser beam is programmed to move along or across a part cross-section, and coupled with a multi-axis sample stage, produces the desired part. by maintaining a constant molten puddle within the focal zone, a continuous liquid/solid interface is possible while achieving constant cooling rates that can be varied between 10 to 10(exp 4) K/s and solidification growth rates (that scale with the beam velocity) ranging up to 10(exp 2) m/s. The DLF technique offers unique advantages over conventional thermomechanical processes in that many labor and equipment intensive steps can be avoided. Moreover, owing to the flexibility in power distributions of lasers, a variety of materials can be processed, ranging from aluminum alloys to rhenium, and including intermetallics such as Mo5Si3. As a result, the rapid fabrication of conventional and advanced materials are possible.

DOE

Fabrication; Laser Beams; Intermetallics; Metal Powder; Metallizing

19980206723 Sandia National Labs., Albuquerque, NM USA

Simulation of orthogonal cutting with smooth particle hydrodynamics

Heinstein, M., Sandia National Labs., USA; Segalman, D., Sandia National Labs., USA; Sep. 1997; 11p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1961; DE97-009295; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

There is an active literature on the simulation of cutting processes through finite element methods. Such efforts are motivated by the enormous economic importance of machining processes and the desire to adjust processes so as to optimize product and throughput, but suffer from some difficulties inherent to the finite element method. An alternative approach, which appears to overcome most of those difficulties, is that of Smooth Particle Hydrodynamics (SPH).Though some finite element work is reviewed here, the focus of this paper is on the demonstration of the SPH technique of to simulate orthogonal cutting.

DOE

Finite Element Method; Hydrodynamics; Economics

19980209855 Los Alamos National Lab., NM USA

Pad polishing for rapid production of large flats

Berggren, R. R., Los Alamos National Lab., USA; Schmell, R. A., Los Alamos National Lab., USA; 1997; 8p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3036; CONF-970706-; DE98-000970; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Pad polishing is an efficient technique for polishing-out a ground surface and reaching a figure better than one wave, ready for completion with less than an hour on a planetary polisher. For the 350 mm square piece of BK-7, removal was one micrometer every 10 minutes. Polishing-out from a 5 micrometer grind took less than 3 hours, to a surface smoothness of one nm rms. Other tests verified that the pad leaves no unusual subsurface damage. Following completion on a pitch planetary polisher, surface finish is the same as obtained for conventional processing. Unlike pitch, the pad retains its surface figure, producing a uniform result when used on a production basis. Coupled with the speed of production and low capital cost of overarm machines, it provides a cost-effective approach.

DOE

Polishing; Planetary Surfaces; Surface Finishing

19980209957 Sandia National Labs., Albuquerque, NM USA

Micro-flex mirror and instability actuation technique

Garcia, E. J., Sandia National Labs., USA; [1997]; 6p; In English; 11th; Micro Electro Mechanical Systems, 25-29 Jan. 1998, Heidelberg, Germany; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2271C; CONF-980126; DE98-001483; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This paper reports on the design and fabrication of a surface micromachined mirror system which is capable of producing the required moments to rotate a mirror structure out of the plane of fabrication. The planar structures created by surface micromachining present difficulties with developing a sufficient moment to move structures out of the x-y plane when actuated by those same planar structures. This is due to the short moment arms (in thickness direction z) that can be created in the fabrication process. The instability actuation technique reported here has general application to moving 2-dimensional structures up and out of the plane of their original fabrication. This technique can be applied to build truly 3-dimensional structures from a nearly 2-dimensional fabrication process. Surface micromachining can now be considered a 3-dimensional process where 3-dimensional structures are built by raising up structures by the instability actuation technique and making appropriate mechanical interconnections. DOE

Micromachining; Planar Structures; Surface Properties

19980210237 Hampton Univ., VA USA

Mixing, Noise and Thrust Benefits Using Corrugated Designs, *1 Jun. 1997 - 31 May 1998*

White, Samuel G., Hampton Univ., USA; Gilinsky, Mikhail M., Hampton Univ., USA; 1998; 4p; In English

Contract(s)/Grant(s): NAG1-1936; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project was conducted as a support for effective research, training and teaching of Hampton University students in Fluid Mechanics and Acoustics. Basically, this work is organized and implemented by the new Fluid Mechanics and Acoustics Laboratory (FM & AL) which was established at Hampton University in the School of Engineering and Technology (E & T) in 1996. In addition, FM & AL in cooperation with NASA LaRC jointly conducts research with the Central AeroHydrodynamics Institute (TSAGI, Moscow) in Russia under a 2 year Civilian Research and Development Foundation (CRDF). This project is also conducted under control of NASA HQ. For fulfillment of the current project, several researchers were involved as was shown in the proposal to NASA in 1996. This work is the development and support for projects solve problems with the goal of reducing jet noise and increasing nozzle thrust.

Derived from text

Noise Reduction; Jet Aircraft Noise; Acoustics; Fluid Mechanics

19980210247 Los Alamos National Lab., NM USA

Isothermal melt processing of Bi-2212 wires and tapes

Holesinger, T. G., Los Alamos National Lab., USA; Hults, W. L., Los Alamos National Lab., USA; Smith, J. L., Los Alamos National Lab., USA; Dai, Weiming, Oxford Instruments, Inc., USA; Marken, K.R., Oxford Instruments, Inc., USA; 1997; 11p; In English; 99th, 4 - 7 May 1997, Cincinnati, OH, USA; Sponsored by American Ceramic Society, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2629; CONF-970568; DE98-001452; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Isothermal melt processing has been used to produce high critical currents (I(sub c)'s) and current densities (J(sub c)'s) in Bi2SR2CaCu2O(y) round wires and flat tapes. I(sub c)'s and J(sub c)'s of 225 A and 80 kA/sq cm have been obtained in short length, monocore wires. However, voids and other macroscopic defects have limited performance over longer lengths. Isothermally melt processed tapes have yielded I(sub c) and J(sub c) values up to 341 A and 245 kA/sq cm, although performance over longer lengths is somewhat reduced. A test coil made from 0.5 m of tape yielded, I(sub c) and J(sub c) values of 208 A and 153 kA/sq cm, respectively.

DOE

Isothermal Processes; Melting; Current Density; Electric Current

19980210412 Los Alamos National Lab., NM USA

Computational modeling of materials processing and processes

Lowe, T. C., Los Alamos National Lab., USA; Zhu, Yuntian, Los Alamos National Lab., USA; Bingert, J. F., Los Alamos National Lab., USA; [1998]; 15p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3251; DE98-001510; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). Anisotropic mechanical properties of densified BSCCO powders are of paramount importance during thermo-mechanical processing of superconducting tapes and wires. Maximum current transport requires high relative density and a high degree of alignment of the single crystal planes of the BSCCO. Unfortunately this configuration causes high stresses that can lead to cracking, and thus reduce the density, and the conductive properties of the tape. The current work develops a micro-mechanical material mode to model is calibrated and compared to experimental results, and then employed to analyze the effects of initial texture and confinement pressure and shear strains in the core of oxide powder-in-tube (OPIT) processed tapes are calculated by finite-element analysis. The calculated deformations were then applied as boundary conditions to the micromechanical model. Our calculated results were used to interpret a set of prototypical rolling experiments.

DOE

BSCCO Superconductors; Manufacturing; Micromechanics; Crystal Structure; Wire; Powder (Particles); Finite Element Method

19980210635 Armstrong Lab., Brooks AFB, TX USA

Gas generation and cryogenic refrigeration technologies

Fenner, J. E., Armstrong Lab., USA; Edman, K. A., Armstrong Lab., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 9; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Armstrong Laboratory is currently developing the Advanced Hybrid Oxygen System, AHOS. These hybrid systems will liquefy gaseous oxygen that is generated by a High Performance Molecular Sieve Oxygen Generating System (HP MSOGS), a pressure swing adsorption technology. The HP MSOGS is capable of generating oxygen in concentrations >= to 99.0%, with peak concentrations at 99.7%. This capability meets the 99.0% level required by the U.S. Pharmacopoeia (USP) for medical grade ”oxygen”, and satisfies paratroopers prebreathing concentration requirements. This technology is targeted for heavy aircraft applications (AHOS-Aircraft) and aeromedical evacuation and field casualty care operations (AHOS-Medical). Critical technology developments include: miniaturized, high speed, gas-bearing turbomachinery; high effectiveness heat exchangers; and high purity oxygen concentrators. AHOS will allow the USAF to replace existing non-generation systems in both aircraft and medical applications significantly reducing the cost and logistical burden associated with these systems.

Derived from text

Oxygen Supply Equipment; Cryogenic Cooling; Adsorption; Liquid Oxygen; Gas Generators

19980210799 Lawrence Livermore National Lab., Livermore, CA USA

Method for removing a stripe from the coating of a Fabry-Perot mirror

Perry, S. J., Lawrence Livermore National Lab., USA; Steinmetz, L. L., Lawrence Livermore National Lab., USA; Oct. 1997; 10p; In English

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-ID-128911; DE98-052090; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We describe a method for removing a stripe from the coating of a Fabry-Perot mirror. This is accomplished by scraping off the soft coating with a finely lapped steel blade mounted on a precision mechanism to accurately position the blade and guide it for straight cuts. The width of the stripe is determined by selecting a blade of desired size. Previous methods and attempts are discussed.

DOE

Procedures; Removal; Coating; Mirrors

32
COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications. 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.

19980206524 National Defence Research Establishment, Div. of Sensor Technology, Linkoeping, Sweden
Analysis of Two Antenna Elements Intended for Usage in a Circular Array ***Analys av tva antennelement avsedda for en cirkular gruppantenn***
Snitting, Tomas, National Defence Research Establishment, Sweden; Dec. 1997; ISSN 1104-9154; 38p; In English
Report No.(s): PB98-147440; FOA-R-97-00645-408-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Circular array antennas give the possibility to excite and control antenna lobes in the horizontal plane. This can be used to decrease risk of interception and interference. The aim with this work has been to design antennas for usage in an electrically small array. The studied antenna elements were of Tagi-Uda and Vivalid type. The report contains a description of how the antennas were designed and result from calculations and measurements. The calculations were performed using NEC3 (Numerical Electromagnetics Code 3) and a FDTD (Finite Difference Time Domain) code.
NTIS
Radio Antennas; Optimization; Yagi Antennas; Antenna Components

19980206600 National Defence Research Establishment, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden
Wideband Multi-Carrier HF Communication ***Topical Report Bredbandig OFDM Transmission pae Kortvaegskanalen***
Nilsson, Jan, National Defence Research Establishment, Sweden; Dec. 1997; ISSN 1104-9154; 52p; In English
Report No.(s): PB98-147580; FOA-R-97-00544-504-SE; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The potential of wideband multi-carrier, or othogonal frequency division multiplex (OFDM), for HF communication is explored. Problems connected with HF communications are atmospheric noise, multi-math propagation and interfering signals from other uses. Interference suppression in an OFDM system, and a comparable direct-sequence (DS) system, is investigated.
NTIS
Wideband Communication; High Frequencies; Frequency Division Multiplexing; Orthogonality; Interference; Carrier Frequencies; Broadband

19980206743 Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Frascati, Frascati, Italy
Interference effects on the coupling impedance of many holes in a coaxial beam pipe
DeSantis, S., Istituto Nazionale di Fisica Nucleare, Italy; Mostacci, A., Istituto Nazionale di Fisica Nucleare, Italy; Palumbo, L., Istituto Nazionale di Fisica Nucleare, Italy; Jun. 1997; 13p; In English
Report No.(s): INFN-IR-LNF-97-022; DE98-712221; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

The problem of many holes in a coaxial beam pipe is studied by means of the modified Bethe's theory. The electromagnetic fields propagating in the coaxial region couple to the equivalent dipole moments of the holes. The effect of the coupling on the longitudinal impedance and on the loss factor is investigated, showing that the interference phenomena are significant for such geometries.
DOE
Coupling; Diffraction Patterns; Electromagnetic Fields; Impedance

19980206789 Helsinki Univ. of Technology, Radio Lab., Espoo, Finland
Study of Low Elevation Angle Scintillation Modelling: Executive Summary
vandeKamp, M. M. J. L., Helsinki Univ. of Technology, Finland; Tervonen, J. K., Helsinki Univ. of Technology, Finland; Salonen, E. T., Helsinki Univ. of Technology, Finland; Kalliola, K., Helsinki Univ. of Technology, Finland; Sep. 1997; 52p; In English
Report No.(s): PB98-145246; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

The major objectives of this study are: to obtain relevant results for scintillation from the 20 and 30 GHz Olympus measurements on a 12.7 deg elevation path; to improve or develop models for scintillation predictions; to develop methods to combine

scintillation and attenuation to predict the total fade margin; and to obtain relevant meteorological data for scintillation and attenuation studies; This Report describes the execution of these tasks, and the results obtained.
NTIS
Artificial Satellites; Scintillation; Atmospheric Attenuation; Superhigh Frequencies; Radio Spectra; Elevation; Elevation Angle

19980209668 Research Inst. of National Defence, FOA Program, Stockholm, Sweden
Annual Report 1997 for the Research Area 'Communication Technique' ***Annual Report, 1997 Aersrapport 1997 foer FoT -Omraedet: Samband och Telekommunikation***
Tarras-Wahlberg, B., Research Inst. of National Defence, Sweden; Jan. 1998; 38p; In Swedish
Report No.(s): PB98-147671; FOA-R-98-00688-504-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report summarizes the result from the fiscal year 1997 within the FOA research are of Communication Systems. The research are consists of applied research in the field of robust and secure communication including wave propagation, for the need of the Armed Forces.
NTIS
Telecommunication; Procedures; Radio Transmission; Security

19980209723 SRI International Corp., Menlo Park, CA USA
Global Resource Management ***Final Report, Nov. 1995 - Feb. 1997***
Chatterjee, Saurav, SRI International Corp., USA; Sabata, Bikash, SRI International Corp., USA; Clark, Pamela, SRI International Corp., USA; Hammond, Charles, SRI International Corp., USA; Sydir, Jaroslaw, SRI International Corp., USA; Apr. 1998; 132p; In English
Contract(s)/Grant(s): F30602-95-C-0299; DARPA ORDER-D293; AF Proj. D293
Report No.(s): AD-A346044; SRI-FR-97-118; AFRL-IF-RS-TR-1998-43; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

An increasing number of applications (e.g., collaborative planning, video conferencing, telemedicine, and distributed command and control) have quality-of-service (QoS) requirements including data precision, accuracy, timeliness, security and availability. These QoS requirements are generally end-to-end requirements because the users of the applications are interested in the end results. This report describes the architecture developed for the Global Resource Management (GRM) project, to enable adaptive, end-to-end, scalable resource management of distributed systems. The architecture includes a QoS taxonomy; models to capture the application, resource, and system design space; algorithms to navigate this system design space; and algorithms to evaluate points within this design space so as to determine the impact on application QoS and system metrics. The architecture can be realized in many system domains, including command and control, multimedia, and medical domains, to provide domain-specific application QoS support.
DTIC
Resources Management; Command and Control; Management Systems; Systems Engineering; Optical Communication; Architecture (Computers)

19980209830 Osaka Univ., Dept. of Electrical Engineering, Osaka, Japan
A Novel Coherent Beam Tracking Scheme in Optical Intersatellite Link
Tsukamoto, Katsutoshi, Osaka Univ., Japan; Komaki, Shozo, Osaka Univ., Japan; Mirinaga, Norihoko, Osaka Univ., Japan; Technology Reports of the Osaka University; Apr. 15, 1994; ISSN 0030-6177; Volume 44, Nos. 2163-2182, pp. 59-66; In English
Report No.(s): Rept-2170; Copyright; Avail: Issuing Activity (Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan), Hardcopy, Microfiche

The performance of long-span optical free-space communication systems depend on the accuracy of spatial tracking systems that estimate the angular coordinates of an incoming optical beam and controls the pointing axis of an optical antenna. The optical heterodyne detection/spatial tracking system is expected to offer superior accuracy over direct detection systems because of its high sensitivity. In this paper, we propose a new type of coherent optical free-space communication system. A feature of this system is that the matching characteristics of spatial field patterns between signal and local lights is utilized in discriminating angular error with a single conventional photodetector. Another important feature is that a single photodetector can be used both in detecting the signal light for communication and in discriminating a tracking error.
Author
Data Links; Beam Steering; Free-Space Optical Communication; Satellite Communication; Optical Tracking; Position Errors; Mathematical Models

19980209883 Communications Research Lab., Koganei, Japan

Mobile Satellite Communications Experiments Using The Engineering Test Satellite Five (ETS-V): Satellite Communication Experiments For Aircraft, Vessels, And Land Vehicles

Wakana, Hiromitsu, Communications Research Lab., Japan; Journal of the Communications Research Laboratory; Nov. 1994; ISSN 0914-9260; Volume 41, No. 3, pp. 141-153; In English; Copyright; Avail: Issuing Activity (Communications Research Laboratory, Ministry of Posts and Telecommunications, Nukui-Kitamachi, 4-chome, Koganei, Tokyo, 184 Japan), Hardcopy, Microfiche

The Engineering Test Satellite Five (ETS-V) was launched in 1987 as the world's first experimental satellite to provide all-around capability for maritime, aeronautical, and land-mobile satellite communications experiments. This paper outlines the field experiments using a training ship, a B-747F freighter plane, a test van (for measuring the propagation characteristics), a hybrid terminal (for communication and positioning determination services), and a portable message communications terminal.
Author

Mobile Communication Systems; Engineering Test Satellites; Satellite Transmission; Earth Terminals; Experimentation

19980209884 Communications Research Lab., Koganei, Japan

Mobile Satellite Communications Experiments Using The Engineering Test Satellite Five (ETS-V): Asia-pacific Telecommunication Network Experiments

Ide, Toshiyuki, Communications Research Lab., Japan; Journal of the Communications Research Laboratory; Nov. 1994; ISSN 0914-9260; Volume 41, No. 3, pp. 155-160; In English; Copyright; Avail: Issuing Activity (Communications Research Laboratory, Ministry of Posts and Telecommunications, Nukui-Kitamachi, 4 chome, Koganei-shi, Tokyo, 184 Japa, Hardcopy, Microfiche

Two temporal communication networks via the Japan's experimental satellite have been established in the Asia-Pacific region for conducting distance education experiments, medical data exchange trials, and computer networking trials. These experiments in conjunction with International Space Year activities are advancing the development of new satellite communications applications and the dispersal of satellite communication technology among Asia-Pacific countries.
Author

Mobile Communication Systems; Engineering Test Satellites; Communication Networks; Satellite Networks; Experimentation; Radio Transmission

19980209886 Communications Research Lab., Koganei, Japan

Propagation Studies At 60 GHz For Millimeter-wave Indoor Communications Systems

Manabe, Takeshi, Communications Research Lab., Japan; Ihara, Toshio, Communications Research Lab., Japan; Sato, Katsuyoshi, Communications Research Lab., Japan; Journal of the Communications Research Laboratory; Nov. 1994; ISSN 0914-9260; Volume 41, No. 3, pp. 167-174; In English; Copyright; Avail: Issuing Activity (Communications Research Laboratory, Ministry of Posts and Telecommunications, Nukui-Kitamachi, 4-chome, Koganei, Tokyo, 184 Japan), Hardcopy, Microfiche

In 1992, the Communications Research Laboratory (CRL) commenced a research and development project for millimeter-wave indoor communications systems in the 60-GHz band. The objective of this project is to develop, as an alternative to hard-wired networks, high-speed indoor wireless communications systems that have transmission rates as high as 160 Mbps compatible with ATM (asynchronous transfer mode networks) for high-speed data and video transmission. As a first step in this project, millimeter-wave indoor propagation studies are currently in progress. In this article, the current CRL research activities on indoor propagation and the characterization of indoor construction materials at 60 GHz relevant to the development of high-speed millimeter-wave indoor communications systems are overviewed, mainly from an experimental viewpoint, by introducing the experimental facilities at CRL.
Author

Wireless Communication; Local Area Networks; Frequency Measurement; Radio Transmission; Signal Reflection

19980209953 Oak Ridge National Lab., TN USA

Coupled spin and charge collective excitations in a spin polarized electron gas

Marinescu, D. C., Oak Ridge National Lab., USA; Quinn, J. J., Tennessee Univ., USA; Yi, K. S., Pusan Univ., Korea, Republic of; Aug. 12, 1997; 7p; In English, 21-26 Sep. 1997, Tokyo, Japan

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-95305; CONF-9709161; DE98-001428; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The charge and longitudinal spin responses induced in a spin polarized quantum well by a weak electromagnetic field are investigated within the framework of the linear response theory. The authors evaluate the excitation frequencies for the intra- and inter-subband transitions of the collective charge and longitudinal spin density oscillations including many-body corrections beyond the random phase approximation through the spin dependent local field factors, G(sub (sigma))(sup (+-)) (q,(omega)). An equation-of-motion method was used to obtain these corrections in the limit of long wavelengths, and the results are given in terms of the equilibrium pair correlation function. The finite degree of spin polarization is shown to introduce coupling between the charge and spin density modes, in contrast with the result for an unpolarized system.
DOE
Electric Charge; Electromagnetic Fields; Electron Gas; Equations of Motion; Many Body Problem; Quantum Wells; Correlation

19980209959 Sandia National Labs., Albuquerque, NM USA
Final report for the robustness-agile Asynchronous Transfer Mode (ATM) encryption laboratory directed research and development project
Tarman, T. D., Sandia National Labs., USA; Hutchinson, R. L., Sandia National Labs., USA; Sholander, P. E., Sandia National Labs., USA; Nov. 1997; 45p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2902; DE98-001495; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

A Robustness-Agile Encryptor (RAE) provides confidentiality services for each Asynchronous Transfer Mode (ATM) virtual circuit at an arbitrary strength (or cryptographic robustness). This enhances ATM's flexibility, particularly in cases where political or policy constraints limit the choices for encryption algorithms. It may also reduce operational costs, since several users can share one RAE. However, this flexibility raises the concern that unauthorized personnel may use inappropriate algorithms (particularly the (open quotes)stronger(close quotes) algorithms). Hence, RAE requires strong use-control techniques (such as cryptographic authentication) in order to enforce each site's security policy. This report describes Sandia's implementation of a prototype RAE. It covers issues such as use-control, cryptographic synchronization, high-speed crypto-module design and RAE's effect on ATM Quality of Service (QoS).
DOE
Asynchronous Transfer Mode; Computer Information Security; Robustness (Mathematics); Control Systems Design; Algorithms

19980210210 Department of the Navy, Washington, DC USA
A Demodulation System and Method for Recovering a Signal of Interest from an Undersampled, Modulated Carrier
Assard, Gerald L., Inventor, Department of the Navy, USA; Blakely, Barry A., Inventor, Department of the Navy, USA; Deus, Antonio L, lll, Inventor, Department of the Navy, USA; Nov. 10, 1997; 20p; In English
Patent Info.: Filed 10 Nov. 1997; US-Patent-Appl-SN-967,741
Report No.(s): AD-D018869; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A demodulation system and method is used in a sensor system, such as a fiber optic sensor system, that senses optical signals and modulates a phase generated carrier having a carrier frequency Wc to form a modulated carrier. The modulated carrier is preferably undersampled at three times the carrier frequency (3Wc), thereby maximizing the sensors' demodulated bandwidth relative to the sensors' sampling frequency. The undersampled, modulated carrier is orthogonally demodulated by multiplying the undersampled, modulated carrier by cos(Wc(to)) and sin(Wc(to)) to extract even and odd harmonic components of the signal of interest. The even and odd harmonic components of the signal of interest are further demodulated by taking the square root of the sum of squares of the even and odd harmonic components, normalizing the even and odd harmonic components, and differentiating, cross-multiplying and differencing the normalized even and odd harmonic components to recover the signal of interest.
DTIC
Bandwidth; Sensory Perception; Optical Communication; Finite Difference Theory; Fiber Optics; Carrier Frequencies

19980210211 Department of the Navy, Washington, DC USA
System and Method for Recovering a Signal of Interest from a Phase Modulated Signal Using Quadrature Sampling
Assard, Gerald L., Inventor, Department of the Navy, USA; Deus, Antonio L., lll, Inventor, Department of the Navy, USA; Blakely, Barry A., Inventor, Department of the Navy, USA; Nov. 10, 1997; 28p; In English
Patent Info.: Filed 10 Nov. 1997; US-Patent-Appl-SN-967,740
Report No.(s): AD-D018866; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A digital receiver system is used to recover a signal of interest, such as a measurand signal, from a phase modulated signal detected from a system utilizing quadrature carriers, such as a fiber optic interferometer sensor system. The digital receiver system

includes a quadrature sampling demodulator that samples the phase modulated signal by using quadrature sampling periods to recover the odd and even components of the signal of interest. The digital receiver system can be used with an interferometer sensor system having an array of sensors that multiplex the measurand signals, e.g., using time or wavelength division multiplexing. Sampling with quadrature time samples provides a spacing in time between the samples that allows additional sensors to be multiplexed.
DTIC
Digital Systems; Interferometers; Time Division Multiplexing; Wavelength Division Multiplexing; Phase Modulation

19980210268 Argonne National Lab., IL USA
Why are PVM and MPI so different?
Gropp, W., Argonne National Lab., USA; Lusk, E., Argonne National Lab., USA; 1997; 9p; In English; 4th; European Pvm-mpi Users' Group Meeting, 3 - 5 Nov. 1997, Krakow, Poland
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/MCS-P-667-0697; CONF-971199; DE97-053744; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

PVM and MPI are often compared. These comparisons usually start with the unspoken assumption that PVM and MPI represent different solutions to the same problem. In this paper we show that, in fact, the two systems often are solving different problems. In cases where the problems do match but the solutions chosen by PVM and MPI are different, we explain the reasons for the differences. Usually such differences can be traced to explicit differences in the goals of the two systems, their origins, or the relationship between their specifications and their implementations.
DOE
Communication; Parallel Processing (Computers); Arrays; Comparators

19980210280 Sandia National Labs., Albuquerque, NM USA
Advanced 3D electromagnetic and particle-in-cell modeling on structured/unstructured hybrid grids
Seidel, D. B., Sandia National Labs., USA; Pasik, M. F., Sandia National Labs., USA; Kiefer, M. L., Sandia National Labs., USA; Riley, D. J., Sandia National Labs., USA; Turner, C. D., Sandia National Labs., USA; Jan. 1998; 49p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3190; DE98-002706; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

New techniques have been recently developed that allow unstructured, free meshes to be embedded into standard 3-dimensional, rectilinear, finite-difference time-domain grids. The resulting hybrid-grid modeling capability allows the higher resolution and fidelity of modeling afforded by free meshes to be combined with the simplicity and efficiency of rectilinear techniques. Integration of these new methods into the full-featured, general-purpose QUICKSILVER electromagnetic, Particle-In-Cell (PIC) code provides new modeling capability for a wide variety of electromagnetic and plasma physics problems. to completely exploit the integration of this technology into QUICKSILVER for applications requiring the self-consistent treatment of charged particles, this project has extended existing PIC methods for operation on these hybrid unstructured/rectilinear meshes. Several technical issues had to be addressed in order to accomplish this goal, including the location of particles on the unstructured mesh, adequate conservation of charge, and the proper handling of particles in the transition region between structured and unstructured portions of the hybrid grid.
DOE
Structured Grids (Mathematics); Charged Particles; Plasma Physics; Unstructured Grids (Mathematics)

19980210299 Department of the Navy, Washington, DC USA
Chirped Fiber Grating Beamformer for Phased Array Antennas Field of the Invention
Roman, Jose E., Inventor, Department of the Navy, USA; Frankel, Michael Y., Inventor, Department of the Navy, USA; Esman, Ronald D., Inventor, Department of the Navy, USA; Apr. 10, 1998; 23p; In English
Patent Info.: Filed 10 Apr. 1998; US-Patent-Appl-SN-058352
Report No.(s): AD-D018891; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A new fiber optic based beamforming architecture for a time steered phased array antenna based on chirped fiber gratings. All of the gratings are identical in length and period chirp so that they all have the same dispersion, thus at a given optical wavelength they have the same time delay. In a preferred embodiment an optical signal is modulated with an RF signal. The RF modulated optical is split and a portion propagates through a length of fiber to a photodetector feeding an antenna array. The second portion of the optical signal is routed through a circulator, which feeds the optical signal to a chirped fiber grating. The grating

reflects and delays the optical signal back to the circulator which routes the reflected optical signal to a second coupler. The amount of delay incurred is determined by the grating dispersion and the wavelength of the optical source. The second splits the time delayed optical signal, passing a portion of the time delayed optical signal to the second antenna element and the other portion to other circulators and ultimately to other antenna elements comprising the antenna array. The time delay imposed on the optical signal through the use of chirped fiber gratings controls the relative timing between the antenna elements, thus allowing one to steer the antenna by changing the wavelength of the optical signal.
DTIC
Chirp; Fiber Optics; Beamforming; Phased Arrays; Antenna Arrays; Antenna Components; Inventions; Time Signals; Time Lag; Gratings (Spectra)

19980210300 Department of the Navy, Washington, DC USA
Wavelet Transform of Super-Resolutions Based on Radar and Infrared Sensor Fusion
Szu, Harold, Inventor, Department of the Navy, USA; Garcia, Joseph, Inventor, Department of the Navy, USA; May 01, 1998; 42p; In English
Patent Info.: Filed 1 May 1998; US-Patent-Appl-SN-071737
Report No.(s): AD-D018889; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A method of enhancing resolution of an electromagnetic image comprising steps of inputting an infrared signal, inputting a radar signal, combining the infrared signal and the radar signal to produce an image and displaying the image.
DTIC
Wavelet Analysis; Infrared Detectors; Infrared Radar; Multisensor Fusion; Radar Detection

19980210389 Physics and Electronics Lab. TNO, The Hague, Netherlands
Bistatic Radar as a Concept for an Weapon Locating Radar ***Bistatische radar als concept voor een Wapen Locatie Radar***
Paquay, M. H. A., Physics and Electronics Lab. TNO, Netherlands; Oct. 1997; 19p; In Dutch
Contract(s)/Grant(s): A94KL783
Report No.(s): TNO-FEL-97-A214; TD97-0144; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., PO Box 96864, 2509 JG The Hague, The Netherlands); US Sales Only, Hardcopy, Microfiche
One of the candidate successors of the Artillery Locating Radar AN/TPQ-37 is based on the bistatic radar concept. One of the apparent advantages is the invulnerability for ARM's and ECM, Probably, state of the art components and processors are needed to realize this complex concept. This report looks into the principles of bistatic radar and the allied properties. In a system evaluation, attention has te be paid to the applied solutions for some basic technical problems.
Author
Radar; Locates System; Armed Forces

19980210391 Physics and Electronics Lab. TNO, The Hague, Netherlands
Fast Convolution Module
Bierens, L. H. J., Physics and Electronics Lab. TNO, Netherlands; Beukelman, P. C. R., Physics and Electronics Lab. TNO, Netherlands; vantWout, C., Physics and Electronics Lab. TNO, Netherlands; Oct. 1997; 67p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A93KLu777
Report No.(s): TNO-FEL-96-A307; TD96-0400; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., PO Box 96864, 2509 JG The Hague, The Netherlands); US Sales Only, Hardcopy, Microfiche
This report describes the design and realization of a real-time range/azimuth compression module, the so-called 'Fast Convolution Module', based on the fast convolution algorithm developed at TNO-FEL. The module will be part of a Real-Time SAR Processor for Air Force applications. Range and azimuth compression, as well as the Corner Turnina Memory, are the critical steps within the Synthetic Aperture Radar (SAR) processing chain. The result of this project, a tested hardware module, shows the feasibility of the technological concept of the 'Fast Convolution Module'. The module is tested in the Real-Time SAR Testbed environment, that has been developed at TNO-FEL. The realization of this module is an important step in the realization of a demonstrator Real-Time SAR Processor.
Author
Real Time Operation; Synthetic Aperture Radar; Signal Processing

19980210427 Bundesakademie fuer Wehrverwaltung und Wehrtechnik, Mannheim, Germany

Electromagnetic compatibility (EMC 97) ***Elektromagnetische Vertraeglichkeit (EMV 97)***

Busse, H., Editor, Bundesakademie fuer Wehrverwaltung und Wehrtechnik, Germany; May 12, 1997; 348p; In German; 7th; Military Engineering Symposium: Electromagnetic Compatibility (Emc), 12-14 May 1997, Mannheim, Germany

Report No.(s): ETDE-DE-582; CONF-9705198-Proc.; DE98-710985; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

This conference volume contains the lectures delivered at the symposium. Two lectures are of biomedical interest. The first one (effect of electromagnetic fields - communication and science) discusses the influence of electromagnetic fields on calcium transfer and the EEG. The manuscript of the second lecture is 'can persistent, weak electromagnetic fields cause disease?'.

DOE

Electromagnetic Fields; Calcium Compounds; Biological Effects; Electrophysiology; Radiation Effects

19980210657 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven, Germany

Two-Frequency Millimeter Wave SAR

Schimpf, H., Forschungsinstitut fuer Hochfrequenzphysik, Germany; Essen, H., Forschungsinstitut fuer Hochfrequenzphysik, Germany; Apr. 1998; 9p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

(NU) The FGAN-FHP MEMPHIS radar transmits simultaneously at 35 GHz and 94 GHz. Accordingly, when flown in a side-looking configuration, closely related SAR images can be generated for both frequencies. These two images can be combined for the purpose of target detection and discrimination. (NU) It is analyzed how this combination can be performed, and how one gains with respect to speckle reduction, target-to-background contrast, detection probability and false alarm rate. For this purpose, a subsequent feature based prescreener and a subsequent feature based discrimination stage. (NU) For multi-look images that are mapped to the ground it is found that the combination of two different frequencies with like polarization provides better speckle reduction and target-to-background enhancement than the combination of two orthogonal polarization channels at the same frequency. The detection/discrimination results depend on how precisely the two images are registered.

Author

Synthetic Aperture Radar; Target Acquisition; Radar Imagery; Millimeter Waves

19980210658 Ministry of Defence, Paris, France

Radar and Optronic Multiple Sensor System for Ground Attack ***Systeme Multi-Senseurs Radar et Optronique pour l'Attaque au Sol***

Mignot, E., Ministry of Defence, France; Mestre, J. P., Thomson-CSF Optronique, France; Levaillant, D., Thomson-CSF Optronique, France; Apr. 1998; 9p; In French; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The variety of recent conflicts in which allied forces participated has demonstrated the limitations of air-to-ground existing armament systems (strong constraints on use, armaments that are too specific, insufficient firing ranges with respect to ground-to-air defences, etc.). France, for this reason, has set the goal of developing a new kind of tactical armament, which would be complementary to SCALP type cruise missiles. This modular design weapon system, designated AASM (modular air-to-ground weapon), will have ranges greater than 15 km and should be capable of two categories of metric and decametric precision. Before firing the weapons, it is necessary to carry out certain number of operations such as detection, recognition and location determination of the targets to be processed.

Author

Weapon Systems; Radar Detection; Missile Defense; Missile Ranges

19980210661 North Atlantic Treaty Organization, Command, Control and Sensor Div., s'Gravenshage, Netherlands

Method of Evaluating Performance Level of a Multiple-Sensor Tracking Device ***Methode d'Evaluation des Performances d'Une Poursuite Multicapteur***

Desbois, M., North Atlantic Treaty Organization, Netherlands; Apr. 1998; 9p; In French; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The purpose of this presentation is to describe the methodology which has been developed for evaluation of multiple-sensor tracking within the C3 agency of NATO. This methodology originally was developed for the purpose of quantifying the performance requirements in terms that are applicable to establishment of the recognized air picture (RAP) within the framework of drafting specifications for the future command and control system of air operations (air command and control system, ACCS) of NATO. A certain number of performance measurements (MOPs) have thereby been defined. A process of segmentation of the

paths and trajectories of the followed targets is necessary as a prior condition to calculating one part of these measurements: description of this segmentation is also included in the developed methodology, just as the involvement of different filters which allow a targeted study of monitoring performance.
Author
Multisensor Applications; Command and Control; Remote Sensing; Remote Sensors; Image Analysis

19980210665 National Aerospace Lab., Emmeloord, Netherlands
ARTAS: Multisensor Tracking in an ATC Environment
Hogendoom, R. A., National Aerospace Lab., Netherlands; Neven, W. H. L., National Aerospace Lab., Netherlands; Apr. 1998; 8p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

ARTAS (an acronym for ATC Radar Tracker and Server) is currently in pre-operational test at four different sites in France, Germany and the Netherlands. The ARTAS system consists d a tracker, responsible for maintaining up-to-date target state vectors, and a server, which handles client subscriptions (e.g. from the ATC display system) and delivers the target state vectors to these clients. An ARTAS system co-operates with adjacent ARTAS systems by exchanging target state vector information. The main features of the ARTAS Tracker are; tracking with up to thirty radars (PR, SSR or CMB); on-line estimation of the radar systematic errors; online estimation of the radar accuracy and coverage; high-accuracy position and velocity-vector estimation; responsiveness to target maneuvers; insensitivity to clutter; and target classification. The tracking filters are interacting multiple-model (IMM)-based filters, a four-model filter for highs speed and highly maneuvering target and a two-model filter for low-speed targets. The plot-to- track association is based on probabilistic data association (PDA), with special joint probabilistic data association (JPDA) algorithms in case of target close approach situations. Track initiation is done by time-reversed multiple-hypothesis tracking. Target classification is based on Shafer-Dempster reasoning.
Author
On-Line Systems; Air Traffic Control; Display Devices

19980210666 Technical Univ. of Crete, Telecommunications Systems Inst., Athens, Greece
Low Altitude Wave Propagation Effects in a Transmitter Independent Receiver Network
Farsaris, Nikos J., Technical Univ. of Crete, Greece; Stavroulakis, Peter P., Technical Univ. of Crete, Greece; Apr. 1998; 5p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A01, Hardcopy; A04, Microfiche

For the design and implementation of a Passive Multistatic Early Warning and/or Fire Control Radar (T.I.R.N., Transmitter Independent Receiver Network) many aspects include the environmental conditions that T.I.R.N's may encounter at operational conditions. Even operating in a standard troposphere, the result of the refraction phenomenon is the curved propagation of the electromagnetic waves. The problem becomes more complicated at low altitudes, where tropospheric refractive index variability, multipath propagation and clutter (sea or ground) must be taken into consideration in order to avoid erroneous results for the location of a target as well as its velocity estimation. Although simplified models of the above environmental parameters are used in this analysis, (e.g. lateral refraction variability is not studied here, and Weibull Distributions Model is taken for granted as regards the sea clutter), useful results can be produced for the evaluation of multistatic systems. In this paper a four-receiver model using the signal of a non-cooperative transmitter is evaluated for its sensitivity at the above conditions and is compared with a conventional monostatic radar operating with the same signal. It is shown that the T.I.R.N. proposed is a more efficient system than its monostatic equivalent. The results presented, despite of being strictly theoretical (not yet evaluated in real operational conditions) may help the design of multistatic radars.
Author
Wave Propagation; Electromagnetic Radiation; Transmitter Receivers; Multipath Transmission

19980210668 Laboratoire d'Etude des Transmissions Ionospheriques, Orsay, France
Data Merging and Reliability of High Frequency Transmissions ***Fusion de Donnees et Fiabilite des Transmissions HF***
Goutelard, C., Laboratoire d'Etude des Transmissions Ionospheriques, France; Caratori, J., Laboratoire d'Etude des Transmissions Ionospheriques, France; Pautot, C., Laboratoire d'Etude des Transmissions Ionospheriques, France; Apr. 1998; 6p; In French; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

High frequency reliable radio communications in decametric band is currently based on procedure such as ALE (Automatic Link Establishment), RTCE (Real Time Channel Evaluation) ... which purpose is to test channel transmission capacity and interferences level. Establishment tests, made in real time, give interesting results by using long time experienced procedures with very good instantaneous reliabilities. Though, procedure can be improved with short time prevision of transmission channel characteristics and with interferences forecasting which are numerous in decametric band. Ionospheric forecasting methods allow to take into account ionospheric transmission characteristic. It is supposed that a very short time forecasting method (1 to 2 hours) or that

a short time method (24 to 48 hours) is implemented. Interference forecasting is of prime importance in prevision of good establishment of links. Electromagnetic spectrum observation in HF band shows that: u Correlation from a day to another of interferences levels are often strong; Spectral correlations are good until distance of about 400/500 km ; Interferences levels are dependent of observation azimuth; and Spectral occupancy is correlated with critical frequency FoF2. Taking into account these characteristics lead to consider the establishment of interferences level forecasting and the critical frequency of F2 layer. Jamming level characterization is introduced by considering the notion of clear frequency for a specified level. Frequency is supposed to be clear for a threshold S if the interferences level remains lower to this threshold. Clearness probability can be determined for each traffic band and we can plot surface of probability that a clear frequency one day remains clear the following days. These surfaces plotted as a function of the threshold and the forecast horizon are shown. Correlation between spectral occupancy and FoF2 frequency is also modelised. Comparison between FoF2 frequency determined by zenithal sounding with measurement of occupancy - mlF -has be proved very satisfying. A data fusion processing lead to a totally passive method of real time network management.
Author

Radio Communication; Multisensor Fusion; High Frequencies; Decametric Waves; Critical Frequencies; Channel Capacity

19980210669 Laboratoire d'Etude des Transmissions Ionospheriques, Orsay, France

Collation of Data and Extremely Low-Power Finder for Telecommunications ***Fusion de Donnees et Sondeur a Extrememment Faible Puissance pour Telecommunications***

Goutelard, C., Laboratoire d'Etude des Transmissions Ionospheriques, France; Pautot, C., Laboratoire d'Etude des Transmissions Ionospheriques, France; Apr. 1998; 6p; In French; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Radio communications in decametric band are made difficult by important variability of transmission channel and by level and density of interferences which congest this part of the radioelectric spectrum. Link establishment methods are currently based on a preliminary sounding of the channels and a scrutation of interference spectrum. This method is implemented by systems which works alternately with radio communication systems or use independent test system. The disadvantages of these methods lie in an uneasy uses and a often insufficient periodic actualisation of estimation. Implementation of system allowing to test channel with extremely low emitted power gives a new way very interesting to establish links and to keep them. Electromagnetic soundings of the ionosphere is limited by the problem of electromagnetic pollution they create, which limits their use, and by the high sensitivity of the interference included in the band. The emitted power reduction solves the first point, on condition that sensitivity to the jammers remains acceptable. This results is obtained for implementation of non linear signal processing which allows to choose the wave shape and coding by solving an optimisation problem without constraints. Results obtained allows to do soundings with very low power. We can notice the protection given by the new method. These news capacities allow a permanent ionospheric sounding, on all the frequencies. A data fusion can then be made taking into account available informations, especially ionospheric disturbances. This method can be applied in particular to the network management to improve their efficiency.
Author

Telecommunication; Decametric Waves; Ionospheric Disturbances; Ionospheric Sounding; Signal Processing

19980210670 Leeds Univ., Inst. of Integrated Information Systems, UK

HF Transmitter Location Using Super-Resolution DF and Ionospheric Sounding

Strangeways, Hal J., Leeds Univ., UK; Apr. 1998; 9p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A new method of SSL (Single Site Location) is presented which makes use of multi-sensor information. Also, unlike conventional SSL methods which generally ray-trace backwards using a single angle of incidence and azimuth, this method uses the incident angles of two or more simultaneous paths (e.g. 1 and 2 hop F2) to determine both an updated ionosphere model at the reflection point(s) and the location of the target transmitter. The angles of azimuth of arrival and elevation are determined using a super-resolution algorithm to decompose the multipath wavefield received on an antenna array. Analytic models are used to approximate the ionosphere and determine propagation paths. If vertical ionospheric sounder data is available, the obtained electron density profile can be fitted using quasi-parabolic segments (MQP model) and parameters of this model optimised in the minimisation procedure. A Nelder Mead simplex algorithm is used for the function minimisation. Greater accuracy in unknown transmitter location can be achieved by including additional constraints in the system such as measured elevation angles of known transmitters. The SSL determination is performed under MATLAB via a menu-driven graphical user interface. This employs pull-down menus for data input, program choice, ionospheric profile plotting and presentation of results.
Author

Transmitters; Multisensor Applications; Multipath Transmission; Ionospheric Sounding; Electron Density Profiles; Antenna Arrays

19980210671 Notre Dame Univ., Dept. of Electrical Engineering, IN USA

Smart Antenna Array Processing for Spread Spectrum Wireless Communication Systems

Huang, Y. F., Notre Dame Univ., USA; Kapoor, S., Notre Dame Univ., USA; Gollamudi, S., Notre Dame Univ., USA; Nagaraj, S., Notre Dame Univ., USA; Apr. 1998; 10p; In English; Also announced as 19980210650

Contract(s)/Grant(s): NSF MIP-97-05173; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper examines the problem of incorporating smart antennas in wireless DS-CDMA systems. The use of array signal processing in DS-CDMA systems offers the possibility of jointly utilizing code and spatial resources to achieve superior performance compared to conventional multiple-access methods. The development of interference suppression techniques is essential to take full advantage of the available radio resources and requires data fusion in the spatial and code domains. Spatial signal processing can also lead to faster and robust synchronization and provide the capability to rapidly adapt to channel fading, co-channel and adjacent channel interferers. The overall method is suitable for real-time implementation and can lead to a direct increase in the overall capacity, quality and coverage of these systems.

Author

Antenna Arrays; Telecommunication; Wireless Communication; Spread Spectrum Transmission

19980210672 Boston Univ., Center for Space Physics, Boston, MA USA

Propagation Diversity Constraints on Reception of GPS Signals at High and Equatorial Latitudes

Aarons, Jules, Boston Univ., USA; Lin, Bosheng, Boston Univ., USA; Apr. 1998; 10p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The coming of years of high solar flux, starting in 1999, will bring propagation problems to some users of GPS; we are concerned with ionospheric irregularities which produce phase and amplitude scintillation. The knowledge of when deteriorated signals will occur and their characteristics can help minimize their impact or at least allow users to understand that the fading phenomena are of natural origin rather than equipment related. At equatorial anomaly latitudes, fades of 20 dB at GPS frequencies have been observed in years of high solar flux; according to receiver experts these are enough to disturb any equipment. The sophistication of the equipment in moving through these signal problems is a function of hardware and complexity of software. Knowledge of diversity can help to minimize the effect of temporary loss of signal. The equatorial region irregularity structures are dominated by patches of irregularities which are frequently of the order of 100-200 km in their East West extent. At times these extensions may be exceeded. In addition their effective magnetic North South dimensions may be effective to a few thousand kilometers along the earth's magnetic field. If the altitude that the plume of irregularities reached at the magnetic equator is high, the effects reach the anomaly region with its high electron density and show strong scintillation intensities. New data on the variety of altitudes of irregularities at the equator puts limits on forecasting of some structures but hope for forecasting some major plumes. In the polar region severe problems are not expected to surface until 1999 since polar irregularities have been found to be a function of solar flux. In this area diversity of propagation paths can play an important role. The irregularity region at auroral latitudes is primarily affected by individual magnetic storms which can occur during any phase of the sunspot cycle. Irregularity intensity is a function of various parameters of the magnetic storm relative to that station. Illustrations of GPS phase fluctuations will be shown as individual storms develop. New data clearly show the forecasting possibilities when using timing of the auroral oval occurrence at a sit as a means of prediction. L Band is to be used in the downlink of new systems proposed and being initiated for personal communications. Low link margins are forecast for several systems to be in the range 6 to 10 dB. These levels indicate that fading due to the ionospheric irregularities such as discussed in these GPS studies will cause problems.

Author

Auroral Zones; Computer Programs; Electron Density (Concentration); Sunspot Cycle; Polar Regions; Magnetic Equator; Magnetic Storms; Solar Flux; Ionospheric Disturbances

19980210673 Naval Air Warfare Center, Geophysics Branch, Point Mugo, CA USA

Meteorological Data Fusion to Assess EM/EO Propagation Conditions in Coastal Environments

Rosenthal, J., Naval Air Warfare Center, USA; Helvey, R., Naval Air Warfare Center, USA; Greiman, P., Naval Air Warfare Center, USA; McGovern, M., Naval Air Warfare Center, USA; Apr. 1998; 7p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

EM/EO propagation conditions can be estimated along specific routes or regions of interest by fusing on one display, the visible satellite imagery showing cloud cover, the operational geometry, and derived quantities such as duct height estimated from the IR duct technique. In addition, by compositing conditions over a set of similar synoptic events, and when also fused with averaged synoptic field gridded data, an average depiction of duct height and associated variability can be obtained. to the extent the cases selected are typical of that type of event, the averaged picture can be used to forecast or estimate the distribution of EM/EO

parameters in the near future if confidence exists in the forecast synoptic situation. Additional compositing is underway to broaden the range of synoptic weather types and regions examined.
Author
Meteorological Parameters; Satellite Imagery; Weather; Forecasting; Cloud Cover

19980210681 British Aerospace Public Ltd. Co., Advanced Information Processing Dept., Filton, UK
Communications Management in Battlespace Data Fusion
Deaves, R. H., British Aerospace Public Ltd. Co., UK; Nicholson, D., British Aerospace Public Ltd. Co., UK; Greenway, P., British Aerospace Public Ltd. Co., UK; Vangasse, P., British Aerospace Public Ltd. Co., UK; Apr. 1998; 9p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Algorithms for managing bandwidth-limited communications links in a multiplatform and multi-target battlespace data fusion scenario are investigated. The platform architecture is modelled on a fully connected decentralised system based on a simplified tactical air warfare scenario. Information on filters on each platform maintain track estimates for each target. These are transmitted around the system in accord with a time-division- multiple-access communications protocal based on JTIDS. Here we address a practical limitations on the communications bandwidth: it unable to support the full set of state information for all of the targets each communications cycle. Strategies must therefore be found to manage the bandwidth. In this paper we consider two different communications management algorithms: (i) a somewhat ad hoc cyclic, or round- robin, algorithm, and (ii) more principled information theoretic algorithm. In general we find that the system has better tracking performance under the information theoretic algorithm than it does for the round-robin algorithm. This result appears to be fairly robust to uncertainties in a transmitting platform's prediction of the state estimates that are currently being maintained at the recipient platforms. In practice since the information theoretic algorithm is more computationally costly to implement than the round-robin algorithm the decision of whether or not to employ intelligent communications management is likely to depend upon the severity of the bandwidth constraint, the number and type of tracked targets,and the predictive power of a platform with regard to other platforms in the network.
Author
Multisensor Fusion; Warfare; Information Theory

19980210727 Fermi National Accelerator Lab., Batavia, IL USA
Effect of hybrid photodiode signal increase in magnetic field parallel to the HPD electric field
Freeman, J., Fermi National Accelerator Lab., USA; Green, D., Fermi National Accelerator Lab., USA; Ronzhin, A., Fermi National Accelerator Lab., USA; Jan. 1998; 15p; In English
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL-TM-2039; DE98-052272; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The 7-pixel Hearing Protection Devices (HPD) was studied in a 5 Tesla magnet. Several percents of the HPD signal increased when the magnetic field was parallel or almost parallel to the HPD electric field.
DOE
Electric Fields; Magnetic Fields; Photodiodes

19980210749 Fermi National Accelerator Lab., Batavia, IL USA
Magnetic fields from the electroweak phase transition
Tornkvist, O., Fermi National Accelerator Lab., USA; Feb. 1998; 7p; In English; International Workshop on Particle Physics and the Early Universe (Cosmo-97), 15 - 19 Sep. 1997, Ambleside, UK
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/018-A; CONF-9709172; DE98-052005; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

I review some of the mechanisms through which primordial magnetic fields may be created in the electroweak phase transition. I show that no magnetic fields are produced initially from two-bubble collisions in a first-order transition. The initial field produced in a three-bubble collision is computed. The evolution of fields at later times is discussed.
DOE
Bubbles; Collisions; Magnetic Fields

19980210833 Fraunhofer-Inst. fuer Solare Energiesysteme, Freiburg, Germany

Investigation of the electromagnetic properties of solar generators in grid-coupled photovoltaic power systems *Final Report Untersuchung der elektromagnetischen Eigenschaften des Solargenerators in netzgekoppelten photovoltaischen Stromversorgungsanlagen. Abschlussbericht*

Erge, T., Fraunhofer-Inst. fuer Solare Energiesysteme, Germany; Bohnenstengel, J., Fraunhofer-Inst. fuer Solare Energiesysteme, Germany; Bopp, G., Fraunhofer-Inst. fuer Solare Energiesysteme, Germany; Dornburg, H., Fraunhofer-Inst. fuer Solare Energiesysteme, Germany; Reimelt, R., Fraunhofer-Inst. fuer Solare Energiesysteme, Germany; Roessler, E., Fraunhofer-Inst. fuer Solare Energiesysteme, Germany; Schaetzle, R., Fraunhofer-Inst. fuer Solare Energiesysteme, Germany; Wimmer, D., Fraunhofer-Inst. fuer Solare Energiesysteme, Germany; Wittek, I., Fraunhofer-Inst. fuer Solare Energiesysteme, Germany; [1997]; 151p; In German

Contract(s)/Grant(s): Foerderkennzeichen BMBF 032960

Report No.(s): ETDE-DE-653; DE98-743580; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

This BMBF-sponsored project, which was carried out from August 1994 to April 1997, has achieved its goal of characterizing the electromagnetic properties of solar generators of grid-coupled photovoltaic power systems. The focus of the study was on systems and components that are typically used in the household sector (range of power output 1-10 kW(sub p)), and which have become widely distributed, especially also among private house-owners and builders, not lastly by the 1000-roofs photovoltaics programme. As far as time permitted within the framework of this project, current trends in inverter technology (string-type inverters and modular inverters) were also taken into account.- The main conclusion from the project is as follows: Photovoltaic plants are principally capable of generating higher-frequency electromagnetic disturbances (both in line-transmitted and radiated form). Moreover, given certain boundary conditions, these disturbances may be emitted to the environment both via the AC side and via the DC side/solar generator.

DOE

Electromagnetic Properties; Solar Generators; Photovoltaic Conversion; Electromagnetic Fields

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry. For related information see also 60 Computer Operations and Hardware and 76 Solid-State Physics.

19980206482 Allied-Signal Aerospace Co., Kansas City Div., Kansas City, MO USA

Advanced Electro-Optic Surety Devices

Watterson, C. E., Allied-Signal Aerospace Co., USA; May 1997; 56p; In English

Contract(s)/Grant(s): DE-AC04-76DP-00613

Report No.(s): KCP-613-5369; DE97-053281; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Advanced Electro-Optic Surety Devices project was initiated in march 1991 to support design laboratory guidance on electro-optic device packaging and evaluation. Sandia National Laboratory requested AlliedSignal Inc., Kansas City Division (KCD), to prepare for future packaging efforts in electro-optic integrated circuits. Los Alamos National Laboratory requested the evaluation of electro-optic waveguide devices for nuclear surety applications. New packaging techniques involving multiple fiber optic alignment and attachment, binary lens array development, silicon V-groove etching, and flip chip bonding were requested. Hermetic sealing of the electro-optic hybrid and submicron alignment of optical components present new challenges to be resolved. A 10-channel electro-optic modulator and laser amplifier were evaluated for potential surety applications.

DOE

Electro-Optics; Optical Equipment; Optoelectronic Devices; Integrated Circuits; Fiber Optics

19980206489 Sandia National Labs., Albuquerque, NM USA

Today's thermal imaging systems: Background and applications for civilian law enforcement and military force protection

Bisbee, T. L., Sandia National Labs., USA; Pritchard, D. A., Sandia National Labs., USA; 1997; 8p; In English; 1997 International Carnahan Conference on Security Technology, 15 - 17 Oct. 1997, Canberra, Australia; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1104C; CONF-971091; DE98-000208; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Thermal (infrared) imagers can solve many security assessment problems associated with the protection of high-value assets at military bases, secure installations, or commercial facilities. Thermal imagers can provide surveillance video from security areas or perimeters both day and night without expensive security lighting. In the past, thermal imagers required cryogenic cooling to operate. The high cost and maintenance requirements restricted their use. However, recent developments in reliable, linear drive cryogenic coolers and uncooled infrared imagers have dramatically reduced system cost. These technology developments are resulting in greater accessibility and practicality for military as well as civilian security and force protection applications. This paper discusses recent advances in thermal imaging technology including uncooled and cryo-cooled. Applications of Forward Looking InfraRed (FLIR) systems are also discussed, including integration with a high-speed pan/tilt mount and remote control, video frame storage and recall, low-cost vehicle-mounted systems, and hand-held devices. Other facility installation topics will be discussed, such as site layout, assessment ranges, imager positioning, fields-of-view, sensor and alarm reporting systems, and communications links.

DOE

Communication Networks; Cryogenic Cooling; Infrared Instruments; Infrared Radiation; Remote Control; Thermal Mapping; Warning Systems; FLIR Detectors

19980206490 Los Alamos National Lab., NM USA

Silicon photodiode soft x-ray detectors for pulsed power experiments

Idzorek, G. C., Los Alamos National Lab., USA; Bartlett, R. J., Los Alamos National Lab., USA; 1997; 8p; In English; 11th; Pulsed Power Conference, 29 Jun. - 2 Jul. 1997, Baltimore, MD, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2283; CONF-9706113; DE98-000249; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Silicon photodiodes offer a number of advantages over conventional photocathode type soft x-ray detectors in pulsed power experiments. These include a nominally flat response, insensitivity to surface contamination, low voltage biasing requirements, sensitivity to low energy photons, excellent detector to detector response reproducibility, and ability to operate in poor vacuum or gas backfilled experiments. Silicon photodiodes available from International Radiation Detectors (IRD), Torrance, California have been characterized for absolute photon response from 1 eV to 10 keV photon energy, time response, and signal saturation levels. The authors calibration measurements show factor of ten deviations from the silicon photodiode theoretical flat response due to diode sensitivity outside the center 'sensitive area'. Detector response reproducibility between diodes appears to be better than 5%. Time response measurements show a 10-90% rise time of about 0.1 nanoseconds and a fall time of about 0.5 nanoseconds.

DOE

Contamination; Photocathodes; Radiation Detectors; X Ray Detectors; Photodiodes

19980206540 Sandia National Labs., Albuquerque, NM USA

Blocking diodes and fuses in low-voltage PV systems

Wiles, J. C., New Mexico State Univ., USA; King, D. L., Sandia National Labs., USA; [1997]; 5p; In English; 26th; Photovoltaic Specialists Conference, 29 Sep. - 3 Oct. 1997, Anaheim, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1071C; CONF-970953-; DE98-001181; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Instructions and labels supplied with listed PV modules and the requirements of the National Electrical Code (NEC) dictate that a series fuse shall be used to protect the module against backfeed currents. Few of the hundreds of thousands of low-voltage (12, 24, and 48-volt) stand-alone photovoltaic (PV) power systems use series fuses on each module or string of modules. Tests and simulations at the Southwest Technology Development Institute (TDI) and at Sandia National Laboratories (SNL) have established that the absence of these fuses can pose significant fire and safety hazards even on 12-volt PV systems. If the system has sufficient backfeed voltage and current, it is possible that a ground fault in the wiring or inside a module can result in the destruction of a PV module.

DOE

Blocking; Diodes; Low Voltage; Electric Fuses; Electric Control; Photovoltaic Cells; Semiconductor Diodes; Solar Cells; Arrays

19980206622 Connecticut Univ., Storrs, CT USA

Grating-Assisted All-Optical Switching in CdSSe-Doped Nonlinear Fiber ***Final Report, Jul. 1996 - Jun. 1997***

Donkor, Eric, Connecticut Univ., USA; Mar. 1998; 22p; In English

Contract(s)/Grant(s): F30602-96-2-0256; AF Proj. 2300

Report No.(s): AD-A341566; RL-TR-97-243; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three experiments were performed during this effort. The first experiment measured the pump induced wavelength shift of a 1550 nm probe signal in a 100 cm CdSSe doped fiber. This initial experiment provided the necessary data which formed the basis for the design of a new all-optical switch. The second experiment was the fabrication of the all-optical switch. The operation of the switch was based upon the pump induced wavelength shift of a probe signal. The presumption that such a switch could be designed to be more stable and have higher contract ratios than a Mach-Zehnder switch or 'loop mirror' all-optical switches was demonstrated. in the process of conducting this work, a design configuration for a three-terminal optical gate was developed. The best on-off switching time was 70 Ps. The third experiment determined the transfer characteristics of the optical gate. The transfer characteristics exhibited similar current-voltage characteristics to an electronic transistor; a basic building block for designing all-optical logic gates.

DTIC

Optical Switching; Nonlinearity; Doped Crystals; Fabrication; Switches

19980206718 Sandia National Labs., Albuquerque, NM USA

Validating theoretical calculations of thermomechanical stress and deformation using the ATC4.1 flip-chip test vehicle

Peterson, D. W., Sandia National Labs., USA; Sweet, J. N., Sandia National Labs., USA; Burchett, S. N., Sandia National Labs., USA; [1997]; 13p; In English; 7th; Annual Surface Mount International Conference, 7 - 11 Sep. 1997, San Jose, CA, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1969C; CONF-970977-2; DE97-008360; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Two closed form analytical solutions for tri-material thermomechanical stress and deformation, along with one-quarter section finite element model (FEM), were validated using an in-situ CMOS piezoresistive stress measurement test chip that has been repatterned into a fine pitch area array flip-chip. A special printed circuit board substrate for the test chip was designed at Sandia and fabricated by the Hadco Corp. The flip-chip solder attach (FCA) and underfill was performed by a SEMATECH member company. The measured incremental stresses produced by the underfill are reported and discussed for two underfill materials used in this experiment. Detailed comparisons between theory and experiment are presented and discussed.

DOE

Finite Element Method; Thermodynamics; Stress Measurement; Printed Circuits; Circuit Boards

19980206732 Argonne National Lab., IL USA

Coated-wire-in-tube processing of bismuth-2223 superconductors

Dorris, S. E., Argonne National Lab., USA; Ashcom, N., Argonne National Lab., USA; Truchan, T., Argonne National Lab., USA; Vasanthamohan, N., Argonne National Lab., USA; Burlone, D.A., BASF Corp., USA; Woolf, L. D., General Atomics Co., USA; May 1997; 10p; In English; 99th, 4 - 7 May 1997, Cincinnati, OH, USA; Sponsored by American Ceramic Society, USA

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/ET/CP-91790A; CONF-970568-13; DE97-053873; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A coated-wire-in-tube (CWIT) process greatly increases the silver/superconductor interface area in silver-sheathed Bi-2223 superconductors. When the performance of CWIT samples is compared to that of conventional monofilaments made with the same powder, critical current density increases significantly with increased silver/superconductor interface area. Benefits of increasing the silver/superconductor interface area are realized only when there is good continuity of the coated wires, and this requires a mechanical deformation sequence to preserve good continuity of the wires.

DOE

Superconductors (Materials); Coatings; Bismuth; Current Density

19980206744 Argonne National Lab., IL USA

MOCVD capacitors

Lanagan, M. T., Argonne National Lab., USA; Foster, C., Argonne National Lab., USA; Sep. 1997; 8p; In English; Annual Automotive Technology Development Customers' Coordination Meeting, 27 - 30 Oct. 1997, Dearborn, MI, USA

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/ET/CP-94589; CONF-971089; DE98-000643; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A significant effort within the Department of Energy's Office of Transportation Technologies and the US Navy's Power Electronic Building Block (PEBB) project has focused on reducing the size and weight of power electronic devices for electric and hybrid vehicles. Power electronic circuits, which are composed of active switching elements and passive components such as capacitors and inductors, provide motor control, power distribution, and DC/AC conversion functions in electric vehicles. Progress has been made on reducing the size and weight of power electronic components such as MOS-controlled thrustors and insulated-gate bipolar transistors. Additional effort on high-power capacitors will be needed for load leveling and filter functions. The objective of this work is to fabricate a new class of high-power capacitors with reduced size and weight. Capacitors will be integrated with semiconductor components of electric motor and actuator control subsystems.

DOE

Capacitors; Weight Reduction; Electric Motors; Fabrication

19980206759 Naval Postgraduate School, Monterey, CA USA

Design of an 8 x 8 Non-Blocking Crosspoint Switch in GaAs Two-Phase Dynamic FET Logic

Bates, David R., Naval Postgraduate School, USA; Dec. 1997; 92p; In English

Report No.(s): AD-A346010; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Computer resources on military and telecommunications satellites are being over-tasked more than ever before, and the increasing shift to onboard signal processing will only compound the problem in the future. Space-based multiprocessor computer systems linked by high speed interconnect networks offer one possible solution to this ever expanding problem. Gallium arsenide (GaAs) integrated circuits using metal-semiconductor field effect transistors (MESFETs) offer very high speed operation, reduced power consumption, and inherent radiation tolerance, which make them ideally suited to the harsh space environment. The design, simulation and layout of an 8 x 8 non-blocking crosspoint switch implemented in GaAs two-phase dynamic FET logic (TDFL) is presented in this thesis. The design of the TDFL crosspoint switch given here is a modification of a crosspoint switch design that uses GaAs direct-coupled FET logic (DCFL). Design specifics of working with GaAs are presented first, followed by detailed descriptions of the DCFL and TDFL crosspoint switches, and finally, an analysis of the advantages and disadvantages of dynamic logic over static logic is presented. The TDFL crosspoint switch presented here could easily be modified to serve as a one gigabit per second serial interconnect for future space-based multiprocessor computer systems.

DTIC

Switches; Signal Processing; Gallium Arsenides; Computers; Field Effect Transistors; Telecommunication; Onboard Data Processing

19980209686 Department of the Navy, Washington, DC USA

Doppler Video Signal Conditioning Circuit

Cirineo, Anthony, Inventor, Department of the Navy, USA; Dec. 16, 1997; 24p; In English

Patent Info.: Filed 28 May 1996; US-Patent-5,699,068; US-Patent-Appl-SN-668,455

Report No.(s): AD-D018846; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A doppler video signal conditioning circuit comprising first, second and third buffers which respectively receive a voltage controlled oscillator signal a second intermediate frequency signal and a second local oscillator signal from a missile's radar receiver. The buffered voltage controlled oscillator, second intermediate frequency and second local oscillator signals are then supplied to a doppler processing circuit. The doppler processing circuit processes these signals, providing at its output a reconstructed doppler video signal which includes a marker which is 20 kHz above the frequency the missile's radar is tracking. The doppler processing circuit provides the reconstructed doppler video signal to an analog-to-digital converter. The analog-to-digital converter digitizes the reconstructed doppler video signal before supplying the digitized signal to a frame controller. The frame controller assembles the digital data of the reconstructed doppler video signal into a plurality of telemetry frames with each frame having 1024 eight bit words. The eight bit words of each telemetry frame are then supplied to a parallel to serial shift register which converts each word from a parallel format to a serial format. The frame controller also generates timing signals and control signals for the analog-to-digital converter and the serial to parallel shift register.

DTIC

Analog to Digital Converters; Intermediate Frequencies; Voltage Controlled Oscillators; Video Signals; Signal Processing; Radar Receivers; Digital Data

19980209726 Joint Publications Research Service, Arlington, VA USA

JPRS Report Science and Technology Europe and Latin America

Sep. 11, 1997; 95p; In English

Report No.(s): AD-A345845; JPRS-ELS-87-048; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report on Europe and Latin America contains articles on Advanced Materials, Aerospace, Civil Aviation, Biotechnology, Computers, Microelectronics, Science and Technology, Lasers, Sensors, Optics and Science and Technology Policy.

DTIC

Computer Programs; Microelectronics; Research and Development; Technologies; Biotechnology; Aerospace Environments

19980209808 National Inst. of Standards and Technology, Electricity Div., Gaithersburg, MD USA

NIST Measurement Services: NIST Calibration Service for Capacitance Standards at Low Frequencies

Chang, Y. M., National Inst. of Standards and Technology, USA; Tillett, S. B., National Inst. of Standards and Technology, USA; Apr. 1998; 92p; In English

Report No.(s): PB98-144587; NIST/SP-250/47; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document describes the capacitance calibration service provided by NIST, including measurement procedures and systems used to calibrate capacitance standards of nominal values in the range of 0.001 pF to 1 microFarad, at frequencies up to 10 kHz. Discussed are the process to transfer the unit of capacitance from the NIST capacitance primary laboratory, which maintains the U.S. representation of the farad, realized by the calculable capacitor, and the quality controls of reference standards and check standards in the calibration laboratory. Also included are summaries of calibration uncertainties of capactors of various dielectric materials, such as fused-silica, nitrogen, air, and mica.

NTIS

Calibrating; Capacitance; Capacitors

19980209826 Department of the Navy, Washington, DC USA

Rosette-Shaped Monopole Antenna Top-Load for Increased Antenna Voltage and Power Capability

Hansen, Peder M., Inventor, Department of the Navy, USA; Sep. 30, 1997; 17p; In English

Patent Info.: Filed 21 Apr. 1994; US-Patent-5,673,055; US-Patent-Appl-SN-232784

Report No.(s): AD-D018837; No Copyright; Avail: US Patent and Trademark Office, Microfiche

In an umbrella top-loaded monopole (UTLM) antenna, the charge distribution on top-load radials increases approximately linearly from the top of the antenna because the activated wires are separating from the tower and each other at the same time they are getting closer to ground. The UTLM antenna of the invention incorporates a top-load configuration in which top-load elements, whether they be radiating or receiving, are arranged in the shape of frames that originate at the top of the antenna and that extend away from the antenna towards the antenna's base where, at those points of the configuration furthest from the antenna tower and closest to ground at least two top-load elements converge to shield each other and hence reduce charge density. The top-load frames may be arranged contiguously such as in a rosette configuration. The self-shielding effect of the invention permits an antenna to operate at considerably higher voltage. This top-load configuration can also show superior effective height and static capacitance as compared to the traditional UTLM antenna. Because of the efficiency offered by the invention, intrinsic bandwidth and radiated power can be superior to the typical UTLM antenna even with the same top-load voltage limit. Such results can be achieved with half of the traditional number of top-load high voltage insulators. This new top-load configuration also facilitates top-load element deicing.

DTIC

Antenna Components; Monopole Antennas; Capacitance; Loads (Forces)

19980209837 Sandia National Labs., Albuquerque, NM USA

W88 integrated circuit shelf life program

Soden, J. M., Sandia National Labs., USA; Anderson, R. E., Sandia National Labs., USA; Jan. 1998; 27p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-98-0029; DE98-002696; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The W88 Integrated Circuit Shelf Life Program was created to monitor the long term performance, reliability characteristics, and technological status of representative WR ICs manufactured by the Allied Signal Albuquerque Microelectronics Operation (AMO) and by Harris Semiconductor Custom Integrated Circuits Division. Six types of ICs were used. A total of 272 ICs entered two storage temperature environments. Electrical testing and destructive physical analysis were completed in 1995. During each year of the program, the ICs were electrically tested and samples were selected for destructive physical analysis (DPA). ICs that

failed electrical tests or DPA criteria were analyzed. Fifteen electrical failures occurred, with two dominant failure modes: electrical overstress (EOS) damage involving the production test programs and electrostatic discharge (ESD) damage during analysis. Because of the extensive handling required during multi-year programs like this, it is not unusual for EOS and ESD failures to occur even though handling and testing precautions are taken. The clustering of the electrical test failures in a small subset of the test operations supports the conclusion that the test operation itself was responsible for many of the failures and is suspected to be responsible for the others. Analysis of the electrical data for the good ICs found no significant degradation trends caused by the storage environments. Forty-six ICs were selected for DPA with findings primarily in two areas: wire bonding and die processing. The wire bonding and die processing findings are not surprising since these technology conditions had been documented during manufacturing and were determined to present acceptable risk. The current reliability assessment of the W88 stockpile assemblies employing these and related ICs is reinforced by the results of this shelf life program. Data from this program will aid future investigation of 4/3 micron or MNOS IC technology failure modes.
DOE
Service Life; Application Specific Integrated Circuits

19980209871 Istituto Nazionale di Fisica Nucleare, Lab. Nazionale di Frascati, Frascati, Italy
New kinds of electrolytic regimes and geometrical configurations to obtain anomalous results in Pd(M)-D systems
Celani, F., Istituto Nazionale di Fisica Nucleare, Italy; Spallone, A., Istituto Nazionale di Fisica Nucleare, Italy; DiGioacchino, D., Istituto Nazionale di Fisica Nucleare, Italy; Pace, S., Istituto Nazionale di Fisica Nucleare, Italy; Tripodi, P., Istituto Nazionale di Fisica Nucleare, Italy; Marini, P., Euresis, Italy; DiStefano, V., Euresis, Italy; Mancini, A., Orim s.r.l., Italy; Feb. 1997; 12p; In English
Report No.(s): INFN-P-LNF-97-008; DE98-712145; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

Electrolysis of long and thin Pd (and PdY alloy) wires, in dilute solutions of LiOD-D2O and LiOH-H2O at large operating voltages, were made. An innovative kind of geometrical set-up to improve the efficiency of electromigration effect in proton conductors was developed: the usual ''single, ended'' geometry at the most cathodic point of the wire changed to the ''central wire''-geometry. The detected excess heat seems to be related to: (H/D) isotopic effect, lattice characteristics, geometrical set-up, dynamic variation of concentration inside Pd wire, anode cathode and inter-cathodic voltages.
DOE
Electrolysis; Electric Potential; Electromigration; Configurations; Electric Wire

19980209872 Istituto Nazionale di Fisica Nucleare, Lab. Nazionale di Frascati, Frascati, Italy
Observations of strong resistivity reduction in a palladium thin long wire using ultra-high frequency pulsed electrolysis at D/Pd greater than 1
Celani, F., Istituto Nazionale di Fisica Nucleare, Italy; Spallone, A., Istituto Nazionale di Fisica Nucleare, Italy; Tripodi, P., Istituto Nazionale di Fisica Nucleare, Italy; DiGioacchino, D., Istituto Nazionale di Fisica Nucleare, Italy; Marini, P., Euresis, Italy; Mancini, A., Orim s.r.l., Italy; Feb. 1997; 7p; In English
Report No.(s): INFN-P-LNF-97-009; DE98-712144; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

They performed ultra-short width high voltage pulse electrolysis using a thin Pd wire cathode; a diluted electrolytic solution of D2O+LiOD was used in a peculiar wire-turned electrodes geometry. The deuterated Pd loading was evaluated by the D/Pd normalised electric resistance curve (R/Ro). After a long time of electrolysis a very high D/Pd loading (1 : 1 or more) was reached. Very low R/Ro less than 0.1 Pd wire was measured after switching off the electrolysis and this effect lasted for several minutes. The Deuterium deloading occurred in several typologies (fast and slow terms) showed as a resistance transition on the Pd wire. This effect can be related to a peculiar surface structural condition.
DOE
Electrolysis; High Voltages; Electrical Resistance; Electrical Resistivity; Cathodes

19980209935 Department of the Navy, Washington, DC USA
Optical RF Bandpass Filter and Method for Manufacturing Same
Kasa, Shannon D., Inventor, Department of the Navy, USA; Shimabukuro, Randy L., Inventor, Department of the Navy, USA; Dubbelday, Wadad B., Inventor, Department of the Navy, USA; Gookin, Debra M., Inventor, Department of the Navy, USA; Nov. 11, 1997; 10p; In English
Patent Info.: Filed 2 Oct. 1995; US-Patent-5,687,263; US-Patent-Appl-SN-537373
Report No.(s): AD-D018836; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method for manufacturing an optical RF bandpass filter comprises the steps of: (1) mounting an optical fiber having first and second ends in a fiber support structure having first and second surfaces so that the first end is exposed at the first surface and the second end is exposed at the second surface; (2) forming a first layered mirror structure on a first substrate to create a first mirror wafer structure having a first reflective surface; (3) forming a second layered mirror structure on a second substrate to create a second mirror wafer structure having a second reflective surface; (4) affixing the first reflective surface of the first mirror wafer structure to the first surface of the fiber support structure; and (5) affixing the second reflective surface of the second mirror wafer structure to the second surface of the fiber support structure.
DTIC
Bandpass Filters; Optical Filters; Manufacturing; Procedures; Optical Fibers

19980209964 Sandia National Labs., Albuquerque, NM USA
Using heavy ion backscattering spectrometry (HIBS) to solve integrated circuit manufacturing problems
Banks, J. C., Sandia National Labs., USA; Doyle, B. L., Sandia National Labs., USA; Knapp, J. A., Sandia National Labs., USA; Werho, D., Motorola, Inc., USA; Gregory, R.B., Motorola, Inc., USA; Anthony, M., Texas Instruments, Inc., USA; Hurd, T. Q., Texas Instruments, Inc., USA; Diebold, A. C., SEMATECH, USA; [1997]; 16p; In English; International Conference on Ion Beam Analysis, 27 Jul. - 1 Aug. 1997, Lisbon, Portugal
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3114C; CONF-970785; DE98-001699; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Heavy Ion Backscattering Spectrometry (HIBS) is a new IBA tool for measuring extremely low levels of surface contamination on very pure substrates, such as Si wafers used in the manufacture of integrated circuits. HIBS derives its high sensitivity through the use of moderately low energy ((approximately) 100 keV) heavy ions (e.g., C(sup 12)) to boost the RBS cross-section to levels approaching 1,000 barns, and by using specially designed time-of-flight detectors which have been optimized to provide a large scattering solid angle with minimal kinematic broadening. A HIBS User Facility has been created which provides US industry, national laboratories, and universities with a place for conducting ultra-trace level surface contamination studies. A review of the HIBS technique is given and examples of using the facility to calibrate Total-Reflection X-ray Fluorescence Spectroscopy (TXRF) instruments and develop wafer cleaning processes are discussed.
DOE
Backscattering; Integrated Circuits; X Ray Fluorescence; Heavy Ions; Contamination

19980209968 Sandia National Labs., Albuquerque, NM USA
Application specific Tester-On-a-Resident-Chip (TORCH(trademark)): Innovation in the area of semiconductor testing
Bowles, M., L and M Technologies, Inc., USA; Peterson, T., New Mexico Highlands Univ., USA; Savignon, D., Sandia National Labs., USA; Campbell, D., Sandia National Labs., USA; Dec. 1997; 70p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2946; DE98-001735; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Manufacturers widely recognize testing as a major factor in the cost, producability, and delivery of product in the $100 billion integrated circuit business: (open quotes)The rapid development of VLSI using sub-micron CMOS technology has suddenly exposed traditional test techniques as a major cost factor that could restrict the development of VLSI devices exceeding 512 pins an operating frequencies above 200 MHz.(close quotes) -- 1994 Semiconductor Industry Association Roadmap, Design and Test, Summary, pg. 43. This problem increases dramatically for stockpile electronics, where small production quantities make it difficult to amortize the cost of increasingly expensive testers. Application of multiple ICs in Multi-Chip Modules (MCM) greatly multiplies testing problems for commercial and defense users alike. By traditional test methods, each new design requires custom test hardware and software and often dedicated testing equipment costing millions of dollars. Also, physical properties of traditional test systems often dedicated testing equipment costing millions of dollars. Also, physical properties of traditional test systems limit capabilities in testing at-speed (>200 MHz), high-impedance, and high-accuracy analog signals. This project proposed a revolutionary approach to these problems: replace the multi-million dollar external test system with an inexpensive test system integrated onto the product wafer. Such a methodology enables testing functions otherwise unachievable by conventional means, particularly in the areas of high-frequency, at-speed testing, high impedance analog circuits, and known good die assessment. The techniques apply specifically to low volume applications, typical of Defense Programs, where testing costs represent an unusually high proportional of product costs, not easily amortized.
DOE
CMOS; Computer Programs; Integrated Circuits; Semiconductors (Materials); Very Large Scale Integration; Analog Circuits

19980210018 Oak Ridge National Lab., TN USA

TGV32: A 32-channel preamplifier chip for the multiplicity vertex detector at PHENIX

Britton, C. L., Jr., Oak Ridge National Lab., USA; Ericson, M. N., Oak Ridge National Lab., USA; Frank, S. S., Oak Ridge National Lab., USA; [1997]; 6p; In English

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-95295; DE98-001426; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The TGV32, a 32-channel preamplifier-multiplicity discriminator chip for the Multiplicity Vertex Detector (MVD) at PHENIX, is a unique silicon preamplifier in that it provides both an analog output for storage in an analog memory and a weighted summed-current output for conversion to a channel multiplicity count. The architecture and test results of the chip are presented. Details about the design of the preamplifier, discriminator, and programmable digital-analog converters (DACs) performance as well as the process variations are presented. The chip is fabricated in a 1.2-(micro)m, n-well, CMOS process.

DOE

Analog Computers; Chips; CMOS; Preamplifiers

19980210102 Sandia National Labs., Albuquerque, NM USA

Artificial neural network simulation of battery performance

OGorman, C. C., Sandia National Labs., USA; Ingersoll, D., Sandia National Labs., USA; Jungst, R. G., Sandia National Labs., USA; Paez, T. L., Sandia National Labs., USA; 1998; 10p; In English; 31st; System Sciences, 6-9 Jan. 1998, Kohala Coast, HI, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2318C; CONF-980113; DE98-000233; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Although they appear deceptively simple, batteries embody a complex set of interacting physical and chemical processes. While the discrete engineering characteristics of a battery such as the physical dimensions of the individual components, are relatively straightforward to define explicitly, their myriad chemical and physical processes, including interactions, are much more difficult to accurately represent. Within this category are the diffusive and solubility characteristics of individual species, reaction kinetics and mechanisms of primary chemical species as well as intermediates, and growth and morphology characteristics of reaction products as influenced by environmental and operational use profiles. For this reason, development of analytical models that can consistently predict the performance of a battery has only been partially successful, even though significant resources have been applied to this problem. As an alternative approach, the authors have begun development of a non-phenomenological model for battery systems based on artificial neural networks. Both recurrent and non-recurrent forms of these networks have been successfully used to develop accurate representations of battery behavior. The connectionist normalized linear spline (CMLS) network has been implemented with a self-organizing layer to model a battery system with the generalized radial basis function net. Concurrently, efforts are under way to use the feedforward back propagation network to map the ”state” of a battery system. Because of the complexity of battery systems, accurate representation of the input and output parameters has proven to be very important. This paper describes these initial feasibility studies as well as the current models and makes comparisons between predicted and actual performance.

DOE

Electric Batteries; Chemical Reactions; Mathematical Models; Reaction Kinetics; Neural Nets; Electrochemistry

19980210261 Idaho National Engineering Lab., Idaho Falls, ID USA

Electric vehicle fleet operations in the USA

Francfort, J. E., Idaho National Engineering Lab., USA; OHara, D., Department of Energy, USA; 1997; 8p; In English; 30th; Automotive Technology and Automation: In Fusion of Technical Excellence, 16-19 Jun. 1997, Florence, Italy

Contract(s)/Grant(s): DE-AC07-94ID-13223

Report No.(s): INEL/CON-97-00642; CONF-970639; DE98-050307; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The USA Department of Energy (DOE) is actively supporting the development and commercialization of advanced electric vehicles, and advanced batteries and propulsion systems. As part of this effort, the DOE Field Operations Program is performing commercial validation of electric vehicles. These efforts have included on-board data acquisition of electric vehicle operations and baseline performance testing. The baseline performance tests focus on parameters such as range, acceleration, and battery charging. This testing, performed in conjunction with EV America, has included the baseline performance testing of 14 electric vehicles will also be baseline performance tested. The baseline performance testing has documented annual improvements in per-

formance. This and additional information is made available to the public via the internet homepage (http://ev.inel.gov). The Field Operations Program continues to support the development of electric vehicles and infrastructure in conjunction with its new qualified vehicle test partners: Electric Transportation Application of Phoenix, and Southern California Edison. The Field Operations Program is managed by the Lockheed Martin Idaho Technologies Company, at the Idaho National Engineering Laboratory.
DOE
Electric Motor Vehicles; Data Acquisition; Electric Batteries

19980210298 Department of the Navy, Washington, DC USA
Microwave Channelized Bandpass Filter Having Two Channels
Rauscher, Christen, Inventor, Department of the Navy, USA; Apr. 30, 1998; 22p; In English
Patent Info.: Filed 30 Apr. 1998; US-Patent-Appl-SN-069855
Report No.(s): AD-D018892; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A channelized active bandpass filter having only two branches which provide respective frequency-selective feed-forward signal paths. The two signal paths have overlapping frequency response bands such that the combination of the two paths provides a composite filter with a bandpass response. The two branches may be provided with bandpass transfer characteristics of different orders and shapes, such as a second-order response and a fourth-order response. Two-way signal splitting and combining to define the two channels may be performed with in-phase splitters and combiners, for example, or diplexer circuits, each composed of two bandpass filters with different characteristics but overlapping frequency responses and preferably approximately equal center frequencies. Combinations of the two splitting and combining arrangements are also usable.
DTIC
Microwave Filters; Channel Flow; Bandpass Filters; Integrated Circuits

19980210301 Department of the Navy, Washington, DC USA
Field Emitter Cell and Array With Vertical Thin-Film-Edge Emitter
Hsu, David S., Inventor, Department of the Navy, USA; Gray, Henry F., Inventor, Department of the Navy, USA; Mar. 23, 1998; 35p; In English
Patent Info.: Filed 23 Mar. 1998; US-Patent-Appl-SN-045853
Report No.(s): AD-D018888; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A field emitter cell includes a thin film edge emitter normal to a gate layer. The field emitter is a multilayer structure including a low work function material sandwiched between two protective layers. The field emitter may be fabricated from a composite starting structure including a conductive substrate layer, an insulation layer, a standoff layer and a gate layer, with a perforation extending from the gate layer into the substrate layer. The emitter material is conformally deposited by chemical beam deposition along the sidewalls of the perforation. Alternatively, the starting material may be a conductive substrate having a protrusion thereon. The emitter layer, standoff layer, insulation layer, and gate layer are sequentially deposited, and the unwanted portions of each are preferentially removed to provide the desired structure.
DTIC
Emitters; Thin Films; Work Functions; Laminates

19980210316 Los Angeles City Dept. of Water and Power, System Development Div., CA USA
Los Angeles Department of Water and Power Electric and Hybrid Vehicle Program site operator program
[1998]; 4p; In English
Contract(s)/Grant(s): DE-FC07-94ID-13309
Report No.(s): DOE/ID/13309-T1; DE98-003239; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche
During the term of the above mentioned agreement, the Los Angeles Department of Water and Power (LADWP), a municipal utility serving the citizens of Los Angeles, marked its tenth year of involvement in testing and promoting electric vehicles as part of Los Angeles' overall air quality improvement program, and as a means of improving the regions' economic competitiveness through the creation of new industries. LADWP maintained and operated twenty electric vehicles (EVs) during the test period. These vehicles consisted of six G-Vans, four Chrysler TEVans, five U.S. Electricar pickup trucks, and five U.S. Electricar Prizms. LADWP's electric transportation program also included infrastructure, public transit development, public and awareness, and legislative and regulatory activities.
DOE
Electric Motor Vehicles; Air Quality; Economics

19980210359 Argonne National Lab., IL USA

Assigning functional meaning to digital circuits

Eckmann, S. T., Argonne National Lab., USA; Chisholm, G. H., Argonne National Lab., USA; Jul. 1997; 68p; In English

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/DIS/TM-43; DE98-003113; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

During computer-aided design, the problem of how to determine the logical function of a digital circuit arises in many contexts. For example, assigning functional meaning to a circuit is a fundamental operation in both reverse engineering and implementation validation. This report describes such a determination by discussing how a higher-level functional representation is constructed from a detailed circuit description (i.e., a gate-level netlist, which is a list of logic gates and their interconnections). The approach used involves transforming parts of the netlist into a functional representation and then manipulating this representation. Two types of functional representations are described: (1) a mathematical representation based on the logical operators 'exor' and 'and' and (2) a directed acyclic graph representation based on binary decision trees. Each representation provides a canonical form of the logical function being implemented (i.e., a form that is independent of implementation details). Such forms, however, have a well-known problem associated with the ordering of inputs: for each order, a unique form exists. A solution to this problem is given for both representations. Experimental results that demonstrate the use of these representations in the process of assigning functional meaning to a circuit are provided. The report also identifies and discusses issues critical to the performance required of this fundamental operation.

DOE

Canonical Forms; Logic Circuits; Gates (Circuits); Design Analysis; Circuits; Switching Circuits

19980210475 Tracor Aerospace Electronic Systems, Inc., Lansdale, PA USA

Double Sideband Suppressed Carrier Optical Modulator ***Final Report, Sep. 1994 - Sep 1996***

Logan, Ronald T., Jr., Tracor Aerospace Electronic Systems, Inc., USA; Bynum, R. D., Tracor Aerospace Electronic Systems, Inc., USA; Paul, Dilip, Tracor Aerospace Electronic Systems, Inc., USA; Bonocore, Steve, Tracor Aerospace Electronic Systems, Inc., USA; Wood, Jerry, Tracor Aerospace Electronic Systems, Inc., USA; Apr. 1998; 140p; In English; Prepared in collaboration with Uniphase Telecommunications Products, Chalfont, PA.

Contract(s)/Grant(s): F30602-94-C-0277; AF Proj. 2863

Report No.(s): AD-A345679; AFRL-SN-RS-TR-1998-31; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The development of a novel single-chip integrated optic double sideband suppressed carrier (DSSC) modulator on lithium niobate substrate for operation at 1300 and 1550 nm wavelengths is described in this report. This chip contains two Mach-Zehnder (m-z) and two phase modulator sections which are computer controlled for operation at the third-order intermodulation distortion point minimum. to assess insertion potential into microwave/millimeter wave (mW/mmW) systems, systems level performance characteristics of the DSSC has been investigated. Performance measures included but were not limited to measurement of IMD, harmonics, noise figure (NF), and phase drift. This data was used to determine the intercept point, spurious free dynamic range (SFDR), etc. to some extent environmental and operational effects were also studied. Additional investigation was conducted to look into alternative biasing schemes to improve or optimize performance of the DSSC. Experiments were performed to validate optimization and are reported here.

DTIC

Numerical Control; Noise Measurement

19980210487 State Univ. of New York, Melville Library, Stony Brook, NY USA

Single Electronics ***Final Report, 1 Jan. 1995 - 31 Mar. 1998***

Likharev, Konstantin K., State Univ. of New York, USA; Averin, Dmitri V., State Univ. of New York, USA; Lukens, James E., State Univ. of New York, USA; May 1998; 10p; In English

Contract(s)/Grant(s): F49620-95-1-0044; AF Proj. 2305

Report No.(s): AD-A346383; AFRL-SR-BL-TR-98-0475; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the past decade, single-electronics has turned into a major field of physical and applied electronics. Preliminary studies of possible applications of single-electron devices (1,4,5) indicated that they might yield a completely new generation of both digital and analog devices with unparalleled performance. most notably extremely dense digital circuits. However, many issues before the beginning of this work these expectations have not been confirmed by detailed, quantitative analyses. In 1991, a collab-

oration of three research groups at Stony Brook began an AFOSR-supported project in the field of single-electronics. During the few first years of this work, a solid technological, experimental and theoretical base for single-electronics was established at Stony Brook, and many interesting results have been obtained. Since January 1995, this research has been supported under the current grant.
DTIC
Digital Electronics; Electronic Equipment; Quantitative Analysis

19980210535 Fermi National Accelerator Lab., Batavia, IL USA
Preliminary results from the D-Zero silicon vertex beam tests
Roco, M. T. P., Fermi National Accelerator Lab., USA; Oct. 1997; 11p; In English; 6th; Vertex Detectors, 31 Aug. - 5 Sep. 1997, Mangaratiba, Brazil
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/343-E; CONF-9708123; DE98-051237; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Extensive tests of the D-Zero silicon vertex detectors and the final version of the SVX-II chip and readout electronics were performed at a test beam facility equipped with a 2 Tesla magnet at FNAL. Preliminary results are reported on the performance of the SVX-II chip, charge collection properties, signal to noise ratio, cluster pulse height and spatial resolution.
DOE
Performance Tests; Pion Beams; Readout; Semiconductor Devices

19980210538 Fermi National Accelerator Lab., Batavia, IL USA
SVX3: A deadtimeless readout chip for silicon strip detectors
Zimmerman, T., California Univ., Lawrence Berkeley Lab., USA; Huffman, T., California Univ., Lawrence Berkeley Lab., USA; Srage, J., California Univ., Lawrence Berkeley Lab., USA; Stroehmer, R., California Univ., Lawrence Berkeley Lab., USA; Yarema, R., California Univ., Lawrence Berkeley Lab., USA; Garcia-Sciveras, M., California Univ., Lawrence Berkeley Lab., USA; Luo, L., California Univ., Lawrence Berkeley Lab., USA; Milgrome, O., California Univ., Lawrence Berkeley Lab., USA; Dec. 1997; 6p; In English; 7th; Advanced Detectors, 25-31 May 1997, Isola d'Elba, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/427; CONF-9705193; DE98-051567; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A new silicon strip readout chip called the SVX3 has been designed for the 720,000 channel CDF silicon upgrade at Fermilab. SVX3 incorporates an integrator, analog delay pipeline, ADC, and data spesification for each of 128 identical channels. Many of the operating parameters are programmable via a serial bit stream, which allows the chip to be used under a variety of conditions. Distinct features of SVX3 include use of a backside substrate contact for optimal ground referencing, and the capability of simultaneous signal acquisition and digital readout allowing deadtimeless operation in the Fermilab Tevatron.
DOE
Silicon; Semiconductor Devices; Readout; Detection; Design Analysis; Tests

19980210549 Argonne National Lab., IL USA
Measurement of local currents in superconductors using an in-situ high field magneto-optical microscope
Wijngaarden, R. J., Vrije Univ., Netherlands; Surdeanu, R., Vrije Univ., Netherlands; Griessen, R., Vrije Univ., Netherlands; 1997; 3p; In English; Materials and Mechanisms of Superconductivity: High Temperature Superconductors, 28 Feb. - 4 Mar. 1997, Beijing, China
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/MSD/CP-93501; CONF-970235-6; DE97-007023; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A contactless method is used to measure the local current density in superconductors at fields up to 7 T with a spatial resolution better than 1 micron. The local currents are derived from magneto-optical images using a powerful inversion scheme. The interpretation of global experimental data on flux flow, flux creep and relaxation phenomena is hindered if the magnetic moment of the sample as a whole is measured, while the current flow in the sample is not uniform. This problem can be overcome by the local measurement of the currents flowing in the sample that is discussed below.
DOE
Creep Properties; Current Density; Superconductors (Materials); Electrical Measurement; Barium Oxides; Bismuth Oxides; Calcium Oxides; Copper Oxides; Yttrium Oxides

19980210555 Argonne National Lab., IL USA

Challenges for the vehicle tester in characterizing hybrid electric vehicles

Duoba, M., Argonne National Lab., USA; 1997; 14p; In English; 7th; On-Road Vehicle Mission, 9-11 Apr. 1997, San Diego, CA, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/ES/CP-92955; CONF-970498-2; DE97-007078; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Many problems are associated with applying test methods, like the Federal Test Procedure (FTP), for HEVs. Although there has been considerable progress recently in the area of HEV test procedure development, many challenges are still unsolved. A major hurdle to overcoming the challenges of developing HEV test procedures is the lack of HEV designs available for vehicle testing. Argonne National Laboratory has tested hybrid electric vehicles (HEVs) built by about 50 colleges and universities from 1994 to 1997 in annual vehicle engineering competitions sponsored in part by the U.S. Department of Energy (DOE). From this experience, the Laboratory has gathered information about the basics of HEV testing and issues important to successful characterization of HEVs. A collaboration between ANL and the Society of Automotive Engineer's (SAE) HEV Test Procedure Task Force has helped guide the development of test protocols for their proposed procedures (draft SAE J1711) and test methods suited for DOE vehicle competitions. HEVs use an electrical energy storage device, which requires that HEV testing include more time and effort to deal with the effects of transient energy storage as the vehicle is operating in HEV mode. HEV operation with electric-only capability can be characterized by correcting the HEV mode data using results from electric-only operation. HEVs without electric-only capability require multiple tests conducted to form data correlations that enable the tester to find the result that corresponds to a zero net change in SOC. HEVs that operate with a net depletion of charge cannot be corrected for battery SOC and are characterized with emissions and fuel consumption results coupled with the electrical energy usage rate.

DOE

Fuel Consumption; Exhaust Gases; Procedures; Electric Automobiles; Performance Tests

19980210594 Sandia National Labs., Albuquerque, NM USA

Radiation transport phenomena and modeling, Part A, Codes

Lorence, L.J., Jr., Sandia National Labs., USA; Beutler, D. E., Sandia National Labs., USA; Sep. 1997; 75p; In English; 34th; Nuclear and Space Radiation Effects, 21-25 Jul. 1997, Snowmass, CO, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2135-Pt-A-B; CONF-970711-10-Pt-A-B; DE97-009293; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report contains the notes from the second session of the 1997 IEEE Nuclear and Space Radiation Effects Conference Short Course on Applying Computer Simulation Tools to Radiation Effects Problems. Part A discusses the physical phenomena modeled in radiation transport codes and various types of algorithmic implementations. Part B gives examples of how these codes can be used to design experiments whose results can be easily analyzed and describes how to calculate quantities of interest for electronic devices.

DOE

Radiation Transport; Nuclear Radiation; Computerized Simulation; Algorithms; Electronic Equipment; Gamma Rays

19980210599 Los Alamos National Lab., NM USA

Establishing the operational durability of polymer light-emitting diodes

Campbell, I. H., Los Alamos National Lab., USA; Davids, P. S., Los Alamos National Lab., USA; Heller, C. M., Los Alamos National Lab., USA; [1998]; 9p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3368; DE98-001581; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a two-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). Recent research has made it clear that polymer light-emitting diodes (PLEDs) have all the necessary device attributes (efficiency, emission colors, operating voltage) required to build a successful display technology. This project was initiated to establish meaningful device operating lifetimes and to understand PLED failure mechanisms in order to control device reliability and ultimately produce a viable commercial product. A PLED lifetime testing capability was established to measure the change in PLED light output and drive voltage at constant current bias as a function of time for different current bias levels, operating temperatures and device (polymer) thickness. The dominant failure mechanism of the polymer light emitting diodes,

occurring at less than 1000 hours of operation, was identified as delamination of the electron-injecting metal contact. A new electroabsorption technique to measure the electric field distribution inside the PLEDs was developed and then used to assess relative device reliability.
DOE
Light Emitting Diodes; Electromagnetic Absorption; Polymers; Beam Injection

19980210703 Lawrence Livermore National Lab., Livermore, CA USA
Structural and electrochemical potential simulation for the cathode material Li(sub 1+x)V(sub 3)O(sub 8)
Benedek, R., Argonne National Lab., USA; Thackeray, M. M., Argonne National Lab., USA; Yang, I. H., Lawrence Livermore National Lab., USA; Dec. 01, 1997; 8p; In English, 1-5 Dec. 1997, Boston, MA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-129291; CONF-971201; DE98-052095; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The structure and electrochemical potential of monoclinic Li(sub 1+x)V(sub 3)O(sub 8) were calculated within the local-density-functional-theory framework by use of plane-wave-pseudopotential methods. Special attention was given to the compositions 1+x=1.2 and 1+x=4, for which x-ray diffraction structure refinements are available. The calculated low-energy configuration for 1+x=4 is consistent with the three Li sites identified in x-ray diffraction measurements and predicts the position of the unobserved Li. The location of the tetrahedrally coordinated Li in the calculated low-energy configuration for 1+x=1.5 is consistent with the structure measured by x-ray diffraction for Li(sub 1.2)V(sub 3)O(sub 8). Calculations were also performed for the two monoclinic phases at intermediate Li compositions, for which no structural information is available. Calculations at these compositions are based on hypothetical Li configurations suggested by the ordering of vacancy energies for Li(sub 4)V(sub 3)O(sub 8) and tetrahedral site energies in Li(sub 1.5)V(sub 3)O(sub 8). The internal energy curves for the two phases cross near 1+x=3. Predicted electrochemical potential curves agree well with experiment.
DOE
Simulation; Cathodes; Electrochemistry

19980210765 National Lab. for High Energy Physics, Ibaraki, Japan
Front-end Interface of the SVD Readout System for BELLE
Ikeda, Hirokazu, National Lab. for High Energy Physics, Japan; Tanaka, Manobu, National Lab. for High Energy Physics, Japan; Matsuda, Takeshi, National Lab. for High Energy Physics, Japan; Fukunaga, Chikara, Tokyo Metropolitan Univ., Japan; Nobori, Takeshi, Tokyo Metropolitan Univ., Japan; Saitoh, Yutaka, Seiko Instruments, Inc., Japan; Akamine, Tadao, Seiko Instruments, Inc., Japan; Inoue, Masahiro, Seiko Instruments, Inc., Japan; Yamanaka, Junko, Seiko Instruments, Inc., Japan; Mandai, Masaaki, Seiko Instruments, Inc., Japan; Takeuchi, Hitoshi, Seiko Instruments, Inc., Japan; Kitta, Tatsuya, Seiko Instruments, Inc., Japan; Saitoh, Makoto, Seiko Instruments, Inc., Japan; Miyahara, Shin-ichi, Seiko Instruments, Inc., Japan; Kamiya, Masaaki, Seiko Instruments, Inc., Japan; Oct. 1996; 18p; In English
Contract(s)/Grant(s): JMESC-05242104
Report No.(s): KEK-Preprint-96-133; TMU-9651; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The data-acquisition system for a silicon micro-vertex detector of the BELLE experiment is described with special emphasis placed on the front-end circuits and their interfaces. The description includes a 128-channel preamplifier chip, a silicon-based double-sided hybrid card, and readout control chips for digital interfaces, which are discussed in terms of both architectural and operational aspects.
Author
Data Acquisition; Readout; Interfaces; Circuits

19980210800 Fermi National Accelerator Lab., Batavia, IL USA
Preparing printed circuit boards for rapid turn-around time on a plotter
Hawtree, J., Fermi National Accelerator Lab., USA; Jan. 1998; 19p; In English
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL-TM-2022; DE98-052052; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This document describes the use of the LPKF ProtoMat mill/drill unit circuit board Plotter, with the associated CAD/CAM software BoardMaster and CircuitCAM. At present its primarily use here at Fermilab's Particle Physics Department is for rapid-

turnover of prototype PCBs double-sided and single-sided copper clad Printed Circuit Boards (PCBs). (The plotter is also capable of producing gravure films and engraving aluminum or plastic although we have not used it for this.) It has the capability of making traces 0.004 inch wide with 0.004 inch spacings which is appropriate for high density surface mount circuits as well as other through-mounted discrete and integrated components. One of the primary benefits of the plotter is the capability to produce double-sided drilled boards from CAD files in a few hours. However to achieve this rapid turn-around time, some care must be taken in preparing the files. This document describes how to optimize the process of PCB fabrication. With proper preparation, researchers can often have a completed circuit board in a day's time instead of a week or two wait with usual procedures. It is assumed that the software and hardware are properly installed and that the machinist is acquainted with the Win95 operating system and the basics of the associated software. This paper does not describe its use with pen plotters, lasers or rubouts. The process of creating a PCB (printed circuit board) begins with the CAD (computer-aided design) software, usually PCAD or VeriBest. These files are then moved to CAM (computer-aided machining) where they are edited and converted to put them into the proper format for running on the ProtoMat plotter. The plotter then performs the actual machining of the board. This document concentrates on the LPKF programs CircuitCam BASIS and BoardMaster for the CAM software. These programs run on a Windows 95 platform to run an LPKF ProtoMat 93s plotter.
DOE
Computer Aided Design; Computer Aided Manufacturing; Printed Circuits; Plotters; Circuit Boards

19980210801 Lawrence Livermore National Lab., Livermore, CA USA
Novel design for a high power superconducting delay line
Chen, Y. J., Lawrence Livermore National Lab., USA; Caporaso, G. J., Lawrence Livermore National Lab., USA; May 08, 1997; 6p; In English; 17th; Particle Accelerator, 12-16 May 1997, Vancouver, Canada; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-126071; CONF-970503; DE98-052020; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Potential designs for a high power superconducting delay line of approximately 10 ms duration are described. The transmitted signal should have low dispersion and little attenuation to recapture the original signal. Such demands cannot be met using conventional metal conductors. This paper outlines a proposal for a new transmission line design using low temperature superconducting material which meets system specifications. The 25 W line is designed to carry pulsed signals with an approximate rise time of 8 nsec and a maximum voltage of 25 kV. Predicted electrical design and performance of the line is presented.
DOE
Design Analysis; Transmission Lines; Superconductivity; Delay Lines; Delay Circuits; Superconducting Devices; Electric Power Transmission

19980210812 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Hard electronics ***Hard electronics***
Mar. 1997; 203p; In Japanese
Report No.(s): NEDO-PR-9605; DE98-745391; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Hard material technologies were surveyed to establish the hard electronic technology which offers superior characteristics under hard operational or environmental conditions as compared with conventional Si devices. The following technologies were separately surveyed: (1) The device and integration technologies of wide gap hard semiconductors such as SiC, diamond, and nitride; (2) The technology of hard semiconductor devices for vacuum micro- electronics technology; and (3) The technology of hard new material devices for oxides. The formation technology of oxide thin films made remarkable progress after discovery of oxide superconductor materials, resulting in development of an atomic layer growth method and mist deposition method. This leading research is expected to solve such issues difficult to be easily realized by current Si technology as high-power, high-frequency and low-loss devices in power electronics, high temperature-proof and radiation-proof devices in ultimate electronics, and high-speed and dense-integrated devices in information electronics.
DOE
Microelectronics; Semiconductor Devices; Silicon Carbides; Thin Films; Deposition; Oxides; Nitrides; Diamonds

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FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling. For related information see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics.

19980206706 Front Range Scientific Computation, Inc., Dept. of Mathematics, Denver, CO USA
Copper Mountain conference on multigrid methods ***Final Report***
1997; 39p; In English; 8th, 6 - 11 Apr. 1997, Copper Mountain, CO, USA
Contract(s)/Grant(s): DE-FG03-97ER-25309
Report No.(s): CONF-970497-Absts.; DE98-000614; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Copper Mountain Conference on Multigrid Methods was held on April 6-11, 1997. It took the same format used in the previous Copper Mountain Conferences on Multigrid Method conferences. Over 87 mathematicians from all over the world attended the meeting. 56 half-hour talks on current research topics were presented. Talks with similar content were organized into sessions. Session topics included: fluids; domain decomposition; iterative methods; basics; adaptive methods; non-linear filtering; CFD; applications; transport; algebraic solvers; supercomputing; and student paper winners.
DOE
Conferences; Copper; Mountains; Multigrid Methods

19980206721 Sandia National Labs., Albuquerque, NM USA
Issues in computational fluid dynamics code verification and validation
Oberkampf, W. L., Sandia National Labs., USA; Blottner, F. G., Sandia National Labs., USA; Sep. 1997; 35p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-95-1352; DE97-009291; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A broad range of mathematical modeling errors of fluid flow physics and numerical approximation errors are addressed in computational fluid dynamics (CFD). It is strongly believed that if CFD is to have a major impact on the design of engineering hardware and flight systems, the level of confidence in complex simulations must substantially improve. to better understand the present limitations of CFD simulations, a wide variety of physical modeling, discretization, and solution errors are identified and discussed. Here, discretization and solution errors refer to all errors caused by conversion of the original partial differential, or integral, conservation equations representing the physical process, to algebraic equations and their solution on a computer. The impact of boundary conditions on the solution of the partial differential equations and their discrete representation will also be discussed. Throughout the article, clear distinctions are made between the analytical mathematical models of fluid dynamics and the numerical models. Lax's Equivalence Theorem and its frailties in practical CFD solutions are pointed out. Distinctions are also made between the existence and uniqueness of solutions to the partial differential equations as opposed to the discrete equations. Two techniques are briefly discussed for the detection and quantification of certain types of discretization and grid resolution errors.
DOE
Computational Fluid Dynamics; Differential Equations; Integral Equations; Mathematical Models; Boundary Conditions; Fluid Flow; Fluid Dynamics; Algebra

19980206742 Sandia National Labs., Albuquerque, NM USA
Experimental methodology for computational fluid dynamics code validation
Aeschliman, D. P., Sandia National Labs., USA; Oberkampf, W. L., Sandia National Labs., USA; Sep. 1997; 35p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-95-1189; DE97-009292; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Validation of Computational Fluid Dynamics (CFD) codes is an essential element of the code development process. Typically, CFD code validation is accomplished through comparison of computed results to previously published experimental data that were obtained for some other purpose, unrelated to code validation. As a result, it is a near certainty that not all of the information required by the code, particularly the boundary conditions, will be available. The common approach is therefore unsatisfactory, and a different method is required. This paper describes a methodology developed specifically for experimental validation of CFD codes. The methodology requires teamwork and cooperation between code developers and experimentalists throughout the validation process, and takes advantage of certain synergisms between CFD and experiment. The methodology employs a novel

uncertainty analysis technique which helps to define the experimental plan for code validation wind tunnel experiments, and to distinguish between and quantify various types of experimental error. The methodology is demonstrated with an example of surface pressure measurements over a model of varying geometrical complexity in laminar, hypersonic, near perfect gas, 3-dimensional flow.
DOE
Computational Fluid Dynamics; Boundary Conditions; Hypersonic Flow; Pressure Measurement; Three Dimensional Flow

19980206754 Sverdrup Technology, Inc., Arnold AFS, TN USA
A Three-Dimensional Turbine Engine Analysis Compressor Code (TEACC) for Steady-State Inlet Distortion
Hale, Alan, Sverdrup Technology, Inc., USA; OBrien, Walter, Sverdrup Technology, Inc., USA; Jan. 1997; 12p; In English
Report No.(s): AD-A345894; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The direct approach of modeling the flow between all blade passages for each blade row in the compressor is too computationally intensive for practical design and analysis investigations with inlet distortion. Therefore a new simulation tool called the Turbine Engine Analysis Compressor Code (TEACC) has been developed. TEACC solves the compressible, time dependent, 3D Euler equations modified to include turbomachinery source terms which represent the effect of the blades. The source terms are calculated for each blade row by the application of a streamline curvature code. TEACC was validated against experimental data from the transonic NASA rotor, Rotor 1B, for a clean inlet and for an inlet distortion produced by a 90 deg, one per revolution distortion screen. TEACC revealed that strong swirl produced by the rotor caused the compressor to increase in loading in the direction of rotor rotation through the distorted region and decrease in loading circumferentially away from the distorted region.
DTIC
Gas Turbines; Three Dimensional Models; Turbine Engines; Computer Programs; Flow Distribution; Turbocompressors

19980206786 Los Alamos National Lab., NM USA
Flow structure in a Rayleigh-Benard cell upon impulsive spin-up
Vorobieff, P., Los Alamos National Lab., USA; Ecke, R. E., Los Alamos National Lab., USA; 1997; 9p; In English, 16 - 21 Nov. 1997, Dallas, TX, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2949; CONF-971157; DE98-001075; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We investigate convection in a cylindrical Rayleigh-Benard cell with radius-to-height ratio Gamma = 1/2. The cell is subjected to impulsive spin-up about its vertical axis. We use TLC (thermochromic liquid crystal) for temperature field measurements and PIV (particle image velocimetry) for the velocity reconstruction of the transition in the range of Rayleigh numbers R from 5 x 10(exp 7) to 5 x 10(exp 8) and Taylor numbers Ta from 0 up to 2.4 x 10(exp 10). The initial (at rest) and the final (in steady rotation) convection. The most persistent transient feature emerging is a sharply defined ringlike pattern or concentric patterns characterized by a decrease in temperature, axial velocity directed downward and high azimuthal shear. The latter leads to formation of an azimuthally regular structure of Kelvin-Helmholz vortices. During the next stage of the transition, the vortical structure loses azimuthal regularity and the pattern characteristic of turbulent rotating convection forms.
DOE
Cylindrical Bodies; Rayleigh-Benard Convection; Temperature Measurement; Velocity Measurement; Turbulence; Flow Characteristics

19980209685 Department of the Navy, Washington, DC USA
Circumferential Circulation Control System
Rice, James Q., IV, Inventor, Department of the Navy, USA; Nov. 18, 1997; 6p; In English; Supersedes US-Patent-Appl-SN-605315, AD-D017946.
Patent Info.: Filed 7 Feb. 1996; US-Patent-5,687,670; US-Patent-Appl-SN-605,315
Report No.(s): AD-D018847; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Disclosed is a device used to maneuver a vehicle consisting of a tubular body with suction circumferential slots adjacent its forward end and exhaust circumferential slots adjacent its aft end on both the outer and inner peripheral surfaces. Fluid is conveyed between the forward slots on one surface of the tubular body to the aft slots on the other surface of the body to produce asymmetrical pressure on the tubular body while traveling through a fluid medium.
DTIC
Asymmetry; Slots; Suction; Pressure Gradients; Underwater Vehicles; Boundary Layers; Underwater Propulsion

19980209687 Department of the Navy, Washington, DC USA

Configurable Port Assembly

Meunier, Robert, Inventor, Department of the Navy, USA; Nov. 18, 1997; 9p; In English; Supersedes US-Patent-Appl-SN-591182, AD-D018059

Patent Info.: Filed 16 Jan. 1996; US-Patent-Appl-SN-591,182; US-Patent-5,687,769

Report No.(s): AD-D018845; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A configurable port assembly is used proximate a medium containing structure, such as a water tunnel. e.g. to measure fluid flow or inject flowing fluid into the tunnel. The configurable port assembly includes at least two configurable port assembly components assembled to define a configurable port extending from a first opening to a second opening. One or more of the configurable port assembly components can be rotated from a first to a second assembled position to define a configurable port having at least two predefined shapes. The configurable port assembly preferably includes four configurable port assembly components assembled and coupled together with coupling members, such as dowel pins, extending through the components. Two of the configurable port assembly components have shaped surfaces that define a shaped thickness of the configurable port while the other two components have shaped surfaces that define a shaped width of the port. Various shapes can be machined in the configurable port assembly components to provide numerous variations of the configurable port.

DTIC

Fluid Flow; Water Tunnel Tests; Structural Analysis; Ports (Openings)

19980209688 Department of the Navy, Washington, DC USA

Method and Apparatus for Separating Particulate Matter from a Flowing Fluid

Dickinson, Stuart C., Inventor, Department of the Navy, USA; Kuklinski, Robert, Inventor, Department of the Navy, USA; Nov. 18, 1997; 12p; In English; Supersedes US-Patent-Appl-SN-613772, AD-D017963

Patent Info.: Filed 28 Feb. 1996; US-Patent-Appl-SN-613,772; US-Patent-5,688,406

Report No.(s): AD-D018844; No Copyright; Avail: US Patent and Trademark Office, Microfiche

Apparatus and methods for filtering particulate matter from a fluid traveling proximate a surface containing a port. First and second ultrasonic wave generators produce superposed ultrasonic waves to define a composite wave pattern in a region of the fluid body upstream of the port. Nodes and antinodes in the composite wave region define regions at which the particulate matter accumulates. The accumulating particulate matter is displaced out of the fluid that enters the port.

DTIC

Ports (Openings); Particulates; Ultrasonic Radiation

19980209689 Department of the Navy, Washington, DC USA

Fluidic Device Controlled by Remotely Located Acoustic Energy Source

Kuklinski, Robert, Department of the Navy, USA; Dickinson, Stuart C., Department of the Navy, USA; Nov. 25, 1997; 7p; In English; Supersedes US-Patent-Appl-SN-695840, AD-D018175

Patent Info.: Filed 5 Aug. 1996; US-Patent-Appl-SN-695,840; US-Patent-5,690,145

Report No.(s): AD-D018843; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A fluidic device is provided to control the path of a fluid. A control chamber has at least one window incorporated therein that permits acoustic waves impinging thereon to pass there through. An ultrasonic source is remotely located with respect to the control chamber and a coupling medium such as water, air or an acoustic waveguide, acoustically couples the acoustic waves to the window(s).

DTIC

Acoustic Emission; Fluidics; Sound Waves; Waveguides

19980209702 National Aerospace Lab., Experimental Aerodynamics Div., Bangalore, India

Cross-Correlation Measurements in Naturally Occurring Tollmien-Schlichting Waves

Sundaram, S., National Aerospace Lab., India; Grosche, F. R., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Kreplin, H. P., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Oct. 1997; 50p; In English

Contract(s)/Grant(s): NAL Proj. E-9001C

Report No.(s): NAL-PD-EA-9709; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Spanwise cross-correlation measurements are reported for the naturally occurring TS waves on a flat plate at a free-stream velocity of 20 m/s. Three cases, namely, zero, mild adverse and mild favourable streamwise pressure gradients are covered.

Results indicate the spanwise coherence length scale of the waves to be around five times its wave length for zero pressure gradient. Marginal increase and a decrease in length scale is observed for adverse and favourable pressure gradients, respectively.
Author
Cross Correlation; Tollmien-Schlichting Waves; Dimensional Measurement

19980209705 Instituto Nacional de Tecnica Aeroespacial, Div. de Aerodinamica, Madrid, Spain
Euler Code Development: UNSEUL2D (Version 1.0) Vortice: General Development ***Desarrollo Codigo Euler: UNSEUL2D (Version 1.0) Vortice: Desarrollo General***
Sanchez-Martinez, Francisco J., Instituto Nacional de Tecnica Aeroespacial, Spain; Oct. 31, 1997; 43p; In Spanish
Report No.(s): AT/TNO/4510/012/INTA/97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In this document presents the development of a computer code based on Euler equations for a perfect gase. Unstructured space discretization with a triangular mesh. Finite Volume space discretization. Time discretization through first order forward finite differences and upwind discretization for convective flows.
Author
Computer Programs; Finite Volume Method; Computational Grids

19980209859 Sandia Labs., Livermore, CA USA
DRFM: A new package for the evaluation of gas-phase transport properties
Paul, P. H., Sandia Labs., USA; Nov. 1997; 36p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-98-8203; DE98-050977; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report describes a complete and modernized procedure to evaluate pure species, binary and mixture transport properties of gases in the low density limit. This includes a description of the relationships used to calculate these quantities and the means used to obtain the necessary input data. The purpose of this work is to rectify certain limitations of previous transport packages, specifically: to employ collision integrals suitable for high temperatures, to modernize the mixture formula, and to modernize the input data base. This report includes a set of input parameters for: the species involved in H2-, CO- air combustion, the noble gases, methane and the oxides of nitrogen.
DOE
Gas Transport; Gas Mixtures; Transport Properties; Binary Mixtures

19980209874 Los Alamos National Lab., NM USA
Turbulence and turbulence spectra in complex fluid flows
Clark, T. T., Los Alamos National Lab., USA; Chen, Shi-Yi, Los Alamos National Lab., USA; Turner, L., Los Alamos National Lab., USA; Zemach, C., Los Alamos National Lab., USA; [1997]; 22p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2774; DE98-000878; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). Our objective was to develop a theoretical model of fluid turbulence in parallel with a series of direct numerical simulations of increasingly complex test environments to establish limits of error and regimes of applicability, and to guide improvements. The aim is to produce methods of tested accuracy, with tractable numerical approximations, for turbulent fluids of constant density, and then for variable densities and multimaterial flows. We proceed from a recent spectral model that describes turbulent energy and stress densities in terms of a range of length scales. This should lead not only to improved engineering models, but also to a basic conceptual improvement because the spectral approach accounts for the variation of evolution rates with turbulence length scales.
DOE
Turbulence; Spectra; Turbulent Flow

19980209879 Department of the Navy, Washington, DC USA
Method and Apparatus for Separating Particulate Matter from a Fluid
Dickinson, Stuart C., Inventor, Department of the Navy, USA; Kuklinski, Robert, Inventor, Department of the Navy, USA; Nov. 18, 1997; 14p; In English; Supersedes AD-D017964

Patent Info.: Filed 28 Feb. 1996; US-Patent-Appl-SN-613771; US-Patent-5,688,405
Report No.(s): AD-D018804; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method and apparatus for filtering particulate matter entrained in a fluid entering a port from a reservoir. First and second ultrasonic wave generators produce ultrasonic waves to define a composite wave pattern. The patterns produce nodes and antinodes in a region through which fluid entering a port passes. The particulate matter in the portion of the fluid passing through the region accumulates along the nodes and antinodes. The accumulating particulate matter is thereby separated and is displaced from the fluid entering the port.
DTIC
Fluid Filters; Procedures; Acoustic Excitation; Phase Separation (Materials)

19980209939 ESDU International Ltd., London UK
Non-Newtonian Fluids: Guide to Classification and Characteristics
Dec. 1997; 30p; In English; Included in the Fluid Mechanics, Internal Flow Sub-series
Report No.(s): ESDU-97034; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97034 is one of a group on the flow characteristics of non-Newtonian fluids, and provides a guide to their identification and classification. Fluids are classified firstly by their phase condition (as homogeneous, pseudohomogeneous or heterogeneous) and secondly on the basis of their time-dependent behaviour (thixotropic or viscoelastic) when subjected to an initial shear. Guidance is then given on the main classes of flow behaviour exhibited over limited ranges of shear rate under steady-state shear: these classes are Newtonian, shear-thinning, shear-thickening, Bingham plastic and visco-plastic. Most fluids exhibit behaviour conforming to more than one flow classification over a shear rate range wider than two or three decades, and this behaviour is discussed and illustrated by typical flow curves. The range of behaviour of polymeric or particulate systems is illustrated and typical shear rates for various flow conditions are tabulated. Flow curve models are presented that are used to characterize the idealised forms of flow behaviour (over limited shear rate ranges) and the behaviour of real fluids over wider shear rate ranges. A brief discussion is given on commercial viscometers employed for viscosity and flow curve measurement, and includes guidance on practical aspects of their use but ESDU 95012 should be consulted for in-depth consideration of this topic. A glossary of viscometric terms is provided. ESDU 91025 provides methods and computer programs for the estimation, using the flow curve and by scale-up of small-scale pipeline flow data, of frictional pressure drop in fully-developed, isothermal flow in straight pipes.
Author
Classifications; Computer Programs; Flow Characteristics; Mathematical Models; Data Structures

19980210003 NASA Lewis Research Center, Cleveland, OH USA
An Incidence Loss Model for Wave Rotors with Axially Aligned Passages
Paxson, Daniel E., NASA Lewis Research Center, USA; Jun. 1998; 12p; In English; 34th; Joint Propulsion Conference, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 523-26-33
Report No.(s): NASA/TM-1998-207923; NAS 1.15:207923; E-11208; AIAA Paper 99-3251; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A simple mathematical model is described to account for the losses incurred when the flow in the duct (port) of a wave rotor is not aligned with the passages. The model, specifically for wave rotors with axially aligned passages, describes a loss mechanism which is sensitive to incident flow angle and Mach number. Implementation of the model in a one-dimensional CFD based wave rotor simulation is presented. Comparisons with limited experimental results are consistent with the model. Sensitivity studies are presented which highlight the significance of the incidence loss relative to other loss mechanisms in the wave rotor.
Author
Mathematical Models; Wave Rotors; Losses; Axial Loads

19980210086 ESDU International Ltd., London UK
Selection and Costing of Heat Exchangers. Plate-Fin Type
Sep. 1997; 47p; In English; Included in the Heat Transfer Sub-series
Report No.(s): ESDU-97006; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97006 is one of a group on this topic and provides a simple and rapid method of obtaining rough cost estimates for industrial-scale plate-fin heat exchangers. It extends the information in ESDU 92013 based on

information from the plate-fin exchanger manufacturer, IN41 Marston Ltd. ESDU 97006 discusses the construction, configurations and applications (especially in multi-stream use) of the exchangers. The costing data for brazed aluminium construction are presented in two ways. Firstly, the two-stream costing method of ESDU 92013 is used to provide updated costs related to 'standard' designs for a range of hot and cold streams, including boiling, condensing and cryogenic flows and based on typical fluid pressures. Secondly, a methodology is developed for multi-stream use in which heat transfer and then costs are estimated on a volumetric basis. This method, which is based on the techniques of process integration, uses stream volumetric film coefficients; values of these coefficients were derived and are presented for the typical working fluids. From the resulting overall volumetric heat transfer coefficients the total volume of the exchanger is estimated and the cost is obtained directly from a costing curve for 2, 3 and 4 to 6 stream units. Cost factors are also provided that account for increased pressure and stainless steel construction. Details of the calculation procedures used are provided and three worked examples illustrate the use of the method, including a worked example that illustrates the cost saving for a multi-stream unit relative to a multiplicity of 2-stream units. The bases of the approximate design method is given.
Author
Heat Exchangers; Cooling Fins; Procedures; Cost Estimates; Industries

19980210105 Sandia National Labs., Albuquerque, NM USA
Toward parallel, adaptive mesh refinement for chemically reacting flow simulations
Devine, K. D., Sandia National Labs., USA; Shadid, J. N., Sandia National Labs., USA; Salinger, A. G., Sandia National Labs., USA; Hennigan, G. L., New Mexico State Univ., USA; [1997]; 6p; In English; 10th; Finite Elements In Fluids, 5-8 Jan. 1998, Tucson, AZ, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2540C; CONF-980125-; DE98-000554; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Adaptive numerical methods offer greater efficiency than traditional numerical methods by concentrating computational effort in regions of the problem domain where the solution is difficult to obtain. In this paper, the authors describe progress toward adding mesh refinement to MPSalsa, a computer program developed at Sandia National laboratories to solve coupled three-dimensional fluid flow and detailed reaction chemistry systems for modeling chemically reacting flow on large-scale parallel computers. Data structures that support refinement and dynamic load-balancing are discussed. Results using uniform refinement with mesh sequencing to improve convergence to steady-state solutions are also presented. Three examples are presented: a lid driven cavity, a thermal convection flow, and a tilted chemical vapor deposition reactor.
DOE
Computational Fluid Dynamics; Computational Grids; Computer Programs; Three Dimensional Flow; Reacting Flow; Free Convection; Dynamic Loads

19980210106 Sandia National Labs., Albuquerque, NM USA
A two-phase thermal model for subsurface transport on massively parallel computers
Martinez, M. J., Sandia National Labs., USA; Hopkins, P. L., Sandia National Labs., USA; [1997]; 6p; In English; 10th; Finite Elements In Fluids, 5-8 Jan. 1998, Tucson, AZ, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2542C; CONF-980125; DE98-000555; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Many research activities in subsurface transport require the numerical simulation of multiphase flow in porous media. This capability is critical to research in environmental remediation (e.g. contaminations with dense, non-aqueous-phase liquids), nuclear waste management, reservoir engineering, and to the assessment of the future availability of groundwater in many parts of the world. This paper presents an unstructured grid numerical algorithm for subsurface transport in heterogeneous porous media implemented for use on massively parallel (MP) computers. The mathematical model considers nonisothermal two-phase (liquid/gas) flow, including capillary pressure effects, binary diffusion in the gas phase, conductive, latent, and sensible heat transport. The Galerkin finite element method is used for spatial discretization, and temporal integration is accomplished via a predictor/corrector scheme. Message-passing and domain decomposition techniques are used for implementing a scalable algorithm for distrib-

uted memory parallel computers. Illustrative applications are shown to demonstrate capabilities and performance, one of which is modeling hydrothermal transport at the Yucca Mountain site for a radioactive waste facility.
DOE
Distributed Memory; Finite Element Method; Galerkin Method; Heat Transfer; Liquid Flow; Massively Parallel Processors; Memory (Computers); Multiphase Flow; Parallel Computers; Parallel Processing (Computers); Radioactive Wastes; Unstructured Grids (Mathematics)

19980210129 Los Alamos National Lab., NM USA
An experimental investigation of an air cooling scheme for removing environmentally imposed heat loads from the multiplicity and vertex detector's main enclosure
Cunningham, R., Los Alamos National Lab., USA; Bernardin, J. D., Los Alamos National Lab., USA; Simon-Gillo, J., Los Alamos National Lab., USA; Nov. 1997; 22p; In English
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-13377-MS; DE98-001866; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report presents a summary of an experimental investigation of a closed loop air cooling system designed to control the temperature and humidity in the main enclosure of the multiplicity and vertex detector (MVD). Measurements of the cooling air flow rate, the humidity levels inside and outside of the MVD, and the cooling air temperatures were used to assess the performance of the system and to characterize the system limitations and potential assembly problems. The results of the study indicate that several design changes are needed in the final design to meet the temperature and humidity operating requirements. A thorough set of design change recommendations that satisfy these operating criteria completes this report.
DOE
Air Cooling; Atmospheric Temperature; Loads (Forces); Cooling Systems; Humidity; Gas Cooling; Heat Transfer; Temperature Control

19980210188 California Inst. of Tech., Graduate Aeronautics Labs., Pasadena, CA USA
High Speed/Resolution/Dynamic-Range Imaging System for Subsonic and Supersonic Turbulent Flows ***Final Report***
Dimotakis, Paul E., California Inst. of Tech., USA; Lang, Daniel B., California Inst. of Tech., USA; Wadsworth, Mark V., California Inst. of Tech., USA; Apr. 30, 1998; 39p; In English
Contract(s)/Grant(s): F49620-95-1-0199
Report No.(s): AD-A346401; GALCIT-FM-98-8; AFRL-SR-BL-TR-98-0477; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Work performed under the sponsorship of this grant focused on instrumentation development leading to a high-speed, high-resolution and dynamic range digital imaging system, for use in subsonic and supersonic turbulent-flow applications, a well as applications in aerooptics and long-distance ground-based and air-borne platform observations. Accomplishments include the completion of an intermediate-capability system.
DTIC
Digital Systems; Turbulent Flow; Subsonic Flow; Supersonic Flow; Imaging Techniques

19980210228 ESDU International Ltd., London, UK
One-Dimensional Representation of Steady, Spatially Non-Uniform Flow. An Equivalent Mean-Value Set for Compressible Flow, Part 2, Implementation for an ideal, thermally-perfect gas
Feb. 1998; 62p; In English; Included in the Fluid Mechanics, Internal Flow Sub-series
Report No.(s): ESDU-97029; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97029 derives a mean-value set for representation of a non-uniform flow of a thermally-perfect gas at a duct section. A thermodynamically-rigorous, uniform reference-mean flow is derived by extending the stagnation reservoir concept for total-state conditions in uniform flow to non-uniform flow and requiring equality of the sectional mass flow and entropy between the non-uniform flow and a uniform reference-mean flow, leading to rational definitions of the mean pressure, temperature and density. Conventional "variable-c sub p" uniform flow relationships can then be applied for other properties of the reference-mean flow. Rationally-defined profile factors are used to relate other sectional properties of the real flow to the reference-mean flow. This new method allows for the simultaneous variation of total and static temperature and pressure across a duct section and enables the use of temperature-entropy and Mollier diagrams. It provides a correct allocation of work and irreversibilities among components of a multi-component system so that artificial losses are not attributed upstream or

downstream of the duct section. Consistent comparison with other averaging methods is possible. Several examples illustrate analytically the use of the model.
Author
Compressible Flow; Ideal Gas; Uniform Flow; Steady Flow; Mass Flow; Data Structures

19980210233 ESDU International Ltd., London, UK
Heat Transfer Enhancement in Heat Exchanger Design and Utilisation, Part 1, Tube Inserts in Single-Phase Flow
Apr. 1998; 64p; In English; Included in the Heat Transfer Sub-series
Report No.(s): ESDU-97007; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97007 introduces a computer program, ENTRANS, which generates tubes and a range of tube insert types, operating within ranges of tubeside pressure drop. New correlations were developed from published data for the estimation of tubeside heat transfer and pressure drop of single-phase Newtonian fluids. The following types of tube insert are considered: twisted tapes (high and low twist ratios), helically-coiled wires, wire matrix inserts (high and low matrix density), static mixers and core tubes. ESDU 97007 provides a practical guide to the benefits of tube inserts in and illustrates how those benefits can be evaluated rapidly using ENTRANS. ESDU 97007 concentrates mainly on the use of tube inserts in new equipment, but guidance is given on the benefits of their use to improve the performance of existing exchangers. ENTRANS can be used to investigate the effects of tube inserts on a number of factors including area reduction, tube pass reduction, reduction in the number of shells and the effective use of pressure drop. Since ENTRANS provides predictions of the film temperature at the tube wall, it can also be used to assess fouling mitigation in thermally-controlled fouling situations. The full design methodology, including the new correlations, is provided in ESDU 97007 and is illustrated by six worked examples, in which design geometries are selected on the basis of least budget cost. ENTRANS runs under Windows ’95 and makes full use of Windows graphical facilities to present design data in both graphical and tabular forms.
Author
Heat Transfer; Heat Exchangers; Design Analysis; Technology Utilization; Computer Programs

19980210240 Argonne National Lab., IL USA
A computational study of the effect of unstructured mesh quality on solution efficiency
Batdorf, M., Argonne National Lab., USA; Freitag, L. A., Argonne National Lab., USA; Ollivier-Gooch, C., British Columbia Univ., Canada; 1997; 11p; In English; 13th; Computational Fluid Dynamics Conference, 29 Jun. - 2 Jul. 1997, Snowmass, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/MCS/CP-93710; CONF-970666; DE97-053697; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

It is well known that mesh quality affects both efficiency and accuracy of CFD solutions. Meshes with distorted elements make solutions both more difficult to compute and less accurate. We review a recently proposed technique for improving mesh quality as measured by element angle (dihedral angle in three dimensions) using a combination of optimization-based smoothing techniques and local reconnection schemes. Typical results that quantify mesh improvement for a number of application meshes are presented. We then examine effects of mesh quality as measured by the maximum angle in the mesh on the convergence rates of two commonly used CFD solution techniques. Numerical experiments are performed that quantify the cost and benefit of using mesh optimization schemes for incompressible flow over a cylinder and weakly compressible flow over a cylinder.
DOE
Unstructured Grids (Mathematics); Incompressible Flow; Grid Generation (Mathematics); Mathematical Models; Problem Solving

19980210281 Sandia National Labs., Albuquerque, NM USA
Massively parallel computation of 3D flow and reactions in chemical vapor deposition reactors
Salinger, A. G., Sandia National Labs., USA; Shadid, J. N., Sandia National Labs., USA; Hutchinson, S. A., Sandia National Labs., USA; Hennigan, G. L., Sandia National Labs., USA; Devine, K. D., Sandia National Labs., USA; Moffat, H. K., Sandia National Labs., USA; Dec. 1997; 33p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3092; DE98-002707; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Computer modeling of Chemical Vapor Deposition (CVD) reactors can greatly aid in the understanding, design, and optimization of these complex systems. Modeling is particularly attractive in these systems since the costs of experimentally evaluating many design alternatives can be prohibitively expensive, time consuming, and even dangerous, when working with toxic chemicals like Arsine (AsH(sub 3)): until now, predictive modeling has not been possible for most systems since the behavior is three-dimensional and governed by complex reaction mechanisms. In addition, CVD reactors often exhibit large thermal gradients, large changes in physical properties over regions of the domain, and significant thermal diffusion for gas mixtures with widely varying molecular weights. As a result, significant simplifications in the models have been made which erode the accuracy of the models' predictions. In this paper, the authors will demonstrate how the vast computational resources of massively parallel computers can be exploited to make possible the analysis of models that include coupled fluid flow and detailed chemistry in three-dimensional domains. For the most part, models have either simplified the reaction mechanisms and concentrated on the fluid flow, or have simplified the fluid flow and concentrated on rigorous reactions. An important CVD research thrust has been in detailed modeling of fluid flow and heat transfer in the reactor vessel, treating transport and reaction of chemical species either very simply or as a totally decoupled problem. Using the analogy between heat transfer and mass transfer, and the fact that deposition is often diffusion limited, much can be learned from these calculations; however, the effects of thermal diffusion, the change in physical properties with composition, and the incorporation of surface reaction mechanisms are not included in this model, nor can transitions to three-dimensional flows be detected.

DOE

Vapor Deposition; Design Analysis; Heat Transfer; Parallel Flow; Reaction Kinetics; Prediction Analysis Techniques; Three Dimensional Flow

19980210282 Los Alamos National Lab., NM USA

Software requirements, design, and verification and validation for the FEHM application - a finite-element heat- and mass-transfer code

Dash, Z. V., Los Alamos National Lab., USA; Robinson, B. A., Los Alamos National Lab., USA; Zyvoloski, G. A., Los Alamos National Lab., USA; Jul. 1997; 220p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-13305-MS; DE98-002760; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The requirements, design, and verification and validation of the software used in the FEHM application, a finite-element heat- and mass-transfer computer code that can simulate nonisothermal multiphase multicomponent flow in porous media, are described. The test of the DOE Code Comparison Project, Problem Five, Case A, which verifies that FEHM has correctly implemented heat and mass transfer and phase partitioning, is also covered.

DOE

Finite Element Method; Program Verification (Computers); Multiphase Flow; Computer Programming; Computer Programs

19980210293 Minnesota Univ., Dept. of Aerospace Engineering and Mechanics, Minneapolis, MN USA

Effect of Swirl on Turbulent Structures in Supersonic Jets *Final Report*

Rao, Ram Mohan, Minnesota Univ., USA; Lundgren, Thomas S., Minnesota Univ., USA; Mar. 1998; 32p; In English

Contract(s)/Grant(s): NCC2-5221; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Direct Numerical Simulation (DNS) is used to study the mechanism of generation and evolution of turbulence structures in a temporally evolving supersonic swirling round jet and also to examine the resulting acoustic radiations. Fourier spectral expansions are used in the streamwise and azimuthal directions and a 1-D b-spline Galerkin representation is used in the radial direction. Spectral-like accuracy is achieved using this numerical scheme. Direct numerical simulations, using the b-spline spectral method, are carried out starting from mean flow initial conditions which are perturbed by the most unstable linear stability eigenfunctions. It is observed that the initial helical instability waves evolve into helical vortices which eventually breakdown into smaller scales of turbulence. 'Rib' structures similar to those seen in incompressible mixing layer flow of Rogers and Moserl are observed. The jet core breakdown stage exhibits increased acoustic radiations.

Author

Swirling; Turbulent Flow; Supersonic Jet Flow; Sound Waves

19980210355 Sandia National Labs., Albuquerque, NM USA

Analysis of a micro-scale pump which uses controlled acoustic streaming for fluid locomotion

Dohner, J. L., Sandia National Labs., USA; Jan. 1998; 19p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-98-0207; DE98-002762; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In this report the analysis of a micro-scale pump is described. This micro-pump uses active control to produce a distributed body force in a fluid micro-channel. The desired effect of this body force is to drive fluid through the channel. Limitations, assumptions, and design parameters are discussed. The mathematical analysis of pump dynamics is explained in detail. A perturbation analysis is used on the equations of mass, momentum and state to produce equations of motion for first and second order effects. The first order effects are described by linear wave motion in the fluid and are found by using integral equation methods. The second order effects are driven by body forces resulting from first order effects. Thus, by controlling the production of wave motion in the channel, second order excitation can also be controlled. This report is all theory and therefore needs experimental validation. Although many of the assumptions used in this report have been used elsewhere in the literature and have been found to be sufficient, there are many aspects of the problem which have been left unresolved. In particular, flow separation in the fluid channel is a critical problem. If the fluid does not separate, pumping will occur through the channel, however, if internal or external forces are not sufficient to stop separation, this type of pump will not function.

DOE

Fluid Flow; Boundary Layer Separation; Design Analysis; Acoustic Streaming; Active Control; Microchannels; Equations of Motion

19980210361 Sandia National Labs., Albuquerque, NM USA

Molecular dynamics simulations of microscale fluid transport

Wong, C. C., Sandia National Labs., USA; Lopez, A. R., Sandia National Labs., USA; Stevens, M. J., Sandia National Labs., USA; Plimpton, S. J., Sandia National Labs., USA; Feb. 1998; 53p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-98-0336; DE98-003215; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Recent advances in micro-science and technology, like Micro-Electro-Mechanical Systems (MEMS), have generated a group of unique liquid flow problems that involve characteristic length scales of a Micron. Also, in manufacturing processes such as coatings, current continuum models are unable to predict microscale physical phenomena that appear in these non-equilibrium systems. It is suspected that in these systems, molecular-level processes can control the interfacial energy and viscoelastic properties at the liquid/solid boundary. A massively parallel molecular dynamics (MD) code has been developed to better understand microscale transport mechanisms, fluid-structure interactions, and scale effects in micro-domains. Specifically, this MD code has been used to analyze liquid channel flow problems for a variety of channel widths, e.g. 0.005-0.05 microns. This report presents results from MD simulations of Poiseuille flow and Couette flow problems and addresses both scaling and modeling issues. For Poiseuille flow, the numerical predictions are compared with existing data to investigate the variation of the friction factor with channel width. For Couette flow, the numerical predictions are used to determine the degree of slip at the liquid/solid boundary. Finally, the results also indicate that shear direction with respect to the wall lattice orientation can be very important. Simulation results of microscale Couette flow and microscale Poiseuille flow for two different surface structures and two different shear directions will be presented.

DOE

Massively Parallel Processors; Parallel Processing (Computers); Continuum Modeling; Couette Flow; Friction Factor; Laminar Flow

19980210417 Rensselaer Polytechnic Inst., Troy, NY USA

The development of multidimensional two-fluid modeling capabilities

Drew, D. A., Rensselaer Polytechnic Inst., USA; Lahey, R. T., Rensselaer Polytechnic Inst., USA; Sep. 23, 1997; 12p; In English

Contract(s)/Grant(s): DE-FG02-86ER-13489

Report No.(s): DOE/ER/13489-T1; DE98-002620; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A fundamental problem in gas/liquid two-phase flow is the prediction of flow regime. Important macroscopic parameters such as pressure drop, wall heat transfer rate and critical heat flux (CHF) depend on the topology of the interface and the distribution of gas and liquid across the channel. The normal means of treating flow regimes is through a flow regime map, where a point in parameter space is assigned a flow regime, and the analysis proceeds based on models for the type of flow regime that is then appropriate. However, flow regime maps, and the models based on them do not work over a broad range of flows; indeed, the very concept of flow regime is limited in application to the particular geometry and range of conditions for which the flow regime map was developed. In addition, flow regime maps are not valid for transient conditions. The authors are developing a model for two-

phase flow that is capable of describing the range of flow regimes observed in vertical pipe flow without reliance on a flow regime map. The model is capable of describing both steady and transient flows over a wide range of conditions, and consists of multidimensional equations of balance of mass, energy, and momentum for four fields; namely, continuous gas (cg), continuous liquid (cl), dispersed gas, or bubbles (dg), and dispersed liquid, or droplets (dl). to see that the four-field model is capable of predicting how given fluxes of gas and liquid distribute themselves in pipe or channel flow, consider the schematic of different flow regimes in figure 1. by describing the transverse distribution of bubbles and droplets being carried in continuous liquid and gas, respectively, most fundamental features of flow regimes can be captured. In addition, the local nature of the model requires distributed sources of mass and momentum for each field.
DOE
Two Phase Flow; Channel Flow; Bubbles; Pipe Flow; Liquid Flow; Heat Flux; Gas Flow

19980210545 Lawrence Livermore National Lab., Livermore, CA USA
Comparison of reflection boundary conditions for langevin equation modeling of convective boundary layer dispersion
Nasstrom, J. S., Lawrence Livermore National Lab., USA; Ermak, D. L., Lawrence Livermore National Lab., USA; Apr. 1997; 5p; In English; 12th; Symposium on Boundary Layers and Turbulence, 28 Jul. - 1 Aug. 1997, Vancouver, Canada
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-126353; CONF-970760; DE98-051090; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Lagrangian stochastic modeling based on the Langevin equation has been shown to be useful for simulating vertical dispersion of trace material in the convective boundary layer or CBL. This modeling approach can account for the effects of the long velocity correlation time scales, skewed vertical velocity distributions, and vertically inhomogeneous turbulent properties found in the CBL. It has been recognized that Langevin equation models assuming skewed but homogenous velocity statistics can capture the important aspects of diffusion from sources in the CBL, especially elevated sources. We compare three reflection boundary conditions using two different Langevin-equation-based numerical models for vertical dispersion in skewed, homogeneous turbulence. One model, described by Ermak and Nasstrom (1995) is based on a Langevin equation with a skewed random force and a linear deterministic force. The second model, used by Hurley and Physick is based on a Langevin equation with a Gaussian random force and a non-linear deterministic force. The reflection boundary conditions are all based on the approach described by Thompson and Montgomery.
DOE
Boundary Conditions; Boundary Layers; Convection; Diffusion; Homogeneous Turbulence; Lagrangian Function

19980210684 Office National d'Etudes et de Recherches Aerospatiales, Cheminh de la Huniere et des Joncherettes, Palaiseau, France
Nostramarine: A Concept of Multistatic Detection Adjusted to Surveillance of Low Altitude Targets ***Nostramarine: Un Concept de Detection Multistatique Adapte a la Surveillance des Cibles Basse Altitude***
Lesturgie, M., Office National d'Etudes et de Recherches Aerospatiales, France; Flecheux, M., Office National d'Etudes et de Recherches Aerospatiales, France; Apr. 1998; 11p; In French; Also announced as 19980210650; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes a new concept of over-the-horizon detection adjusted to surveillance of low altitude targets. The radar unit, in bistatic configuration, consists of a receiving system installed in the vicinity of the area to be monitored, and of a distant emitter, located behind the zone to be monitored. Overall functioning of the radar unit relies on combination of an 'ionospheric' propagation mode and a 'surface wave' propagation mode. Thus, because of the properties of reflection of electromagnetic waves in the ionosphere, the low altitude targets can be illuminated by the distant emitter, which will function at high frequencies. The electromagnetic waves, following interaction with the targets, will propagate by following the curvature of the earth (by 'surface waves') up to the receiving network. This concept comprises an alternative to the over-the-horizon radar by traditional surface waves (OTH-S), by placing in the geographic area to be monitored, the advantage of a passive and discrete device, which is provided with important integration capabilities.
Author
Ionospheric Propagation; Surveillance; Propagation Modes; Over-The-Horizon Radar; Electromagnetic Radiation; Earth Surface

19980210706 Lawrence Livermore National Lab., Livermore, CA USA

Progress in mix modeling

Harrison, A. K., Lawrence Livermore National Lab., USA; Mar. 14, 1997; 8p; In English; 9th; Nuclear Explosives Code Developers' Conference, 22-25 Oct. 1996, San Diego, CA, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-126738; CONF-9610209-5; DE97-053405; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We have identified the Cranfill multifluid turbulence model as a starting point for development of subgrid models of instability, turbulent, and mixing processes. We have differenced the closed system of equations in conservation form, and coded them in the object-oriented hydrodynamics code FLAG, which is to be used as a testbed for such models.

DOE

Turbulence Models; Mixing; Hydrodynamics; Flow Stability; Turbulent Flow; Computer Programs

19980210767 National Inst. for Fusion Science, Toki, Japan

Identification and Analysis of Vortical Structures

Miura, H., National Inst. for Fusion Science, Japan; Kida, S., National Inst. for Fusion Science, Japan; Nov. 1997; ISSN 0915-633X; 36p; In English; Original contains color illustrations

Report No.(s): NIFS-520; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Various identification and visualization methods of vortical structure, especially of slender vortices, are critically reviewed with a special attention to their objectivity. The sectional-swirl-and-pressure-minimum scheme is presented as a new identification method and applied to homogeneous turbulence. Since the physical quantities associated with an individual vortex can be analyzed separately, this new scheme enables us to investigate quantitatively various physical characteristics related to vortices, such as the variations of the core shape, the circulation and the vorticity vector along a vortex and the temporal evolution of arbitrarily selected vortices.

Author

Structural Analysis; Vorticity; Procedures

19980210807 Goettingen Univ., Inst. fuer Numerische und Angewandte Mathematik, Germany

Finite element solution of incompressible and nonisothermal flow problems in three-dimensional domains with complex geometry ***Final Report Finite-Elemente-Loesung inkompressibler und nichtisothermer Innenstroemungen in dreidimensionalen Gebieten komplexer Geometrie. Schlussbericht***

Auge, A., Goettingen Univ., Germany; Lube, G., Goettingen Univ., Germany; Otto, F. C., Goettingen Univ., Germany; Jan. 08, 1998; 25p; In German

Contract(s)/Grant(s): Foerderkennzeichen BMBF 03LU7G

Report No.(s): ETDE-DE-645; DE98-742323; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The main result of the project is the finite-element research code Parallel NS for solving incompressible and nonisothermal room-air flow problems. A parallel variant is based on a new nonoverlapping domain decomposition method. It is up to now applicable to laminar flow problems. A significant acceleration of the method has been achieved via theoretical and practical contributions to the optimization of the interface conditions of the iteratively decoupled linearized problems (energy equations and linearized Navier-Stokes problem), improvement of the discretization (stabilized Galerkin method) and preconditioned solvers of Krylov type for the large linear systems. A CAD-mesh generator is used with the code for the treatment of domains with a complex 2D- or 3D geometry. Furthermore, mesh adaptation (e.g. in boundary layers) is possible for the 2D-case. The applicability of the code has been demonstrated for 2D- and 3D-laminar benchmark problems. The parallel version has been implemented on (heterogenous) clusters with a moderate number of powerful processors using the message-passing system PVM. The performance of a domain decomposition method with minimal overlap has been tested on a transputer system in order to study possibilities of distributed computation for the simulation of room-air flow problems. The development of the code Parallel NS is only the first step in a long-term research project. It will be continued systematically within theoretical projects and applied to more sophisticated room-air flow problems.

DOE

Finite Element Method; Computational Fluid Dynamics; Computational Grids; Air Flow; Galerkin Method; Incompressible Flow; Laminar Flow; Navier-Stokes Equation

19980210820 Los Alamos National Lab., NM USA

An experimental investigation of a liquid cooling scheme for the low dropout voltage regulators of the multiplicity and vertex detector

Bernardin, J. D., Los Alamos National Lab., USA; Bosze, E., Los Alamos National Lab., USA; Oct. 1997; 23p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-13378-MS; DE98-001728; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report presents a summary of an experimental investigation of a liquid cooling system for the low dropout voltage regulators in the multiplicity and vertex detector (MVD), a device used to determine and characterize the collision location of two accelerated heavy ions. The coolant temperatures and flow rates as well as the voltage regulator operating temperatures were used to assess and optimize the performance of the proposed cooling system, identify potential assembly problems and system limitations, and provide the necessary information for designing and sizing the final MVD cooling system components. The MVD is part of the PHENIX experiment at Brookhaven RHIC.

DOE

Liquid Cooling; Dropouts; Low Voltage

35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Aircraft Instrumentation, and 19 Space Instrumentation.

19980206616 Central Mechanical Engineering Research Inst., Durgapur, India

Transducers Using Strain Gauges: An Overview

Sarkar, A., Central Mechanical Engineering Research Inst., India; Mechanical Engineering Bulletin; Dec. 1988; ISSN 0379-5527; Volume 19, Nos. 3 and 4, pp. 58-65; In English; ISBN 3-1778-00010-7122; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The strain gauge technique of measurements is widely used in stress and vibration analysis. Special type transducers are also made using such gauges. The principal of strain gauge is based on measurement of changes in electrical resistance due to mechanical strain/deformation. The success of implementing this well known technique effectively for solving practical problems depends largely on the proper method of selection and fixation of gauges, the choice of instruments and methods of measurement, which are missed in many applications. The paper deals with some of the salient features for using strain gauges and the strain gauge type transducers along with necessary instrumentation. Basic considerations to design a strain transducer have also been highlighted.

Author

Transducers; Electrical Measurement; Procedures; Measuring Instruments; Deformation; Dynamic Structural Analysis

19980206765 Bechtel Hanford, Inc., Richland, WA USA

Technical basis to describe and document the use of the E-600 and SHP-380 detector

Hensley, J. R., Bechtel Hanford, Inc., USA; Jun. 1997; 13p; In English

Contract(s)/Grant(s): DE-AC06-93RL-12367

Report No.(s): BHI-01054; DE97-053982; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This technical basis document describes and documents the parameters under which the Eberline E-600 ratemeter and the associated SHP-380 detector can be operated to quantify alpha and beta contamination levels.

DOE

Contamination; Measuring Instruments; Beta Particles; Alpha Particles

19980206776 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

A linear motion machine for soft x-ray interferometry

Duarte, R., California Univ., Lawrence Berkeley Lab., USA; Howells, M. R., California Univ., Lawrence Berkeley Lab., USA; Hussain, Z., California Univ., Lawrence Berkeley Lab., USA; Lauritzen, T., California Univ., Lawrence Berkeley Lab., USA; McGill, R., California Univ., Lawrence Berkeley Lab., USA; Jul. 1997; 12p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA,

USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): DE-AC03-76SF-00098
Report No.(s): LBNL-40494; CONF-970706; LSBL-400; DE97-054548; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A Fourier Transform x-ray Spectrometer has been designed and built for use at the Advanced light source at Lawrence Berkeley National Laboratory. The design requires a total rectilinear motion of 15 mm with a maximum pitch error of the stage below +/- 0.4 micro-radians, to achieve this the authors chose to build the entire machine as a single monolithic flexure. A hydraulic driver with sliding O-ring seals was developed with the intention to provide motion with a stick-slip position error of less than 0.8 nm at a uniform velocity of 20 micro-m/sec. The machine is comprised of two pairs of nested linear motion flexures, all explained by means of a theory published earlier by Hathaway. Certain manufacturing errors were successfully corrected by an extra weak-link feature in the monolith frame. The engineering details of all the subsystems of the linear motion machine are described and measured performance reported.

DOE

X Ray Spectrometers; Flexing; Interferometry; Light Sources

19980209661 Lawrence Livermore National Lab., Livermore, CA USA

LIFTIRS, the Livermore imaging FTIR Spectrometer

Bennett, C. L., Lawrence Livermore National Lab., USA; Aug. 1997; 20p; In English; 11th; Fourier Transform Spectroscopy, 10 - 15 Aug. 1997, Athens, GA, USA
Contract(s)/Grant(s): DE-AC06-93RL-12367; W-7405-Eng-48
Report No.(s): UCRL-JC-128253; CONF-970812; DE98-051067; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The imaging FTIR spectrometer was invented 25 years ago. Only recently, however, with the development of infrared focal plane array technology and high speed microprocessors, has the imaging FTIR spectrometer become a practical instrument. Among the class of imaging spectrometer instruments, the imaging Fourier transform spectrometer enjoys a great advantage in terms of its calibratibility, sensitivity, broad band coverage and resolution flexibility. Recent experience with the LIFTIRS instrument is summarized. As a concrete example of the acquisition, calibration, and comprehension of the data from an imaging Fourier transform spectrometer, the case history of a geological sample is discussed in great detail. In particular, the importance of principal component analysis to imaging spectroscopy is especially emphasized. It is shown how the various spatial/spectral constituents within a sample can be detected, located, identified and quantified.

DOE

Fourier Transformation; Infrared Spectrometers; Imaging Spectrometers; Principal Components Analysis

19980209798 Army Research Lab., Sensors and Electron Devices Directorate, Adelphi, MD USA

QWIP and MCT for Long Wavelength and Multicolor Focal Plane Array Applications, *Nov. 1996 - Jul. 1997*

Tidrow, Meimei Z., Army Research Lab., USA; May 1998; 36p; In English
Report No.(s): AD-A345861; ARL-TR-1534; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Infrared (IR) sensor technology is critical to all phases of ballistic missile defense. Traditionally, material systems such as indium antimonide (InSb), platinum silicide (PtSi), mercury cadmium telluride (MCT), and arsenic doped silicon (Si:As) have dominated IR detection. Improvement in surveillance sensors and interceptor seekers requires large, highly uniform, and multicolor (or multispectral) IR focal plane arrays involving mid-wave (NW), long-wave (LW), and very-long-wave (VLW) IR regions. Among the competing technologies are quantum-well infrared photodetectors (QWIPs) base on lattice-matched GaAs/AlGaAs an strained layer InGaAs/AlGaAs material systems. Even though QWIP cannot compete with MCT at the single device level (considering the quantum efficiency and D*), it has potential advantages over MCT for LW and VLW focal plane array applications in terms of the array size, uniformity, operability, yield, reliability, and cost effectiveness. QWIPs are especially promising for VLWIR at low temperature operation, and when simultaneous multicolor detection with a single focal plane array is desired. Operating a VLWIR focal plane array at low background is a challenge to both MCT and QWIP, while QWIP has more potential to be realized due to its good properties at low temperatures. In this paper, I discuss cooled IR technology with an emphasis on QWIP and MCT. I give details concerning device physics, material growth, device fabrication, device performance, and cost effectiveness for LWIR, VLWIR, and multicolor applications.

DTIC

Quantum Wells; Infrared Detectors; Wavelengths; Focal Plane Devices; Ballistic Missiles; Detection; Missile Defense; Infrared Radiation

19980209862 Westinghouse Savannah River Co., Aiken, SC USA

FY 1997 report on hydrogen sensors for enhanced surveillance program project LL-ESP96-13

Nave, S. E., Westinghouse Savannah River Co., USA; Sep. 30, 1997; 14p; In English

Contract(s)/Grant(s): DE-AC09-96SR-18500

Report No.(s): WSRC-RP-97-00904; DE98-050546; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A prototype for an all fiber optic hydrogen sensor system was developed. Capability to measure concentrations of hydrogen in air or nitrogen in the range of 0.5% to 4.0% with a resolution of 0.1% was demonstrated. A DC planar magnetron sputter system was procured and assembled for use in the thin metal film deposition necessary for fabrication of the palladium and palladium-silver alloy sensors used in this development. A method was developed to coat the metal films with an organic coating permeable to hydrogen but not oxygen and other reactive gases. The results of tests on these sensors gave positive results but long-term studies are required to confirm protection under conditions expected to be encountered in a real world application. A new type of sensor base on a layered yttrium/palladium structure was constructed and tested. The greater magnitude and wavelength dependence of the spectral response observed may lead to a more robust sensor. However, the need to have oxygen present for this sensor in order for it to rapidly recover after exposure to hydrogen may complicate its use.

DOE

Hydrogen; Surveillance; Fiber Optics; Fabrication; Prototypes

19980210096 Oak Ridge Y-12 Plant, TN USA

Exhaust gas sensors

Hiller, J., Lockheed Martin Energy Systems, Inc., USA; Miree, T. J., Ford Motor Co., USA; Feb. 09, 1997; 3p; In English

Contract(s)/Grant(s): DE-AC05-84OR-21400

Report No.(s): Y/AMT-417; DE97-008286; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The automotive industry needed a fast, reliable, under-the-hood method of determining nitrogen oxides in automobile exhaust. Several technologies were pursued concurrently. These sensing technologies were based on light absorption, electrochemical methods, and surface mass loading. The Y-12 plant was selected to study the methods based on light absorption. The first phase was defining the detailed technical objectives of the sensors--this was the role of the automobile companies. The second phase was to develop prototype sensors in the laboratories--the national laboratories. The final phase was testing of the prototype sensors by the automobile industries. This program was canceled a few months into what was to be a three-year effort.

DOE

Gas Detectors; Exhaust Gases; Automobiles; Exhaust Emission

19980210166 Purdue Univ., Thermal Sciences and Propulsion Center, West Lafayette, IN USA

Fire Detection Using Reflected Near Infrared Radiation and Source Temperature Discrimination

Lloyd, A. C., Purdue Univ., USA; Zhu, Y. J., Purdue Univ., USA; Tseng, L. K., Purdue Univ., USA; Gore, J. P., Purdue Univ., USA; Sivathanu, Y. R., Purdue Univ., USA; Apr. 1998; 52p; In English

Contract(s)/Grant(s): NIST-60NANB5D0113

Report No.(s): PB98-146145; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A new type of near infrared (NIR) fire detector which utlizes a statistical analysis of apparent source temperatures of fire was developed. The NIR fire detector measures the spectral radiation intensities emanating from fires at 900 and 1000 nm. These measurements are used to obtain and a time series of apparent source temperatures. The near infrared radiation characteristics of five standard test fires specified in the guidelines of the European Committee for Standardization were measured and utilized to develop a fire detection algorithm. The five test fires specified in the guidelines involved a heptane pool, a polyurethane foam, a wooden crib, a smoldering cotton and a smoldering wood. The NIR fire detector was evaluated for sensitivity to both direct and reflected radiation from the five test fires. When direct radiation is incident on the NIR fire detector, four of the five test fires were always detected. The smoldering wood fire was detected only if the NIR fire detector was very close. The NIR fire detector can also detect the heptane pool, the polyurethane foam and the wooden crib fires from reflected radiation. The response time of the NIR fire detector ranged from approximately 1 to 4 minutes for the open fires. The NIR fire detector had no instances of false alarms during the test period.

NTIS

Infrared Detectors; Near Infrared Radiation; Polyurethane Foam; Radiant Flux Density

19980210168 National Inst. of Standards and Technology, Gaithersburg, MD USA

Journal of Research of the National Institute of Standards and Technology, Volume 103

1998; ISSN 1044-677X; 165p; In English

Report No.(s): PB98-146418; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Contents include the following: Ultraviolet Spectral Irradiance Scale Comparison: 210 nm to 300 nm; The 1995 North American Interagency Intercomparison of Ultraviolet Monitoring Spectroradiometers; High-Temperature Adiabatic Calorimeter for Constant-Volume Heat Capacity Measurements of Compressed Gases and Liquids; Moving Particles Through a Finite Element Mesh; Metrological Timelines in Traceability.

NTIS

Finite Element Method; Gas Analysis; High Temperature; Light (Visible Radiation); Liquids

19980210356 Sandia National Labs., Albuquerque, NM USA

Microholographic computer generated holograms for security applications: Microtags

Sweatt, W. C., Sandia National Labs., USA; Warren, M. E., Sandia National Labs., USA; Kravitz, S. H., Sandia National Labs., USA; Jan. 1998; 30p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-98-0046; DE98-002763; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We have developed a method for encoding phase and amplitude in microscopic computer-generated holograms (microtags) for security applications. Eight-by-eight-cell and 12 x 12-cell phase-only and phase-and-amplitude microtag designs has been exposed in photoresist using the extreme-ultraviolet (13.4 nm) lithography (EUVL) tool developed at Sandia National Laboratories. Using EUVL, we have also fabricated microtags consisting of 150-nm lines arranged to form 300-nm-period gratings. The microtags described in this report were designed for readout at 632.8 nm and 442 nm. The smallest microtag measures 56 (mu)m x 80 (mu)m when viewed at normal incidence. The largest microtag measures 80 by 160 microns and contains features 0.2 (mu)m wide. The microtag design process uses a modified iterative Fourier-transform algorithm to create either phase-only or phase-and-amplitude microtags. We also report on a simple and compact readout system for recording the diffraction pattern formed by a microtag. The measured diffraction patterns agree very well with predictions. We present the results of a rigorous coupled-wave analysis (RCWA) of microtags. Microtags are CD modeled as consisting of sub-wavelength gratings of a trapezoidal profile. Transverse-electric (TE) and TM readout polarizations are modeled. The objective of our analysis is the determination of optimal microtag-grating design parameter values and tolerances on those parameters. The parameters are grating wall-slope angle, grating duty cycle, grating depth, and metal-coating thickness. Optimal microtag-grating parameter values result in maximum diffraction efficiency. Maximum diffraction efficiency is calculated at 16% for microtag gratings in air and 12% for microtag gratings underneath a protective dielectric coating, within fabrication constraints. TM-microtag gratings. Finally, we suggest several additional microtag concepts, such as two-dimensional microtags and pixel-code microtags.

DOE

Holography; Design Analysis; Fourier Transformation; Dielectrics

19980210379 Fermi National Accelerator Lab., Batavia, IL USA

Test beam performance of CDF plug upgrade EM calorimeter

Fukui, Y., National Lab. for High Energy Physics, Japan; Jan. 1998; 8p; In English; Scintillating and Fiber Detectors (Scifi 1997), 2-6 Nov. 1997, South Bend, IN, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-98/032-E; CONF-9711110; DE98-051891; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

CDF Plug Upgrade(tile-fiber) EM Calorimeter performed resolution of 15% radical E(circle plus)0.7% with non-linearity less than 1% in a energy range of 5-180 GeV at Fermilab Test Beam. Transverse uniformity of inside-tower-response of the EM Calorimeter was 2.2% with 56 GeV positron, which was reduced to 1.0% with response map correction. We observed 300 photo electron/GeV in the EM Calorimeter. Ratios of EM Calorimeter response to positron beam to that to (exp 137)Cs Source was stable within 1% in the period of 8 months.

DOE

Plugs; Calorimeters; Tiles

19980210406 Norwegian Defence Research Establishment, Kjeller, Norway

Gyrocompass for Static Applications Based on Fiberoptic Gyro ***Statisk Gyrokompass Med Fiberoptisk Gyro***

Blomdal, Odd Johan, Norwegian Defence Research Establishment, Norway; Apr. 15, 1998; 128p; In Norwegian

Contract(s)/Grant(s): FFIE Proj. 697/134

Report No.(s): FFI/RAPPORT-98/01807; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

This report is a MSc thesis in computer of science at the University of Oslo. It's analysing the performance of a static north finder based on a fiberoptic gyroscope. The accuracy of several north finding algorithms are investigated both analytical and by computer simulations, and a conclusion is drawn. The report also investigate gyro characterisation and gyro parameter estimation using the Allan variance method. A model of a high accuracy gyroscope, Fibersense FOG1000/80, based on preliminary data from the manufacturer is used during the study.

Author

Performance Tests; Gyrocompasses; Computerized Simulation

19980210537 Fermi National Accelerator Lab., Batavia, IL USA

Test of the DEP hybrid photodiode in 5 Tesla Magnet

Green, D, Minnesota Univ., USA; Freeman, J., Minnesota Univ., USA; Ronzhin, A., Minnesota Univ., USA; Cushman, R., Minnesota Univ., USA; Heering, A., Minnesota Univ., USA; Oct. 1997; 11p; In English

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL-TM-2027; DE98-051456; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The CMS detector is designed so that the tile/fiber Hadronic CALorimeter (HCAL) is immersed in a 4 Tesla magnetic field. The Hybrid PhotoDiode (HPD) will be used as the photodetector. Below we present the experiment data which we obtained on the HPD behavior in a magnetic field.

DOE

Photodiodes; Magnetic Fields; Performance Tests

19980210573 Los Alamos National Lab., NM USA

Testing of the small sample (new concept) calorimeter received from EG and G Mound Applied Technology

Cech, R., Los Alamos National Lab., USA; Craft, M., Los Alamos National Lab., USA; Fultz, R., Los Alamos National Lab., USA; [1998]; 9p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3934; DE98-001577; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Small Sample calorimeter, also known as the New Concepts calorimeter, has undergone testing in the transfer of the calorimeter operations to Los Alamos National Laboratory from EG&G Mound Applied Technology (Mound), Miamisburg, Ohio, in September 1996. The design of the calorimeter incorporated several new concepts, thus the name New Concepts. The normal water bath was replaced with a small self-contained bath and control that used a thermal electric cooling/heating device to supply the control for the bath temperature. This change replaces the large refrigeration unit that has been used in the past, thus reducing the weight and the power required to operate the system. The design was done to allow the complete calorimeter system to be contained in a single electronics rack. With the new electronics package, this change would allow the unit to use a short electronics rack with a laptop computer and make the complete system transportable. by reducing the amount of water in the bath, the control and size of the bath could also be reduced. by making the bath self-contained and sealed, there would be no need to replace water or supply de-ionized water for the system. This change would remove some of the concerns about using a water bath in certain situations. The water would be about 5 gal. or less depending on the size of the calorimeter. The present system is a 5 in. diameter sample chamber system which can accept most older material now in storage. It will not handle the new 3013 size container as built but could be easily designed for that size. There is also a new sensor design that takes less wire and can eliminate the constant current source used in past Mound calorimeter designs. With the new digital voltmeters, the complete system could be run from a single meter with the ability to monitor bath and room as well as the calorimeter operating voltages for electrical heater runs. A few problems, though minor, need to be corrected to make the system available.

DOE

Calorimeters; Equipment Specifications; Performance Tests

19980210575 Los Alamos National Lab., NM USA

Scanning probe microscopy competency development

Hawley, M. E., Los Alamos National Lab., USA; Reagor, D. W., Los Alamos National Lab., USA; Jia, Quan Xi, Los Alamos National Lab., USA; [1998]; 9p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3153; DE98-001590; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The project collaborators developed an ultra-high vacuum scanning tunneling microscope (UHV-STM) capability, integrated it with existing scanning probe microscopes, and developed new, advanced air-based scanning force techniques (SPMs). Programmatic, basic, and industrially related laboratory research requires the existence of SPMs, as well as expertise capable of providing local nano-scale information. The UHV-STM capability, equipped with load-lock system and several surface science techniques, will allow introduction, examination, and reaction of surfaces prepared under well-controlled vacuum conditions, including the examination of morphology and local bonding associated with the initial stages of film growth under controlled growth conditions. The resulting capabilities will enable the authors to respond to a variety of problems requiring local characterization of conducting and nonconducting surfaces in liquids, air, and UHV.

DOE

Electron Microscopes; Microscopy; Scanners; Design Analysis; Equipment Specifications; Electron Tunneling

19980210714 Rutherford Appleton Lab., Chilton, UK

A High Resolution, Imaging Neutron Beam Monitor Using Gas Microstrip Technology

Bateman, J. E., Rutherford Appleton Lab., UK; Rhodes, N. J., Rutherford Appleton Lab., UK; Stephenson, R., Rutherford Appleton Lab., UK; Mar. 1998; ISSN 1358-6254; 16p; In English

Report No.(s): RAL-TR-1998-030; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK); US Sales Only, Hardcopy, Microfiche

The performance of a new high resolution, position-sensitive beam monitor for slow neutrons on the ISIS spallation neutron source is reported. Based on gas microstrip technology developed at RAL for particle physics applications, the monitor delivers high spatial resolution (sigma approx equal 1 mm) combined with a fast timing response, high data rate capability and a low gamma sensitivity.

Author

High Resolution; Imaging Techniques; Neutron Beams; Monitors; Rates (Per Time)

19980210728 Fermi National Accelerator Lab., Batavia, IL USA

Visible light photon counters (VLPCs) for high rate tracking medical imaging and particle astrophysics

Atac, M., Fermi National Accelerator Lab., USA; Feb. 1998; 18p; In English; 7th; Icfa School on Instrumentation In Elementary Particle Physics, 7 - 19 Jul. 1997, Leon, Mexico

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/392; CONF-9707140; DE98-052266; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This paper is on the operation principles of the Visible Light Photon Counters (VLPCs), application to high luminosity-high multiplicity tracking for High Energy Charged Particle Physics, and application to Medical Imaging and Particle Astrophysics. The VLPCs as Solid State Photomultipliers (SSPMS) with high quantum efficiency can detect down to single photons very efficiently with excellent time resolution and high avalanche gains.

DOE

Photons; Counters; Imaging Techniques; Radiation Detectors; Scintillation Counters; Light (Visible Radiation)

19980210756 Brookhaven National Lab., Upton, NY USA

A portable gamma-ray spectrometer using compressed xenon

Mahler, G. J., Brookhaven National Lab., USA; Yu, B., Brookhaven National Lab., USA; Smith, G. C., Brookhaven National Lab., USA; Kane, W. R., Brookhaven National Lab., USA; Lemley, J. R., Brookhaven National Lab., USA; Oct. 1997; 5p; In English; Nuclear Science Symposium, 11-13 Nov. 1997, Albuquerque, NM, USA

Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-64949; CONF-971147; DE98-001634; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

An ionization chamber using compressed xenon has been designed and built for gamma-ray spectrometry. The device is based on signal measurement from a parallel plate detector, with the gas enclosure constructed specifically for packaging into a portable instrument; thus, appropriate engineering practices comprises two small containers that can be setup for operation in just a few minutes. Its sensitivity is 100 keV to over 1 MeV, with a resolution at 662 keV of 2.5% FWHM for uniform irradiation, and 2% FWHM for collimated irradiation, comparable to the best ever with compressed xenon. It also exhibits greater specificity that most scintillators, such as NaI. The device is insensitive to neutron damage and has a low power requirement.
DOE
Portable Equipment; Gamma Ray Spectrometers; Ionization Chambers; Design

19980210825 Fermi National Accelerator Lab., Batavia, IL USA
Test beam performance of the CDF plug upgrade hadron calorimeter
deBarbaro, P., Rochester Univ., USA; Jan. 13, 1998; 11p; In English; Scintillating and Fiber Detectors (Scifi 97), 2-6 Nov. 1997, South Bend, IN, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/057-E; CONF-9711110; DE98-052135; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We report on the performance of the CDF End Plug Hadron Calorimeter in a test beam. The sampling calorimeter is constructed using 2 inch iron absorber plates and scintillator planes with wavelength shifting fibers for readout. The linearity and energy resolution of the calorimeter response to pions, and the transverse uniformity of the response to muons and pions are presented. The parameter e/h, representing the ratio of the electromagnetic to hadronic response, is extracted from the data.
DOE
Performance Tests; Calorimeters; Detection; Hadrons; Revisions

36
LASERS AND MASERS

Includes parametric amplifiers. For related information see also 76 Solid-State Physics.

19980206606 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
Optimisation of Transient Gain X-Ray Laser for 20-32 nm
Allott, R., Rutherford Appleton Lab., UK; Nickles, P. V., Max-Born-Inst., Germany; Schnuerer, M., Max-Born-Inst., Germany; Kalachnikov, M. P., Max-Born-Inst., Germany; Sandner, W., Max-Born-Inst., Germany; Shlyaptsev, V. N., Max-Born-Inst., Germany; Wolfrum, E., Oxford Univ., UK; Zhang, J., Oxford Univ., UK; Behjat, A., Essex Univ., UK; Demir, A., Essex Univ., UK; Tallents, G., Essex Univ., UK; Lewis, C., Queens Univ., UK; Warwick, J., Queens Univ., UK; Pert, G. J., York Univ., UK; Allott, R., Rutherford Appleton Lab., UK; Collier, J., Rutherford Appleton Lab., UK; Danson, C., Rutherford Appleton Lab., UK; Neely, D., Rutherford Appleton Lab., UK; Pepler, D. A., Rutherford Appleton Lab., UK; Jan. 1998; 19p; In English; Original contains color illustrations
Report No.(s): RAL-TR-98-008; Copyright; Avail: Abstract Only (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

Summarizing we can state, that as a result of the excellent optical parameters and the operational reliability of the pump laser, the complex diagnostic and the technical support, accessible at the RAL during the campaign the results have surpassed our aims. Saturation of the 326 A line in Ne-like Ti has been achieved for the first time due to a gain coefficient of 35/ cm. Measurable amplified emission was observed from 3 mm targets for a total pump energy of 0.5 J, representing a truly table-top system. A second 3d-3p laser line has been identified at 301.5 +/- 0.5 A and a gain coefficient of 15/ cm measured. This is 1 - 2 orders of magnitude in pump energy reduction as compared to common quasistationary XRL systems. Additionally, the XRL divergence was determined to be about 5 -10 mrad. The output energy in the range of several tens of uJ corresponds to a very high Ti XRL efficiency of - 10(exp -5). With its predicted ultra-short pulse length this laser has applications for high temporal resolution probing of other laser produced plasmas. Finally, it is worth mentioning that the new efficient XRL excitation is not only restricted to neon like schemes but should be also attractive for nickel like as well as innershell transitions opening a route to short wavelength low sized X-ray laser. Therefore, related experiments will be a matter of future experiments. This work was supported by the European Union Large Scale Facility Programme. The authors gratefully acknowledge the support of laser operation, and engineering support groups of the Central Laser Facility of the RAL.
Author
X Ray Lasers; Reliability; Pumps; Lasers; Plasmas (Physics)

19980206618 Sandia National Labs., Albuquerque, NM USA

Simulation of coarsening during laser engineered Net-Shaping

Tikare, V., Sandia National Labs., USA; Griffith, M., Sandia National Labs., USA; Schlienger, E., Sandia National Labs., USA; Smugeresky, J., Sandia National Labs., USA; 1997; 10p; In English; Solid Freeform Fabrication Conference, 11 - 13 Aug. 1997, Austin, TX, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1943C; CONF-970888; DE97-009386; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Laser Engineered Net-Shaping, otherwise known as LENS(TM), is an advanced manufacturing technique used to fabricate complex near net shaped components directly from engineered solid models without the use of dies or machining. The ultimate objective of this project is to develop predictive simulation capability which will allow the LENS(TM) processors to determine fabrication conditions given the material, shape, and application of the final part. In this paper, the authors will present an incremental achievement to meeting the ultimate goal, a model capable of simulating the coarsening of microstructural features under the unique thermal history to which a LENS(TM) part is subjected during processing. The simulation results show how grains of very different shapes and sizes form within the same deposition line. They also show that relatively minor changes in the dynamic temperature profile results in microstructures with vastly different characteristics. The implications of this work for LENS(TM) fabrication is that controlling the temperature profile is essential to tailoring the microstructure of a component to its application.

DOE

Manufacturing; Laser Applications; Laser Machining; Powder Metallurgy; Lasers

19980206623 Rochester Inst. of Tech., NY USA

Mechanism and Optimum Demodulation Scheme for Frequency-Modulated Feedback Sustained Pulsations in Laser Diodes ***Final Report, Mar. 1996 - Sep. 1997***

Li, Guifang, Rochester Inst. of Tech., USA; Mar. 1998; 35p; In English

Contract(s)/Grant(s): F30602-96-2-0032; AF Proj. 4600

Report No.(s): AD-A341567; AFRL-SN-RS-TR-1998-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The operation regimes and dynamic properties of semiconductor laser diodes are significantly affected by external feedback. Investigation of the dynamics of Self-Sustained Pulsation (SSP) in the semiconductor laser diodes with optoelectronic feedback is presented. The Laser Diode (LD) is assumed to be a noiseless two section Fabry-Perot laser diode with linear gain in both sections. The feedback is assumed to consist of a photodetector and wide band and band pass microwave amplifier. For a certain range of the laser diode and feedback parameters the system undergoes high frequency (about 1 GHz) oscillations resulting from structural instability in system dynamics. Frequency, amplitude and other parameters of Self-Sustained Pulsation are electrically tunable. The system dynamics are investigated from the standpoint of stability analysis as well as direct numerical simulation. The stability analysis performed shows that for certain laser diode and feedback operating parameters, the feedback laser diode system exhibits an instability which results in Self-Sustained Pulsation.

DTIC

Optical Communication; Diodes; Demodulation; Frequency Modulation; Dynamic Characteristics; Semiconductor Lasers

19980206690 Army Research Lab., Aberdeen Proving Ground, MD USA

Thermal Response of Sapphire to Propellant Combustion ***Final Report, Jan. 1997 - Jan 1998***

Bundy, Mark, Army Research Lab., USA; Apr. 1998; 45p; In English

Report No.(s): AD-A344626; ARL-TR-1654; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Laser ignition is a relatively new approach to initiating the combustion of gun propellant. In this application, the laser pulse is transmitted into the combustion chamber through a window, typically made of sapphire, located in the breech face. In order to evaluate the long-term effects of propellant combustion on the laser window itself, it is important to know the window temperature during firing. This report presents temperature data on a sapphire sample located in the region of the laser window in a laser-ignited 155mm M199 cannon, firing various charge configurations.

DTIC

Propellant Combustion; Sapphire; Combustion; Propellants; Thermodynamic Properties

19980206701 Aerospace Corp., El Segundo, CA USA

Laser PM to AM Conversion in Atomic Vapors and Short Term Clock Stability

Camparo, J. C., Aerospace Corp., USA; Buell, W. F., Aerospace Corp., USA; Jan. 15, 1998; 12p; In English

Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A341654; TR-97(8555)-4; SMC-TR-98-09; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The optical thick vapors employed in gas cell atomic clocks provide for very efficient conversion of laser phase noise (PM) to amplitude noise (AM). Here, we discuss the role of PM to AM conversion in determining gas cell clock performance. First, a brief overview of the PM to AM conversion process will be given, highlighting the fact that laser phase noise creates fluctuations in the atom's optical absorption cross section, which have an exponential influence on the laser's transmitted intensity. Experimental results will then be presented showing that the PM to AM conversion process can increase the relative intensity noise of transmitted laser light by orders of magnitude, and that this can, under certain conditions, cause laser pumped clock performance to be poorer than lamp pumped clock performance.

DTIC

Atomic Clocks; Lasers; Noise Intensity; Stability; Laser Outputs; Amplitudes

19980206762 Lawrence Livermore National Lab., Livermore, CA USA

Table-top transient collisional excitation x-ray laser research at LLNL

Dunn, J., Lawrence Livermore National Lab., USA; Osterheld, A. L., Lawrence Livermore National Lab., USA; Shepherd, R., Lawrence Livermore National Lab., USA; Stewart, R. E., Lawrence Livermore National Lab., USA; Oct. 06, 1997; 12p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-128435; CONF-970706-; DE98-050910; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We describe recent experiments at the Lawrence Livermore National Laboratory (LLNL) to produce a table-top x-ray laser. Using a combination of long 800 ps and short approximately 1 ps high power laser pulses with approximately 6 J in each beam, a transient collisionally excited Ne-like ion x-ray laser scheme has been investigated. We present results of high x-ray laser gain for the Ne- like Ti 3p-3s J = O-l transition at 326 A and have achieved gL product of 15 for target lengths up to 1 cm. We have extended the transient collisional scheme to shorter wavelengths using the Ni-like analog, specifically the 4d-4p J = O-l of Ni-like Pd at 147 A.

DOE

X Ray Lasers; Pulsed Lasers; High Power Lasers; Excitation

19980209822 Department of the Navy, Washington, DC USA

Excimer Laser Dopant Activation of Backside Illuminated CCD's

Sexton, Douglas A., Inventor, Department of the Navy, USA; Russell, Stephen D., Inventor, Department of the Navy, USA; Reedy, Ronald E., Inventor, Department of the Navy, USA; Kelley, Eugene P., Inventor, Department of the Navy, USA; Nov. 18, 1997; 12p; In English
Patent Info.: Filed 14 Aug. 1995; US-Patent-Appl-SN-514922; US-Patent-5,688,715
Report No.(s): AD-D018823; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method uses an excimer laser to activate previously implanted dopant species in the backside of a backside-illuminated CCD or to incorporate dopant ions from a gaseous ambient into the backside of a backside-illuminated CCD and simultaneously activate. The controlled ion implantation of the backside and subsequent thin layer heating by the short wavelength pulsed excimer laser energy activates the dopant and provides for an improved dark current response and improved spectral response. The energy of the pulsed excimer laser is applied uniformly across a backside-illuminated CCD in a very thin layer of the semiconductor substrate (usually silicon) material that requires annealing to uniformly activate the dopant. The very thin layer of the material can be heated to exceedingly high temperatures on a nanosecond time scale white the bulk of the delicate CCD substrate remains at low temperature. Repair of semiconductor dies by effecting a uniform annealing enables salvage and utilization of otherwise discard able components by bringing their dark current response to within an acceptable range.

DTIC

Pulsed Lasers; Excimers; Charge Coupled Devices; Procedures

19980209823 Department of the Navy, Washington, DC USA

ER: YALO Upconversion Laser

Scheps, Richard, Inventor, Department of the Navy, USA; Oct. 28, 1997; 39p; In English
Patent Info.: Filed 30 Nov. 1995; US-Patent-Appl-SN-565075; US-Patent-5,682,397
Report No.(s): AD-D018825; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A laser comprises an upconversion laser gain element made of a crystalline oxide host doped with activator ions for emitting output radiation at an output wavelength. The gain element is pumped by pumping radiation at a pumping wavelength that is longer than the output wavelength. A laser resonator comprising a reflective element and an output coupler is arranged with the gain element to resonate the output radiation. The reflective element is spaced from the output coupler by a distance approaching the radius of curvature of the reflective element or the output coupler. The pumping radiation has a waist that is substantially coincident with the waist of the output radiation within the active region of the gain element.
DTIC
Yttrium; Erbium; Aluminates; Fabrication; Lasers

19980210091 Lawrence Livermore National Lab., Livermore, CA USA
Evaluation of B(sub 4)C as an ablator material for NIF capsules
Burnham, A. K., Lawrence Livermore National Lab., USA; Alford, C. S., Lawrence Livermore National Lab., USA; Makowiecki, D. M., Lawrence Livermore National Lab., USA; Dittrich, T. R., Lawrence Livermore National Lab., USA; Wallace, R. J., Lawrence Livermore National Lab., USA; Honea, E. C., Lawrence Livermore National Lab., USA; King, C. M., Lawrence Livermore National Lab., USA; Steinman, D., General Atomics Co., USA; Mar. 26, 1997; 10p; In English; 11th; Target Fabrication Specialist Meeting, 8 - 12 Sep. 1996, Orcas Island, WA, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-125144-Rev.1; CONF-9609225-4; DE97-053407; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Boron carbide (B(sub 4)C) is examined as a potential fuel container and ablator for implosion capsules on the National Ignition Facility (NIF). A capsule of pure B(sub 4)C encasing a layer of solid DT implodes stably and ignites with anticipated NIF x-ray drives, producing 18 MJ of energy. Thin films of B(sub 4)C were found to be resistant to oxidation and modestly transmitting in the infrared (IR), possibly enabling IR fuel characterization and enhancement for thin permeation barriers but not for full-thickness capsules. Polystyrene mandrels 0.5 mm in diameter were successfully coated with 0.15-2.0 micrometers of B(sub 4)C. Thickness estimated from optical density agreed well with those measured by scanning electron microscopy (SEM). The B(sub 4)C microstructure was columnar but finer than for Be made at the same conditions. B(sub 4)C is a very strong material, with a fiber tensile strength capable of holding NIF fill pressures at room temperature, but it is also very brittle, and microscopic flaws or grain structure may limit the noncryogenic fill pressure. Argon (Ar) permeation rates were measured for a few capsules that had been further coated with 5 micrometers of plasma polymer. The B(sub 4)C coatings tended to crack under tensile load. Some shells filled more slowly than they leaked, suggesting that the cracks open and close under opposite pressure loading. As observed earlier for Ti coatings, 0.15-micrometer layers of B(sub 4)C had better gas retention properties than 2-micrometer layers, possibly because of fewer cracks. Permeation and fill strength issues for capsules with a full ablator thickness of B(sub 4)C are unresolved.
DOE
Ablative Materials; Scanning Electron Microscopy; Plasmas (Physics); Microstructure; Fiber Strength; Characterization; Infrared Radiation

19980210094 Lawrence Livermore National Lab., Livermore, CA USA
Gain saturation studies in LG-750 and LG-770 amplifier glass
Pennington, D. M., Lawrence Livermore National Lab., USA; Milam, D., Lawrence Livermore National Lab., USA; Eimerl, D., Lawrence Livermore National Lab., USA; Mar. 10, 1997; 16p; In English; 2nd; Annual Solid State Lasers for Applications to Inertial Confinement Fusion (LCFf), 22 - 25 Oct. 1996, Paris, France
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-124504; CONF-9610225-42; DE97-053414; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Experiments were performed on the 100-J class Optical Sciences Laser (OSL) at LLNL to characterize the saturation fluence and small-signal gain of a solid-state Nd:glass amplifier utilizing LG-750 and LG-770, an amplifier glass developed for the National Ignition Facility (NIF). These high quality measurements of gain saturation at NIF level fluences, i.e., 10-15 J/sq cm, provide essential parameters for the amplifier performance codes used to design NIF and future high power laser systems. The small-signal gain, saturation fluence and square-pulse distortion were measured as a function of input fluence and pulse length in platinum-free LG-750 and LG-770. The input fluence, output fluence, small-signal gain and passive losses were measured to allow calculation of the saturation fluence. Least square fits of the output vs. input fluence data using a Frantz-Nodvik model was used to obtain an average saturation fluence for each data set. Overall, gain saturation in LG-750 and LG-770 is comparable at long pulse lengths. For shorter pulse length, less than 5 ns, LG-770 exhibits a stronger pulse length dependence than LG-750,

possibly due to a longer terminal level lifetime. LG-770 also has a higher cross-section, which is reflected by its slightly higher extraction efficiency.
DOE
High Power Lasers; Ignition; Platinum; Fluence; Extraction; High Gain

19980210139 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Undulator interruption in high-gain free electron lasers
Kim, K. J., California Univ., Lawrence Berkeley Lab., USA; Oct. 1997; 11p; In English; 4th; Free Electron Laser, 18-22 Aug. 1997, Beijing, Beijing, China, China
Contract(s)/Grant(s): DE-AC03-76SF-00098
Report No.(s): LBNL-40689; CONF-970885; CBP-Note-237; DE98-001380; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The effect of interrupting an undulator on the performance of high-gain Free-Electron Lasers (FELs) is evaluated by analyzing 1-D Maxwell-Vlasov equations. It is found that the effect is small for a reasonable length of the interruptions for FEL parameters envisaged for short wavelength Self-Amplified Spontaneous Emission (SASE). Since the interruptions provide valuable space for quadrupoles and diagnostics, and at the same time permit a greater flexibility in mechanical design, the result of this paper is encouraging for construction of long undulator magnets required for SASE.
DOE
Free Electron Lasers; Numerical Analysis; Wiggler Magnets; Maxwell Equation; Vlasov Equations

19980210394 NASA Langley Research Center, Hampton, VA USA
A 50-kW Module Power Station of Directly Solar-Pumped Iodine Laser
Choi, S. H., NASA Langley Research Center, USA; Lee, J. H., NASA Langley Research Center, USA; Meador, W. E., NASA Langley Research Center, USA; Conway, E. J., NASA Langley Research Center, USA; ASME Journal of Solar Energy Engineering; 1997; Volume 119, pp. 304-311; In English
Report No.(s): NASA/TM-1997-208110; NAS 1.15:208110; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The conceptual design of a 50 kW Directly Solar-Pumped Iodine Laser (DSPIL) module was developed for a space-based power station which transmits its coherent-beam power to users such as the moon, Martian rovers, or other satellites with large (greater than 25 kW) electric power requirements. Integration of multiple modules would provide an amount of power that exceeds the power of a single module by combining and directing the coherent beams to the user's receiver. The model developed for the DSPIL system conservatively predicts the laser output power (50 kW) that appears much less than the laser output (93 kW) obtained from the gain volume ratio extrapolation of experimental data. The difference in laser outputs may be attributed to reflector configurations adopted in both design and experiment. Even though the photon absorption by multiple reflections in experimental cavity setup was more efficient, the maximum secondary absorption amounts to be only 24.7 percent of the primary. However, the gain volume ratio shows 86 percent more power output than theoretical estimation that is roughly 60 percent more than the contribution by the secondary absorption. Such a difference indicates that the theoretical model adopted in the study underestimates the overall performance of the DSPIL. This fact may tolerate more flexible and radical selection of design parameters than used in this design study. The design achieves an overall specific power of approximately 5 W/kg and total mass of 10 metric tons.
Author
Solar Energy Conversion; Iodine Lasers; Modules; Laser Outputs; Design Analysis; Solar Thermal Electric Power Plants

19980210689 Air Force Research Lab., Wright-Patterson AFB, OH USA
Development of a Wideband Airborne Laser Data Link
Gill, Robert A., Air Force Research Lab., USA; Feldmann, Robert J., Air Force Research Lab., USA; Apr. 1998; 7p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The USA Air Force Research Laboratory is conducting a program to develop a wideband airborne laser data link. The program successfully ground demonstrated a 1.1 gigabit/second (sec) full duplex data link over a distance of 150 kilometers (km). This ground demonstration was accomplished in Hawaii in September 1995. The system used in the ground demonstration has been redesigned and will be installed in two jet aircraft for flight demonstration at distances up to 500 km. These demonstration flights will begin in September 1998.
Author
Airborne Lasers; Data Links; Duplexers; Flight Tests; Laser Ranger/Tracker

19980210709 Lawrence Livermore National Lab., Livermore, CA USA

Characterization of third-harmonic target plane irradiance on the National Ignition Facility Beamlet demonstration project

Wegner, P. J., Lawrence Livermore National Lab., USA; VanWonterghem, B. M., Lawrence Livermore National Lab., USA; Dixit, S. N., Lawrence Livermore National Lab., USA; Henesian, M. A., Lawrence Livermore National Lab., USA; Barker, C. E., Lawrence Livermore National Lab., USA; Thompson, C. E., Lawrence Livermore National Lab., USA; Seppala, L. G., Lawrence Livermore National Lab., USA; Caird, J. A., Lawrence Livermore National Lab., USA; Apr. 25, 1997; 12p; In English, 16-20 Jun. 1996, Reno, NV, USA; Sponsored by American Nuclear Society, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-123070; CONF-9606116-97; DE97-053412; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Beamlet laser is a single-aperture prototype for the National Ignition Facility (NIF). We have recently installed and activated a 55 cu m vacuum vessel and associated diagnostic package at the output of the Beamlet that we are using to characterize target plane irradiance at high power. Measurements obtained both with and without a kinoform diffractive optic are reported. Dependences on critical laser parameters including output power, spatial filtering, and wavefront correction are discussed and compared with simulations.

DOE

Laser Targets; Irradiance; Lasers

19980210716 Lawrence Livermore National Lab., Livermore, CA USA

Laser Programs Highlight 1995

Jacobs, R. R., Lawrence Livermore National Lab., USA; Jan. 31, 1997; 12p; In English

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-ID-109089-95; DE98-050217; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Our contributions to laser science and technology and corresponding applications range from concept to design of the National Ignition Facility, transfer of Atomic Vapor Laser Isotope Separation technology to the private sector, and from new initiatives in industry and defense to micro-optics for improving human vision.

DOE

Laser Applications; Research and Development; Lasers

19980210791 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of

Development of high-power laser technology: Development of pulse modification technique of dye laser

Lee, In Won, Korean Atomic Energy Research Inst., Korea, Republic of; Kim, Dong Ho, Korean Atomic Energy Research Inst., Korea, Republic of; Han, Jae Won, Korean Atomic Energy Research Inst., Korea, Republic of; Seo, Jung Chul, Korean Atomic Energy Research Inst., Korea, Republic of; Jul. 1997; 68p; In Korean

Report No.(s): KAERI-CM-145/96; DE98-725031; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The pulsed dye laser beam obtained through the pulsed amplification of weak CW narrow bandwidth dye laser with four-pass amplifier has high power gain of 10(exp 7) and narrow bandwidth of 130 MHz. The use of grating in four-pass= amplifier reduced the intensity ratio of the amplified spontaneous emission v. total laser power to less than 1.5%, and the technique improved output power by about 4%. Also, the dye laser amplifier composed of three stage amplification system was fabricated to study time-resolved spectroscopy. We performed a pump-probe experiment with continuum pulses generated by high-power femtosecond pulses and study on a technique to generate femtosecond pulses in wide wavelength region.

DOE

Laser Applications; Pulsed Lasers; Dye Lasers; Laser Beams; High Power Lasers; Laser Outputs; Laser Materials

19980210811 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Research cooperation in the development of laser radar for environmental measurements. Environmental network ***Kankyo keisokuyo laser radar no kaihatsu ni kansuru kenkyu kyoryoku. Kankyo network***

Mar. 1997; 108p; In Japanese

Report No.(s): NEDO-KKS-LR4-2; DE98-745370; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Among the research cooperation in the development of laser radar for environmental measurements with Indonesia between FY 1993 and FY 1996, results of the research and development of the environmental network are summarized. For the environmental information network, the Tokyo NOC is linked as an Internet connection point in Japan with the Jakarta NOC using an international dedicated line with a capacity of 64 Kbps. The Tokyo NOC is linked with domestic environmental information researchers using Internet. Thus, data stored in the data processing system of laser radar can be exchanged, information in both countries can be exchanged using E-mail, and data can be accumulated. For the research cooperation with Indonesia, research of path control and information relay server, research of effective transmission of data on the network, and research of multimedia communication have been conducted. The multimedia communication, distributed processing, and extension of dedicated line network using PPTP have been also conducted.

DOE

Computer Networks; Lasers; Laser Applications; Data Processing; Data Base Management Systems; Environment Effects

19980210813 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Photon technology. Laser process technology ***Photon technology. Laser process gijutsu***

Mar. 1997; 172p; In Japanese

Report No.(s): NEDO-PR-9612; DE98-745397; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

For developing laser process technology by interaction between substance and photon, the present state, system, R and D issues and proposal of such technology were summarized. Development of the photon technology aims at the modification of bonding conditions of substances by quantum energy of photon, and the new process technology for generating ultra-high temperature and pressure fields by concentrating photon on a minute region. Photon technology contributes to not only the conventional mechanical and thermal forming and removal machining but also function added machining (photon machining) in quantum level and new machining technology ranging from macro- to micro-machining, creating a new industrial field. This technology extends various fields from the basis of physics and chemistry to new bonding technology. Development of a compact high-quality high-power high-efficiency photon source, and advanced photon transmission technology are necessary. The basic explication of an unsolved physicochemical phenomenon related to photon and substance, and development of related application technologies are essential.

DOE

Quantum Electronics; Physical Chemistry; Laser Applications; Bonding; Fabrication; Laser Machining; Binding Energy

19980210830 Lawrence Livermore National Lab., Livermore, CA USA

New class of diode-pumped, mid-IR, broadly-tunable lasers based on TM(2+) Ions in T(sub d) coordination: Cr(2+):ZnX (X = S,Se)

Krupke, W. F., Lawrence Livermore National Lab., USA; Page, R. H., Lawrence Livermore National Lab., USA; Schaffers, K. I., Lawrence Livermore National Lab., USA; Payne, S. A., Lawrence Livermore National Lab., USA; Beach, R. J., Lawrence Livermore National Lab., USA; Skidmore, J. A., Lawrence Livermore National Lab., USA; Emmanuel, M. A., Lawrence Livermore National Lab., USA; Jan. 1997; 11p; In English; 2nd; Tunable Solid State Lasers, 1-4 Sep. 1997, Wroclaw, Poland

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-125994; CONF-970948-1; DE97-051897; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A new class of room-temperature, diode-pumped solid state lasers, that are broadly tunable in the mid-infrared spectral region, has been conceptualized and demonstrated. These lasers are based on intra-ion transitions of divalent transition metals placed in substitutional cation sites of tetrahedral symmetry in large bandgap chalcogenide semiconductor crystals. These combinations of laser-ions and host crystals are seen to provide favorable radiative and non-radiative transition processes for the realization of the desired laser performance characteristics. Spectroscopic data for candidate schemes are reviewed and divalent chromium doped zinc chalcogenides are identified as potentially superior laser candidates. Preparation of laser quality Cr(2+):ZnSe crystals is described and experimental results to date for a diode-pumped laser are given. Remaining laser development issues are discussed briefly.

DOE

Diodes; Semiconductor Lasers; Ions; Chromium; Tunable Lasers; Solid State Lasers; Infrared Radiation; Laser Pumping; Zinc Selenides

19980210831 Lawrence Livermore National Lab., Livermore, CA USA

The Petawatt laser system

Pennington, D. M., Lawrence Livermore National Lab., USA; Perry, M. D., Lawrence Livermore National Lab., USA; Stuart, B. C., Lawrence Livermore National Lab., USA; Mar. 11, 1997; 14p; In English; 2nd; Annual Solid State Lasers for Applications to Inertial Confinement Fusion (LCF), 22-25 Oct. 1996, Paris, France

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-124492; CONF-9610225; DE97-053413; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We recently demonstrated the production of over a petawatt of peak power in the Nova/Petawatt Laser Facility, generating > 600 J in approximately 440 fs. The Petawatt Laser Project was initiated to develop the capability to test the fast ignitor concept for inertial confinement fusion (ICF), and to provide a unique capability in high energy density physics. The laser was designed to produce near kJ pulses with a pulse duration adjustable between 0.5 and 20 ps. At the shortest pulse lengths, this laser is expected to surpass 10 21 W/ sq cm when focused later this year. Currently, this system is limited to 600 J pulses in a 46.3-cm beam. Expansion of the beam to 58 cm, with the installation of 94-cm gratings, will enable 1 kJ operation. Target experiments with petawatt pulses will be possible either integrated with Nova in the 10 beam target chamber or as a stand alone system in an independent, dedicated chamber. Focusing the beam onto a target will be accomplished using an on axis parabolic mirror. The design of a novel targeting system enabling the production of ultrahigh contrast pulses and an easily variable effective focal length is also described. DOE

Inertial Confinement Fusion; Lasers

19980210832 Lawrence Livermore National Lab., Livermore, CA USA

Petawatt laser and target irradiation system at LLNL

Pennington, D. M., Lawrence Livermore National Lab., USA; Perry, M. D., Lawrence Livermore National Lab., USA; Britten, J. A., Lawrence Livermore National Lab., USA; Brown, C. G., Lawrence Livermore National Lab., USA; Herman, S., Lawrence Livermore National Lab., USA; Homer, J., Lawrence Livermore National Lab., USA; Miller, J. L., Lawrence Livermore National Lab., USA; Stuart, B. C., Lawrence Livermore National Lab., USA; Tietbohl, G., Lawrence Livermore National Lab., USA; Van-Lue, J., Lawrence Livermore National Lab., USA; Yanovsky, V.; Jun. 06, 1997; 6p; In English; Ultrafast Optics 1997, 4-7 Aug. 1997, Monterey, CA, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-127729; CONF-9708122; DE98-051079; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In May, 1996, we demonstrated the production over a petawatt of peak power in the Nova/Petawatt Laser Facility, generating 620 J in approximately 430 fs. Results of the first focused irradiance tests, and recent deployment of a novel targeting system will be presented.

DOE

Lasers; Laser Targets; Irradiation

37
MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

19980206576 Sandia National Labs., Albuquerque, NM USA

Electrothermal actuators fabricated in four-level planarized surface-miromachined polycrystalline silicon

Comtois, J. H., Phillips Lab., USA; Michalicek, A., Phillips Lab., USA; Barron, C. C., Sandia National Labs., USA; 1997; 20p; In English; Innovative Systems In Silicon '97, 8 - 10 Oct. 1997, Austin, TX, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2533C; CONF-971088; DE98-000559; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper presents the results of tests performed on a variety of electrochemical microactuators and arrays of these actuators fabricated in the SUMMiT process at the US Department of Energy's Sandia National Laboratories. These results are intended to aid designers of thermally actuated mechanisms, and they apply to similar actuators made in other polysilicon MEMS processes such as the MUMPS process. Measurements include force and deflection versus input power, maximum operating frequency,

effects of long term operation, and ideal actuator and array geometries for different applications' force requirements. Also, different methods of arraying these actuators together are compared. It is found that a method using rotary joints, enabled by the advanced features of the SUMMiT fabrication process, is the most efficient array design. The design and operation of a thermally actuated stepper motor is explained to illustrate a useful application of these arrays.
DOE
Actuators; Fabrication; Silicon; Silicon Polymers; Polycrystals

19980206717 Sandia National Labs., Albuquerque, NM USA
Routes to failure in rotating MEMS devices experiencing sliding friction
Miller, S. L., Sandia National Labs., USA; LaVigne, G., Sandia National Labs., USA; Rodgers, M. S., Sandia National Labs., USA; Sniegowski, J. J., Sandia National Labs., USA; Waters, J. P., Sandia National Labs., USA; McWhorter, P. J., Sandia National Labs., USA; [1997]; 9p; In English; Micromachining and Microfabrication, 29 - 30 Sep. 1997, Austin, TX, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-1734C; CONF-970968-6; DE97-007264; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Gear systems rotating on hubs have been operated to failure using Sandia's microengine as the actuation device. Conventional failure modes such as fatigue induced fracture did not occur, indicating that the devices are mechanically extremely robust. The generic route to failure observed for all rotating devices involves sticking of structures that are in sliding contact. This sticking evidently results from microscopic changes in the sliding surfaces during operation. The rate at which these changes occur is accelerated by excessive applied forces, which originate from non-optimized designs or inappropriate drive voltages. Precursors to failure are observed, enabling further understanding of the microscopic changes that occur in the sliding surfaces that ultimately lead to failure.
DOE
Electric Potential; Failure Modes; Fracturing; Sliding Friction; Actuators

19980209817 Department of the Navy, Washington, DC USA
Variable Orifice Ball Value
Moody, Paul E., Inventor, Department of the Navy, USA; Nov. 25, 1997; 8p; In English
Patent Info.: Filed 30 Jul. 1996; US-Patent-Appl-SN-700746; US-Patent-5,690,142
Report No.(s): AD-D018811; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A variable orifice ball valve includes an external housing with a longitudinal fluid bore formed therethrough. A ball member is rotatably positioned within the external housing. The ball member can include first and second ball portions with the longitudinal fluid bore formed through the ball member and a pressure port formed through the ball member. An elastically expansible sleeve member is secured to an inner wall of the ball member, the elastically expansible sleeve member including opposing end portions and a middle section. The end portions are secured to an inner wall of the ball member, the elastically expansible sleeve member defining an expansible chamber between the inner wall of the ball member and the elastically expansible sleeve member such that a variable sized fluid port is formed on the inner surface of the elastically expansible sleeve member for restricting fluid flow by expanding the sleeve member upon introduction of a pressurized fluid through the fluid bore and pressure port.
DTIC
Orifices; Balls; Valves

19980209880 Department of the Navy, Washington, DC USA
High Pressure Enabled, Low Pressure Activated Automatic Fluid Control Valve
Clark, Robert H., Inventor, Department of the Navy, USA; Dec. 09, 1997; 9p; In English
Patent Info.: Filed 5 Sep. 1995; US-Patent-Appl-SN-528631; US-Patent-5,694,977
Report No.(s): AD-D018808; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A simple and highly reliable automatic valve is disclosed which is enabled by being subjected to a predetermined pressure and actuated as pressure is reduced from that pressure. A pressure differential of several orders of magnitude between enablement pressure and actuation pressure can be obtained by providing non-linear or plural springs which oppose fluid pressure against a reciprocable piston. The piston includes an aperture or passage which seals against a surrounding bore when the valve is closed. The piston is maintained in a position where the aperture or passage is sealed against the bore by a latch. The latch comprises a

band spring held in position by a protrusion on the piston and released when the piston is moved by a predetermined fluid pressure. Fine adjustment of both enablement and actuation pressures is provided.
DTIC
High Pressure; Valves; Hydraulic Equipment; Automatic Control Valves

19980209933 ESDU International Ltd., London, UK
Geneva Mechanisms, Part 2, Computer Program
Dec. 1996; 23p; In English; Included in the Mechanisms Sub-series
Report No.(s): ESDU-96011; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96011 introduces a FORTRAN program, ESDUpac A961 1, provided on disc in the software volume both uncompiled and compiled within ESDUview, a user-friendly interface that prompts on-screen for input data, for analysing the performance of either external or internal Geneva mechanisms. Starting with either the centre distance between the crank and wheel shafts or the diameter of the wheel, the program determines the key dimensions of the mechanism and makes a number of checks on the validity of the geometry. From the defined motion of the crank, the wheel motion, bearing forces, input torque, frame shaking force, contact stress between the roller (or pin) and the slot, lubricant film thickness (if applicable) and roller life (if applicable), are calculated. In order to communicate with other computer aided design software, a DXF file of the outline of the wheel is generated (for external Genevas only). If desired, external data files of the variation of the external torque acting on the Geneva wheel can be input. Similarly, if the angular velocity of the crank is not constant during each rotation, an external crank motion data file can be imported. Examples are given that demonstrate the creation of these files using either a FORTRAN program or a spreadsheet. Guidance in the design of Geneva mechanisms is given in ESDU 96002. Examples of the use of the software in realistic design situations appear in ESDU 96035. The derivation of the kinematic and kinetostatic equations used is presented in ESDU ME3.
Author
FORTRAN; Tables (Data); Software Engineering; Computer Graphics; Computer Aided Design; Applications Programs (Computers)

19980209936 Department of the Navy, Washington, DC USA
A Bulkhead Penetrator and Method for Separating Cables from a Bulkhead Penetrator
Santa, Gene J., Jr., Inventor, Department of the Navy, USA; Jan. 20, 1998; 13p; In English
Patent Info.: Filed 20 Jan. 1998; US-Patent-Appl-SN-008921
Report No.(s): AD-D018803; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

In a bulkhead penetrator comprising a housing, a first grommet plate having peripheral recesses therein and adapted to be received by the housing, a grommet for disposition adjacent the first grommet plate in the housing and having bores therein alignable with the recesses, a second grommet plate for disposition adjacent the grommet in the housing and having peripheral recesses alignable with the bores of the grommet, and a retaining ring for connection to the housing to lock the second grommet plate, the grommet, and the first grommet plate in the housing with the second grommet plate recesses and the grommet bores and the first grommet plate recesses being adapted to receive and retain cables extending from outside the bulkhead, through the penetrator, and into a compartment defined in part by the bulkhead, an improvement wherein the retaining ring comprises a plurality of discrete portions, each of the portions being mountable on the housing, and the grommet comprises a plurality of discrete portions, each of the grommet portions having one of the bores therein. There is further contemplated a method for separation of cables from such a penetrator.
DTIC
Bulkheads; Procedures; Penetration

19980209937 ESDU International Ltd., London UK
Analysis of Geneva Mechanisms: Derivation of Kinematic and Kinetostatic Equations
Sep. 1996; 37p; In English; Included in the Mechanisms Sub-series
Report No.(s): ESDU-ME3; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) ME3 treats the relationships used in the performance analysis of internal and external Geneva mechanisms driven by a crank rotating at constant or varying speed and transmitting power using a roller bearing or pin. The equations derived are the basis of the program of ESDU 96011 (ESDUpac 9611) and guidance on its use is given in ESDU 96002. The equations cover the key functional dimensions, velocities, accelerations, bearing/contact forces, and driving torques

in the principal components. The lubricant entrainment velocity equations are also included. Practical worked examples on the use of the program are in ESDU 96035.
Author
Reliability Analysis; Kinematic Equations; FORTRAN; Data Structures

19980209938 ESDU International Ltd., London UK
Geneva Mechanisms, Part 1, Design
Dec. 1996; 55p; In English; Included in the Mechanisms Sub-series
Report No.(s): ESDU-96002; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96002 presents the equations used in the program of ESDU 96011 (ESDUpac A9611) for calculating the important performance indicators used in the design of internal and external Geneva mechanisms. Guidance is given on the choice of the input parameters to the program including typical values of material and lubricant properties and roller bearing design factors. If required, variable crank speed and external torque through the cycle may be used. The form of the output is discussed and guidance is given on the use of the program in design, for example, suggesting that the sensitivity of the results to changes in values of particular input parameters be explored. The derivation of the equations appears in ESDU ME3 and the program is introduced in ESDU 9601 1. Starting with either the centre distance between the wheel and crank shafts or the diameter of the wheel, the program determines the key dimensions of the mechanism and makes a number of checks on the validity of the geometry. From the defined motion of the crank, the wheel motion, bearing forces, input torque, frame shaking force, contact stress between the roller (or pin) and the slot, lubricant film thickness (if applicable) and roller life (if applicable), are calculated. In order to communicate with other computer aided design software, a DXF file of the outline of the wheel is generated (for external Genevas only). Examples of the use of the software in realistic design situations appear in ESDU 96035.
Author
Computer Aided Design; Data Structures; Software Engineering; Shafts (Machine Elements)

19980209956 Sandia National Labs., Albuquerque, NM USA
Computational simulations and experimental validation of a furnace brazing process
Hosking, F. M., Sandia National Labs., USA; Gianoulakis, S. E., Sandia National Labs., USA; Malizia, L. A., Sandia National Labs., USA; 1998; 11p; In English, 15-19 Feb. 1998, San Antonio, TX, USA; Sponsored by Minerals, Metals and Materials Society, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2750C; CONF-980202; DE98-001445; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Modeling of a furnace brazing process is described. The computational tools predict the thermal response of loaded hardware in a hydrogen brazing furnace to programmed furnace profiles. Experiments were conducted to validate the model and resolve computational uncertainties. Critical boundary conditions that affect materials and processing response to the furnace environment were determined. (open quotes)Global(close quotes) and local issues (i.e., at the furnace/hardware and joint levels, respectively) are discussed. The ability to accurately simulate and control furnace conditions is examined.
DOE
Boundary Conditions; Software Development Tools; Temperature Effects

19980210080 Department of the Navy, Washington, DC USA
Vibration Isolating Flange Assembly
Dubois, Neil J., Inventor, Department of the Navy, USA; Sep. 29, 1997; 8p; In English
Patent Info.: Filed 29 Sep. 1997; US-Patent-Appl-SN-976,133
Report No.(s): AD-D018856; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A vibration isolating flange mount assembly for a pipe has a vibration absorbing gasket and fastener recesses having a vibration dampening material disposed therein to provide a fluid seal between the pipe and a flooded structure and to isolate pipe vibrations.
DTIC
Vibration; Pipes (Tubes); Gaskets; Fasteners

19980210081 Department of the Navy, Washington, DC USA

Tri-Joint Coupling

Vanasse, Robert D., Inventor, Department of the Navy, USA; Norris, Robert P., Inventor, Department of the Navy, USA; Geer, Roger H., Inventor, Department of the Navy, USA; Oct. 07, 1997; 7p; In English

Patent Info.: Filed 22 Aug. 1996; US-Patent-5,673,644; US-Patent-Appl-SN-701,321

Report No.(s): AD-D018852; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A tri-joint coupling far enabling the streaming and retrieving of a towed array system having a single tow cable and multiple towed array lines without disconnecting the lines from the towcable. The system is capable of being used on state-of-the-art inboard submarine handling systems. The tri-joint coupling is circular in cross-section at the single towcable end and elliptical in cross-section at the multiple towed array line end. The elliptical end of the coupling has three coupling inserts that are circular in cross-section and have electrical/optical connectors that connect individual electrical/optical conductors on the cable side to individual electrical/optical conductors on the multiple array side.

DTIC

Coupling; Couplers; Electric Connectors; Fiber Optics; Communication Cables; Joints (Junctions)

19980210185 Allison Engine Co., Indianapolis, IN USA

Hybrid Vehicle Turbine Engine Technology Support (HVTE-TS) ceramic design manual

Oct. 1997; 29p; In English

Contract(s)/Grant(s): DE-AC02-96EE-50453

Report No.(s): DOE-0336-7; EDR-18119; DE98-001952; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This ceramic component design manual was an element of the Advanced Turbine Technology Applications Project (ATTAP). The ATTAP was intended to advance the technological readiness of the ceramic automotive gas turbine engine as a primary power plant. of the several technologies requiring development before such an engine could become a commercial reality, structural ceramic components represented the greatest technical challenge, and was the prime focus of the program. HVTE-TS, which was created to support the Hybrid Electric Vehicle (HEV) program, continued the efforts begun in ATTAP to develop ceramic components for an automotive gas turbine engine. In HVTE-TS, the program focus was extended to make this technology applicable to the automotive gas turbine engines that form the basis of hybrid automotive propulsion systems consisting of combined batteries, electric drives, and on-board power generators as well as a primary power source. The purpose of the ceramic design manual is to document the process by which ceramic components are designed, analyzed, fabricated, assembled, and tested in a gas turbine engine. Interaction with ceramic component vendors is also emphasized. The main elements of the ceramic design manual are: an overview of design methodology; design process for the AGT-5 ceramic gasifier turbine rotor; and references. Some reference also is made to the design of turbine static structure components to show methods of attaching static hot section ceramic components to supporting metallic structures.

DOE

Hybrid Propulsion; Turbines; Technology Utilization; Ceramics; Manuals; Fabrication; Automated Guideway Transit Vehicles; Electric Motor Vehicles; Gas Turbine Engines; Structural Design

19980210209 Department of the Navy, Washington, DC USA

Rib Clamp

White, James G., Inventor, Department of the Navy, USA; Nov. 25, 1997; 6p; In English

Patent Info.: Filed 3 Mar. 1997; US-Patent-Appl-SN-810,203; US-Patent-5,689,864

Report No.(s): AD-D018874; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A clamp secures objects against a structure adjacent to and on either side of a rib of the structure. First and second arms are pivotally coupled to one another at a pivot point. The arms define a pair of opposing jaws that engage the rib and a pair of levers extending away from the opposing jaws on either side of the rib. A threaded member cooperating with each lever is rotated towards the structure. An object is positioned between each threaded member and the structure. In this way, the threaded members press the objects securely against the structure as the opposing jaws grip the rib.

DTIC

Clamps; Ribs (Supports); Presses

19980210305 Department of the Navy, Washington, DC USA

Multi-Ported Diverter Valve Assembly

Korczynski, Joseph F., Jr., Inventor, Department of the Navy, USA; Conroy, Patrick D., Inventor, Department of the Navy, USA;

May 09, 1997; 12p; In English
Patent Info.: Filed 9 May 1997; US-Patent-Appl-SN-854033
Report No.(s): AD-D018881; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The metallic housing of a diverter valve assembly has a plurality of threaded positioned inserts therein through which different port passage paths are established with a multi-ported ball valve element angularly displace able inside the housing while sealing enclosed within a tube through which the inserts project into adjusted seating engagement with the ball valve element.

DTIC

Diverters; Valves

19980210307 Department of the Navy, Washington, DC USA

Test Apparatus for Rotary Drive

Williams, Michael W., Inventor, Department of the Navy, USA; Walsh, James B., Inventor, Department of the Navy, USA; Mar. 18, 1998; 11p; In English
Patent Info.: Filed 18 Mar. 1998; US-Patent-Appl-SN-045963
Report No.(s): AD-D018879; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A test apparatus for testing the performance of a rotary drive includes a shaft which extends along a longitudinal axis, at least one support for supporting the shaft in an elevated position, and a flywheel of predetermined weight rotatably attached to the shaft so that upon rotation of the shaft the flywheel rotates as well. A rotary drive powers the rotation of the shaft and flywheel, the rotary drive having a hydraulic motor which is in fluid communication with a reservoir containing hydraulic fluid by way of a servo valve. A microprocessor controls the rotation of the shaft by the rotary drive. The test apparatus further includes a rotary encoder, a torque sensor, and pressure sensors for monitoring the angular displacement of the system, the torque on the shaft, and various system pressures respectively.

DTIC

Rotation; Shafts (Machine Elements); Mechanical Drives

19980210411 Los Alamos National Lab., NM USA

Kinetic studies of competitive adsorption processes related to automobile catalytic converters

Zaera, F., California Univ., USA; Paffett, M. T., Los Alamos National Lab., USA; [1998]; 13p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3250; DE98-001509; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The goal of this project was to study the microscopic details for the adsorption of CO, NO, and O2 on transition metal surfaces under conditions resembling those present in automobile catalytic converters. Initial sticking coefficients were measured as a function of temperature on transition metal single crystals by using a method originally developed by King and Wells. These measurements were performed under conditions emulating those typical of competitive adsorption, namely, where the substrate is exposed to a mixture of two or more gases simultaneously, or where one molecule is adsorbed on the surface prior to exposure to the second gas. The experimental results were then analyzed by using Monte Carlo computer simulation algorithm in an attempt to better understand the relevant aspects of the adsorption process.

DOE

Exhaust Gases; Adsorption; Automobiles; Oxygen; Carbon Monoxide; Nitric Oxide; Computerized Simulation

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QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19980210252 Los Alamos National Lab., NM USA

Damage detection for applications undergoing axial (membrane) response

Duffey, T.A., Duffey (T. A.), USA; Farrar, C. R., Los Alamos National Lab., USA; Doebling, S. W., Los Alamos National Lab., USA; [1997]; 7p; In English; 16th, 29 - 31 Jan. 1998, Santa Barbara, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3678; CONF-980127; DE98-001472; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper extends and applies recently reported damage identification methods, previously utilized for flexural vibrations only, to axial-type vibrations. The methods are applied to an 8-DOF linear spring-mass system, which models a multi-degree-of-freedom axial or membrane system. The goal of the work is to detect damage (as indicated by reduction in stiffness of one or more of the elements) as well as to locate the damage elements. Two damage detection methods were investigated-the change-in-flexibility method and the damage-index method. Both were found to successfully locate the damaged element(s) for 10% reduction in element stiffness. The change-in-flexibility method indicated damage location even when only a limited number of lower modes were included.
DOE
Membranes; Detection; Damage; Mechanical Oscillators; Nondestructive Tests

19980210365 Sandia National Labs., Albuquerque, NM USA
Integrated analysis environment for high impact systems
Martinez, M., Sandia National Labs., USA; Davis, J., Vanderbilt Univ., USA; Scott, J., Vanderbilt Univ., USA; Sztipanovits, J., Vanderbilt Univ., USA; Karsai, G., Vanderbilt Univ., USA; Feb. 1998; 10p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2250; DE98-003222; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Modeling and analysis of high consequence, high assurance systems requires special modeling considerations. System safety and reliability information must be captured in the models. Previously, high consequence systems were modeled using separate, disjoint models for safety, reliability, and security. The MultiGraph Architecture facilitates the implementation of a model integrated system for modeling and analysis of high assurance systems. Model integrated computing allows an integrated modeling technique to be applied to high consequence systems. Among the tools used for analyzing safety and reliability are a behavioral simulator and an automatic fault tree generation and analysis tool. Symbolic model checking techniques are used to efficiently investigate the system models. A method for converting finite state machine models to ordered binary decision diagrams allows the application of symbolic model checking routines to the integrated system models. This integrated approach to modeling and analysis of high consequence systems ensures consistency between the models and the different analysis tools.
DOE
Computerized Simulation; Systems Engineering; Fault Trees; Safety Factors

19980210577 Los Alamos National Lab., NM USA
Design and implementation of an x-ray strain measurement capability using a rotating anode machine
Roberts, J. A., Los Alamos National Lab., USA; Rangaswamy, P., Los Alamos National Lab., USA; Lujan, M., Jr., Los Alamos National Lab., USA; Bourke, M. A. M., Los Alamos National Lab., USA; [1998]; 21p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3268; DE98-001592; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). Residual stresses close to the surface can improve the reliability and lifetime of parts for technological applications. X-ray diffraction plays a significant role in gaining an exact knowledge of the stresses at the surface and their depth distribution. An x-ray capability at Los Alamos is key to developing and maintaining industrial collaborations in strain effects. to achieve this goal, the authors implemented a residual strain measuring station on the rotating anode x-ray instrument at the Lujan Center. This capability has been used to investigate residual strains in heat treated automotive components, machining effects on titanium alloys, resistance welded steel joints, titanium matrix fiber reinforced composites, ceramic matrix composites, thin films, and ceramic coatings. The overall objective is to combine both x-ray and neutron diffraction measurements with numerical models (e.g., finite element calculations).
DOE
Strain Measurement; Residual Stress; X Ray Diffraction; Stress Analysis

19980210773 NASA Lewis Research Center, Cleveland, OH USA
Noncontact Acousto-Ultrasonics for Material Characterization
Kautz, Harold E., NASA Lewis Research Center, USA; Jul. 1998; 16p; In English
Contract(s)/Grant(s): RTOP 523-22-13
Report No.(s): NASA/TM-1998-208410; E-11245; NAS 1.15:208410; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A NdYAG 1064 nm, laser pulse was employed to produce ultrasonic waves in specimens of SiC/SiC and SiC/Ti 6-4 composites which are high temperature materials of interest for aerospace applications. Air coupled transducers were used to detect and collect the signals used for acousto-ultrasonic analysis. Conditions for detecting ultrasonic decay signals were examined. The results were compared to those determined on the same specimens with contact coupling. Some non-contact measurements were made employing conventional air focused detectors. Others were performed with a more novel micromachined capacitance transducer. Concerns of the laser-in technology include potential destructiveness of the laser pulse. Repeated laser pulsing at the same location does lead to deterioration of the ultrasonic signal in some materials, but seems to recover with time. Also, unlike contact AU, the frequency regime employed is a function of laser-material interaction rather than the choice of transducers. Concerns of the air coupled-out technology include the effect of air attenuation. This imposes a practical upper limit to frequency of detection. In the case of the experimental specimens studied ultrasonic decay signals could be imaged satisfactorily.
Author
Nondestructive Tests; Aerospace Engineering; Laser Materials; Refractory Materials; Ultrasonic Tests; Ceramic Matrix Composites

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STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

19980206548 Sandia National Labs., Albuquerque, NM USA
A methodology for defining shock tests based on shock response spectra and temporal moments
Cap, J. S., Sandia National Labs., USA; Smallwood, D. O., Sandia National Labs., USA; [1997]; 10p; In English; 68th; Shock and Vibration Symposium, 3 Nov. 1997, Baltimore, MD, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-1480C; CONF-971164-; DE98-001138; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Defining acceptable tolerances for a shock test has always been a problem due in large part to the use of Shock Response Spectra (SRS) as the sole description of the shock. While SRS do contain a wealth of information if one knows what to look for, it is commonly accepted that different agencies can generate vastly different time domain test inputs whose SRS all satisfy the test requirements within a stated tolerance band. At an even more basic level, the laboratory test specifications often fail to resemble the field environment even though the SRS appear to be similar. A concise means of bounding the time domain inputs would be of great benefit in reducing the variation in the resulting shock tests. This paper describes a methodology that uses temporal moments to improve the repeatability of shock test specifications.
DOE
Procedures; Shock Tests; Shock Spectra; Laboratory Equipment; Mechanical Shock

19980206650 Sandia National Labs., Albuquerque, NM USA
Simultaneous PVDF/VISAR measurement technique for isentropic loading with graded density impactors
Anderson, M. U., Sandia National Labs., USA; Chhabildas, L. C., Sandia National Labs., USA; Reinhart, W. D., Ktech Corp., USA; [1997]; 5p; In English; Shock Compression of Condensed Matter, 27 Jul. - 1 Aug. 1997, Amherst, MA, USA; Sponsored by American Physical Society, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2541C; CONF-970707; DE98-000560; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A simultaneous PVDF/VISAR measurement technique was used for isentropic-loading experiments with a polymethyl methacrylate (PMMA) specimen. The experiments used a graded density impactor accelerated onto a tantalum driver backed with PMMA and then lithium fluoride windows for each experiment. Simultaneous measurements made at each window interface provided precise transit time and particle velocity measurements which can be used to determine the stress-vs-strain loading path using Lagrangian analysis techniques. The experimental technique provides access to 40 GPa stress levels in PMMA under isentropic-loading conditions.
DOE
Velocity Measurement; Impactors; Measurement

19980206657 Los Alamos National Lab., NM USA

Spall wave-profile and shock-recovery experiments on depleted uranium

Hixson, R. S., Los Alamos National Lab., USA; Vorthman, J. E., Los Alamos National Lab., USA; Gustavsen, R. L., Los Alamos National Lab., USA; Zurek, A. K., Los Alamos National Lab., USA; Thissell, W. R., Los Alamos National Lab., USA; Tonks, D. L., Los Alamos National Lab., USA; [1997]; 6p; In English; Shock Compression of Condensed Matter, 27 Jul. - 1 Aug. 1997, Amherst, MA, USA; Sponsored by American Physical Society, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2993; CONF-970707-; DE98-000990; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Depleted Uranium of two different purity levels has been studied to determine spall strength under shock wave loading. A high purity material with approximately 30 ppm of carbon impurities was shock compressed to two different stress levels, 37 and 53 kbar. The second material studied was uranium with about 300 ppm of carbon impurities. This material was shock loaded to three different final stress level, 37, 53, and 81 kbar. Two experimental techniques were used in this work. First, time-resolved free surface particle velocity measurements were done using a VISAR velocity interferometer. The second experimental technique used was soft recovery of samples after shock loading. These two experimental techniques will be briefly described here and VISAR results will be shown. Results of the spall recovery experiments and subsequent metallurgical analyses are described in another paper in these proceedings.

DOE

Shock Waves; Uranium; Velocity Measurement; Data Acquisition

19980206725 Sandia Labs., Livermore, CA USA

Finite element modeling of weld solidification cracking in 6061-T6 aluminum - applicability of strain-based failure criteria

Dike, J. J., Sandia Labs., USA; Bammann, D. J., Sandia Labs., USA; Brooks, J. A., Sandia Labs., USA; Li, M., Sandia Labs., USA; 1997; 5p; In English; 2nd; Thermal Stresses and Related Topics, 8 - 11 Jun. 1997, Rochester, NY, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-8555C; CONF-9706191; DE97-052502; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Finite element simulations using an internal state variable constitutive model are used to study weld solidification cracking of 6061-T6 aluminum. Stress and strain histories at the weld centerline for two types of specimen are studied with regards to application of strain-based failure criteria for predicting weld solidification cracking.

DOE

Aluminum; Finite Element Method; Mathematical Models; Stress-Strain Relationships; Failure

19980206728 Argonne National Lab., IL USA

Impact response of preloaded structures with revolute joints

Kulak, R. F., Argonne National Lab., USA; Pfeiffer, P. A., Argonne National Lab., USA; 1997; 11p; In English; Pressure Vessel and Piping, 27 Jul. - 1 Aug. 1997, Orlando, FL, USA; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/RE/CP-93588; CONF-970726-23; DE97-053551; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Many structural components designed to support static loads must also demonstrate the ability to withstand low probability events that can produce impact loading. For some constructs the structure is not only subjected to the initial impact, but is also subjected to rebound impacts as well. In some designs, support structures must be moved in and out of position as part of normal operations. These structures often employ revolute joints to allow the motions. In addition, functional requirements may require that a significant preload exist within the structure during normal operating conditions. This paper present the methodology needed for simulating the impact response of preloaded structures with revolute joints. A three-dimensional revolute joint is presented for use in explicit time integration analysis of problems with severe impacts. The computational engine used for the transient solution of preloaded structures is discussed. These developments are used in the analysis of a preloaded platen subjected to drop loads. The resulting transient response of the system is presented.

DOE

Functional Design Specifications; Structural Design; Static Loads; Probability Theory; Loads (Forces); Impact Loads

19980206780 Sandia National Labs., Albuquerque, NM USA

A comparison of stresses in armor joints with and without interlayers

Nygren, R. E., Sandia National Labs., USA; 1997; 6p; In English; 17th; Fusion Engineering, 6 - 10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1495C; CONF-971065; DE98-000850; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Reliable joining of armor to heat sinks for plasma facing components has been a persistent problem in fusion and a concern for the International Thermonuclear Experimental Reactor (ITER). Post-fabrication and operating stresses in heat sinks with a 1 mm compliant layer (or no interlayer) between tungsten armor and a CuCrZr channel were analyzed with a 2-D finite element model with temperature dependent properties, generalized plane strain, and strain hardening.

DOE

Finite Element Method; Stress Analysis; Fusion Reactors; Armor; Thermonuclear Reactions; Tungsten; Fabrication; Heat Sinks; Copper Alloys; Thermal Stresses

19980206791 New Hampshire Univ., Dept. of Mechanical Engineering, Durham, NH USA

Stress-Intensity Factors along Three-Dimensional Elliptical Crack Fronts ***Final Report***

Gosz, M., New Hampshire Univ., USA; Moran, B., New Hampshire Univ., USA; May 1998; 20p; In English

Report No.(s): PB98-152671; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the present investigation is to determine the mode I stress-intensity factors along two symmetric surface cracks emanating from a centrally located hole in a rectangular plate (the so-called Round Robin Problem) using the domain integral method. In order to validate the present three-dimensional domain integral implementation, two comparisons were made with benchmark solutions. The authors first considered the problem of an elliptical crack embedded in a rectangular plate. For plate dimensions much greater than the largest characteristic dimension of the elliptical crack, the authors compared the present finite element results with the solution of Irwin (1962) for an elliptical crack embedded in an infinitely extended solid. Next, the authors considered the problem of a quarter-elliptical corner crack in a rectangular plate and compared the results with those of Newman and Raju (1983).

NTIS

Stress Intensity Factors; Surface Cracks; Crack Initiation; Crack Propagation; Three Dimensional Models

19980209665 Research Inst. of National Defence, Avdelningen foer Styrning, Stockholm, Sweden

DABASK: Database for Armour ***DABASK: Databas foer Ballistiska Skydd***

Bratt, C., Research Inst. of National Defence, Sweden; Svensson, L., Research Inst. of National Defence, Sweden; Forsberg, A. S., Research Inst. of National Defence, Sweden; Dec. 1997; 114p; In Swedish

Report No.(s): PB98-147572; FOA-R-00570-310-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report describes the structure of the database DABASK (Database of Armour) made in Microsoft Access 2.0. The report also contain a manual for the database. A disc is included with this report containing the structure of the database, without data. DABASK is structured for ballistic experiments.

NTIS

Armor; Terminal Ballistics; Data Bases; Manuals

19980209674 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

The Applicability of Scaling Laws to Underwater Shock Tests

Hammond, Lloyd, Defence Science and Technology Organisation, Australia; Saunders, David, Defence Science and Technology Organisation, Australia; Nov. 1997; 18p; In English

Report No.(s): DSTO-GD-0162; AR-010-387; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia); US Sales Only, Hardcopy, Microfiche

The applicability and limitations of classical Scaling relationships are reviewed in relation to an AMRL investigation into the structural response of air-backed plates to far-field underwater explosions. It is intended that this investigation will determine the effects of charge size and disposition and a range of structural parameters on the structural response of submerged, air-backed plates.

Author

Underwater Tests; Underwater Explosions; Shock Tests

19980209810 Department of the Navy, Washington, DC USA
Method for Monitoring Surface Stress
Nadolink, Richard H., Inventor, Department of the Navy, USA; Dec. 02, 1997; 5p; In English
Patent Info.: Filed 27 Aug. 1996; US-Patent-Appl-SN-716664; US-Patent-5,693,889
Report No.(s): AD-D018841; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A piece of single crystal silicon is embedded in a material such that the silicon is flush with the surface thereof. The silicon is illuminated with infrared radiation having a wavelength in the range of 80-1100 nanometers. Isochromatic fringe patterns projected from the silicon are monitored as a direct indication of the amount of stress experienced at the surface.
DTIC
Monitors; Single Crystals; Silicon; Stress Measurement

19980209829 Osaka Univ., Dept. of Welding and Production Engineering, Osaka, Japan
Numerical Analysis of Stress and Strain Behavior of Double-Edge Cracked Specimen with Side Groove
El-Shennawy, Mohamed, Osaka Univ., Japan; Minami, Fumiyoshi, Osaka Univ., Japan; Toyoda, Masao, Osaka Univ., Japan; Technology Reports of the Osaka University; Apr. 15, 1994; ISSN 0030-6177; Volume 44, Nos. 2163-2182, pp. 67-76; In English
Report No.(s): Rept-2171; Copyright; Avail: Issuing Activity (Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan), Hardcopy, Microfiche

A three-dimensional FE(finite element)-analysis has been carried out to investigate the stress and strain fields of a double-edge cracked specimen (DECS) with side groove (geometrical discontinuity). At small scale yielding (SSY), no evident difference in stress and strain fields among different geometries of side groove could be found. Distinct changes in stress and strain fields have arisen at large scale yielding (LSY). Existence of side groove elevates the opening stress at the crack tip. Stress triaxiality is also enlarged by the side groove, but the location of the maximum stress triaxiality depends on the geometry of side groove. to detect the geometrical changes' effect on plastic constraint, two crack lengths with different groove dimensions (both width and depth) have been studied. Decreasing groove width and increasing both crack length and groove depth not only magnify the crack-tip region constraint but also displace the maximum plastic constraint point.
Author
Crack Tips; Stress-Strain Relationships; Finite Element Method; Stress Analysis; Numerical Analysis; Triaxial Stresses; Stress Distribution; Cracking (Fracturing); Grooves

19980209845 Westinghouse Savannah River Co., Aiken, SC USA
Displacement analysis of a bend plate test with mechanical loading and laser heating
Lam, P. S., Westinghouse Savannah River Co., USA; Sep. 1997; 16p; In English
Contract(s)/Grant(s): DE-AC09-96SR-18500
Report No.(s): WSRC-TR-97-00294; DE98-051503; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The surface displacment of a steel plate caused by a permanent deformation as a result of local yielding was modeled by a finite element analysis. The local yielding occurs when a small area of the plate is heated by a laser beam. The calculated displacments are in good agreement with the preliminary experimental data obtained using a bend specimen with laser heating at the University of Alabama at Huntsville. It has been shown computuationally and optically that the relative displacments are less than 1 mm near the laser heated area of the specimen. The results demonstrate that the experimental approach is a feasible technique for determining the residual stress under multiaxial stress field.
DOE
Finite Element Method; Metal Plates; Bend Tests; Deformation; Displacement; Steels; Laser Heating; Loads (Forces)

19980209940 ESDU International Ltd., London UK
Methods for Analysis of the Dynamic Response of Structures
Dec. 1997; 38p; In English; Included in the Vibration and Acoustic Fatigue Sub-series
Report No.(s): ESDU-97033; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97033 describes the most commonly used methods of prediction for structures and structures coupled to fluids. It provides guidelines for choosing an appropriate method for a given application. Various physical characteristics of the structural response are described that influence the selection of the most appropriate mathematical model to describe the complete system. The general principles of the methods for modelling the structure are described and their major advantages and limitations summarized. Methods covered are: global or local trial functions, the boundary element method, the

finite element method, the dynamic stiffness method, modal interaction analysis, and statistical energy analysis. The mathematical approach for each method is outlined. Modelling the excitation is discussed. The advantages of choosing either a frequency or a time domain solution are also considered. The various options available appear on four decision trees that guide the user to select the most appropriate approach to model the complete system, and their use is illustrated by practical examples.
Author
Mathematical Models; Statistical Analysis; Procedures; Finite Element Method; Fluid Flow; Molecular Structure

19980209955 Oak Ridge National Lab., TN USA
Use of precracked Charpy and smaller specimens to establish the master curve
Sokolov, M. A., Oak Ridge National Lab., USA; McCabe, D. E., Oak Ridge National Lab., USA; Nanstad, R. K., Oak Ridge National Lab., USA; Davidov, Y. A., Bulgarian Academy of Sciences, Bulgaria; 1997; 16p; In English; 3rd; Small Specimen Test Techniques, 13-14 Jan. 1997, New Orleans, LA, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95332; CONF-970124; DE98-001433; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The current provisions used in the U.S. Code of Federal Regulations for the determination of the fracture toughness of reactor pressure vessel steels employs an assumption that there is a direct correlation between K(sub Ic) lower-bound toughness and the Charpy V-notch transition curve. Such correlations are subject to scatter from both approaches which weakens the reliability of fracture mechanics-based analyses. In this study, precracked Charpy and smaller size specimens are used in three-point static bend testing to develop fracture mechanics based K(sub k) values. The testing is performed under carefully controlled conditions such that the values can be used to predict the fracture toughness performance of large specimens. The concept of a universal transition curve (master curve) is applied. Data scatter that is characteristic of commercial grade steels and their weldments is handled by Weibull statistical modeling. The master curve is developed to describe the median K(sub Jc) fracture toughness for 1T size compact specimens. Size effects are modeled using weakest-link theory and are studied for different specimen geometries. It is shown that precracked Charpy specimens when tested within their confined validity limits follow the weakest-link size-adjustment trend and predict the fracture toughness of larger specimens. Specimens of smaller than Charpy sizes (5 mm thick) exhibit some disparities in results relative to weakest-link size adjustment prediction suggesting that application of such adjustment to very small specimens may have some limitations.
DOE
Fracture Mechanics; Fracture Strength; Pressure Vessels; Reliability; Static Tests; Statistical Analysis; Steels; Weibull Density Functions; Welded Joints

19980210016 NASA Dryden Flight Research Center, Edwards, CA USA
Anomalous Buckling Characteristics of Laminated Metal-Matrix Composite Plates with Central Square Holes
Ko, William L., NASA Dryden Flight Research Center, USA; Jul. 1998; 24p; In English
Contract(s)/Grant(s): RTOP 522-32-34
Report No.(s): NASA/TP-1998-206559; H-2241; NAS 1.60:206559; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Compressive buckling analysis was performed on metal-matrix composite (MMC) plates with central square holes. The MMC plates have varying aspect ratios and hole sizes and are supported under different boundary conditions. The finite-element structural analysis method was used to study the effects of plate boundary conditions, plate aspect ratio, hole size, and the composite stacking sequence on the compressive buckling strengths of the perforated MMC plates. Studies show that by increasing the hole sizes, compressive buckling strengths of the perforated MMC plates could be considerably increased under certain boundary conditions and aspect ratios (”anomalous” buckling behavior); and that the plate buckling mode could be symmetrical or antisymmetrical, depending on the plate boundary conditions, aspect ratio, and the hole size. For same-sized plates with same-sized holes, the compressive buckling strengths of the perforated MMC plates with [90/0/0/90]2 lamination could be as much as 10 percent higher or lower than those of the [45/- 45/- 45/45]2 laminations, depending on the plate boundary conditions, plate aspect ratios, and the hole size. Clamping the plate edges induces far stronger ”anomalous” buckling behavior (enhancing compressive buckling strengths at increasing hole sizes) of the perforated MMC plates than simply supporting the plate edges.
Author
Finite Element Method; Metal Matrix Composites; Structural Analysis; Perforated Plates

19980210083 ESDU International Ltd., London, UK

Fatigue of Bolted Steel Lap Joints and Doublers

Aug. 1996; 47p; In English; Included in the Stress and Strength Sub-series

Report No.(s): ESDU-96014; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96014 presents data relating to joints fabricated from seven different structural steels with tensile strengths ranging from 400 to 867 MN/sq m (58E3 to 126E+3 lbf/sq ft) secured, with the exception of one group of joints, with either ASTM A325 or A490 bolts. The joints were double lap joints with 2, 3, 4, 6 or 10 bolts and a double cover plate butt joint with two bolts. Some data are also given for doublers, that is a configuration similar to a double cover plate butt joint in which the plate is continuous. Fatigue data for 39 different joints are presented as plots of the ratio of alternating stress on the gross section of the joint or doubler to the tensile strength of the material against cycles to failure. Each plot is accompanied by a dimension sketch of the joint and a table giving details of the test specimen and conditions. Comparable data for plain plates and plates with holes are given when available. The effects of the following factors are assessed: the number of bolts and the clamping pressure, the tensile strength of the joint material, the bolt arrangement, the bolt tightening procedure, the condition of the contacting surfaces, the stress ratio, the cover and centre plate thicknesses, and the joint width.

Author

Fatigue (Materials); Bolted Joints; Data Acquisition; Tensile Strength

19980210101 Sandia National Labs., Albuquerque, NM USA

Single-cycle and fatigue strengths of adhesively bonded lap joints

Metzinger, K. E., Sandia National Labs., USA; Guess, T. R., Sandia National Labs., USA; 1998; 10p; In English; Wind Energy, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1325C; AIAA Paper 98-0063; CONF-980104; DE98-000227; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This study considers a composite-to-steel tubular lap joint in which failure typically occurs when the adhesive debonds from the steel adherend. The same basic joint was subjected to compressive and tensile axial loads (single-cycle) as well as bending loads (fatigue). The purpose of these tests was to determine whether failure is more dependent on the plastic strain or the peel stress that develops in the adhesive. For the same joint, compressive and tensile loads of the same magnitude will produce similar plastic strains but peel stresses of opposite signs in the adhesive. In the axial tests, the tensile strengths were much greater than the compressive strengths - indicating that the peel stress is key to predicting the single-cycle strengths. to determine the key parameter(s) for predicting high-cycle fatigue strengths, a test technique capable of subjecting a specimen to several million cycles per day was developed. In these bending tests, the initial adhesive debonding always occurred on the compressive side. This result is consistent with the single-cycle tests, although not as conclusive due to the limited number of tests. Nevertheless, a fatigue test method has been established and future tests are planned.

DOE

Adhesive Bonding; Fatigue Tests; Lap Joints; Bending Fatigue; Bonded Joints; Failure; Debonding (Materials); Composite Materials; Metal Joints; Steels

19980210358 Los Alamos National Lab., NM USA

Estimate for the maximum compression of single shocks

Johnson, J. D., Los Alamos National Lab., USA; Feb. 1998; 6p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-13404-MS; DE98-003055; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors derive that the maximum compression for any single-shock Hugoniot has an upper bound of 7. For the principal Hugoniot, they present a simple analytic estimate for the maximum compression as a function of (rho)(sub o) (initial density), A (atomic weight), Z (atomic number), and (Delta)E (the sum of cohesion, dissociation, and total ionization energies).

DOE

Compressible Fluids; Equations of State; Hydrodynamics; Limits (Mathematics); Many Body Problem; Shock Wave Propagation

19980210362 Sandia National Labs., Albuquerque, NM USA

Mechanical diode: Comparing numerical and experimental characterizations

Sagartz, M. J., Sandia National Labs., USA; Segalman, D., Sandia National Labs., USA; Simmermacher, T., Sandia National Labs., USA; Feb. 1998; 19p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-98-0249; DE98-003217; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In this introductory work, joint compliance is studied in both a numerical and experimental setting. A simple bolted interface is used as the test article and compliance is measured for the joint in both compression and in tension. This simple interface is shown to exhibit a strong non-linearity near the transition from compression to tension (or vice-versa). Modeling issues pertaining to numerically solving for the compliance are addressed. It is shown that the model predictions, in spite of convergence being very sensitive to numerical artifacts of the interface model, are in good agreement with experimentally measured strains and joint compliances. The joint behavior is a mechanical analogy to a diode, i.e., in compression, the joint is very stiff, acting almost as a rigid link, while in tension the joint is relatively soft, acting as a spring.

DOE

Computerized Simulation; Bolted Joints; Compressibility Effects; Nonlinear Equations; Tensile Properties

19980210399 Southampton Univ., Dynamics Group, UK

A Velocity Method for Estimating Dynamic Strain and Stress in Pipes

Finnveden, S., Southampton Univ., UK; Pinnington, R. J., Southampton Univ., UK; Feb. 1998; 50p; In English; Sponsored in part by Swedish Research Council for Engineering Sciences

Report No.(s): ISVR-TR-274; Copyright; Avail: Issuing Activity (Inst. of Sound and Vibration Research, University of Southampton, Southampton SO17 1BJ, England); US Sales Only, Hardcopy, Microfiche

A velocity method for estimating strain and stress in pipe structures is investigated. With this method predicted or measured spatial average vibration velocity and theoretically derived strain factors are used to estimate maximum strain. The strain in a point is limited by an expression proportional to the square root of the strain energy density which in turn is related to its cross sectional average. For reverberant field or for infinite pipes, the average strain energy density is proportional to the mean square velocity. Upon this basis, the non dimensional strain factor is defined as the maximum strain times the ratio of the sound velocity to the spatial rms vibration velocity. Measurements are made confirming that this is a descriptive number. Using a spectral finite element method, numerical experiments are made varying the pipe parameters and considering all sixteen possible homogenous boundary conditions. While indicating possible limitations of the method when equipment is mounted on pipes, the experiments verify the theoretical results. The velocity method may become useful in engineering practice for assessments of fatigue life.

Author

Velocity; Dynamic Loads; Stress Analysis; Strain Rate; Pipes (Tubes); Numerical Analysis

19980210404 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA

Dynamics of Variable Mass Systems ***Final Report, 1 Dec. 1993 - 15 Mar. 1998***

Eke, Fidelis O., California Univ., USA; 1998; 133p; In English

Contract(s)/Grant(s): NAG2-4003

Report No.(s): NASA/CR-1998-208246; NAS 1.26:208246; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report presents the results of an investigation of the effects of mass loss on the attitude behavior of spinning bodies in flight. The principal goal is to determine whether there are circumstances under which the motion of variable mass systems can become unstable in the sense that their transverse angular velocities become unbounded. Obviously, results from a study of this kind would find immediate application in the aerospace field. The first part of this study features a complete and mathematically rigorous derivation of a set of equations that govern both the translational and rotational motions of general variable mass systems. The remainder of the study is then devoted to the application of the equations obtained to a systematic investigation of the effect of various mass loss scenarios on the dynamics of increasingly complex models of variable mass systems. It is found that mass loss can have a major impact on the dynamics of mechanical systems, including a possible change in the systems stability picture. Factors such as nozzle geometry, combustion chamber geometry, propellant's initial shape, size and relative mass, and propellant location can all have important influences on the system's dynamic behavior. The relative importance of these parameters on-system motion are quantified in a way that is useful for design purposes.

Author

Dynamic Characteristics; Variable Mass Systems; Systems Stability; Losses; Mass

19980210457 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of

An analysis of stress wave propagation in an elastic half-space to impact loads

Kim, Hyun Sil, Korean Inst. of Machinery and Materials, Korea, Republic of; Kim, Jae Seung, Korean Inst. of Machinery and Materials, Korea, Republic of; Kang, Hyun Joo, Korean Inst. of Machinery and Materials, Korea, Republic of; Kim, Sang Ryul, Korean Inst. of Machinery and Materials, Korea, Republic of; Dec. 1996; 66p; In Korean

Report No.(s): KAERI-CM-073/96; DE98-724995; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

The stress wave propagation in an elastic half-space to water droplet with high velocity is studied by using the Blowers' impact profile. The Laplace and Hamkel transforms are applied to the governing equations and inverse transforms are obtained by using the Cagniard-de Hoop method. The variables are non-dimensionalized for the dilatational wave speed. The stresses are calculated for given time and positions, where at the surface the residue terms are included. The program 'IMPACT.FOR' and 'ZERO.FOR' are developed for computing the stresses inside the medium and on the surface. The stresses on the surface are dominated by the Rayleigh wave, where stresses show singularity at the Rayleigh wavefront. In the case of the one-dimensional problem where the surface is coated with different material and the pressure is constant in radius, the hard coating (the impedances of the coating is larger than that of the substrate) is better than the soft coating since hard coating experience less stress compared to the one without= coating. The program 'ONE-D.FOR' is developed to compute stress for the one dimensional coated case. DOE

Wave Propagation; Stress Waves; Impact Loads; Stress Analysis; Computation; Laplace Transformation

19980210623 Thiokol Chemical Corp., Brigham City, UT USA

Residual Stress Measurements After Proof and Flight: ETP-0403 ***Final Report***

Webster, Ronald L.., Thiokol Chemical Corp., USA; Nov. 18, 1997; 102p; In English

Contract(s)/Grant(s): NAS8-38100

Report No.(s): NASA/CR-1997-208242; NAS 1.26:208242; TWR-18901; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The intent of this testing was to evaluate the residual stresses that occur in and around the attachment details of a case stiffener segment that has been subjected to flight/recovery followed by proof loading. Not measured in this test were stresses relieved at joint disassembly due to out-of-round and interference effects, and those released by cutting the specimens out of the case segment. The test article was lightweight case stiffener segment 1U50715, S/N L023 which was flown in the forward stiffener position on flight SRM 14A and in the aft position on flight SRM24A. Both of these flights were flown with the 3 stiffener ring configuration. Stiffener L023 had a stiffener ring installed only on the aft stub in its first flight, and it had both rings installed on its second flight. No significant post flight damage was found on either flight. Finally, the segment was used on the DM-8 static test motor in the forward position. No stiffener rings were installed. It had only one proof pressurization prior to assignment to its first use, and it was cleaned and proof tested after each flight. Thus, the segment had seen 3 proof tests, two flight pressurizations, and two low intensity water impacts prior to manufacturing for use on DM-8. On DM-8 it received one static firing pressurization in the horizontal configuration. Residual stresses at the surface and in depth were evaluated by both the x-ray diffraction and neutron beam diffraction methods. The x-ray diffraction evaluations were conducted by Technology for Energy Corporation (TEC) at their facilities in Knoxville, TN. The neutron beam evaluations were done by Atomic Energy of Canada Limited (AECL) at the Chalk River Nuclear Laboratories in Ontario. The results showed general agreement with relatively high compressive residual stresses on the surface and moderate to low subsurface tensile residual stresses.

Author

Tensile Stress; Solid Rocket Binders; Stress Measurement; Static Tests; Static Firing; Horizontal Flight; Space Shuttle Boosters; Flight Characteristics

19980210720 Lawrence Livermore National Lab., Livermore, CA USA

Structural stability of a rectangular, simply-supported beam subject to a sudden air temperature change next to one surface

Landram, C. S., Lawrence Livermore National Lab., USA; Jul. 03, 1997; 16p; In English

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-ID-127766; DE98-051344; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

For a simply-supported, rectangular beam suddenly heated on one of its surfaces by surrounding air, both elongational and flexural thermal distortions occur. For steel beams of order 10 to 30 cm thick and about 3 m long, flexural displacements, developing in minutes, occur much faster than elongational displacements which occur in hours. The rapid response of the flexural modes

is caused by the early-time surface heating of the side of the beam exposed to the suddenly-heated, warmer air. The slower response of the elongation modes is a consequence of a much slower change in the average temperature of the beam. At a span of 3.05 m, the maximum steady state flexural distortions in micrometers were 0.22, 0.78 and 1.56 for respective one-sided air temperature changes in degrees C of 0.28, 1 and 2.
DOE
Structural Stability; Rectangular Beams; Temperature Effects; Temperature Gradients; Steels

19980210834 Fraunhofer-Inst. fuer Werkstoffmechanik, Freiburg, Germany
Applying micromechanic failure models for description of failure modes in the ductile-brittle transition region ***Einsatz mikromechanischer Schaedigungsmodelle im sproed-duktilen Uebergangsbereich***
Bernauer, G., Fraunhofer-Inst. fuer Werkstoffmechanik, Germany; Jul. 1997; 119p; In German
Report No.(s): FhG-IWM-W-5/97; DE98-746400; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The work reported was to examine whether the modified Gurson model and the Beremin model can be applied to the brittle-ductile transition region of a ferritic steel, and whether the material's behaviour can be characterized with a failure model integrating the two models mentioned above into one. Any possible improvements of this approach were to be found. The report at first gives a brief list of terminology and formulas used. Chapter 3 explains the microscopic processes typically observed in the transition region in connection with the failure modes of ductile fracture and cleavage fracture, and shows possible approaches for modelling. Chapter 4 defines the specimens and materials, and chapter 5 explains the experiments as well as the microscopic analyses of the fracture surfaces. Chapter 6 presents subsequent calculations representing the processes observed. Based on the stress distributions thus derived, the Beremin model is re-examined for further development. Chapter 7 summarizes the results obtained.
DOE
Ductile-Brittle Transition; Micromechanics; Failure Modes; Mathematical Models; Steels

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EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see 35 Instrumentation and Photography.

19980206698 Maxwell Labs., Inc., San Diego, CA USA
Further Analyses of Regional Seismic Data Recorded From the Soviet PNE Program: Implications With Respect to CTBT Monitoring ***Final Report, Aug. 1995 - Aug 1997***
Murphy, J.R., Maxwell Labs., Inc., USA; Sultanov, D. D., Maxwell Labs., Inc., USA; Barker, B. W., Maxwell Labs., Inc., USA; Kitov, I. O., Maxwell Labs., Inc., USA; Marshall, M. E., Maxwell Labs., Inc., USA; Oct. 1997; 84p; In English
Contract(s)/Grant(s): F19628-95-C-0109; AF Proj. 5101
Report No.(s): AD-A341784; PL-TR-97-2141; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report summarizes the result of a joint research program which has been carried out by scientists from Maxwell Technologies, Inc. and the Russian Institute for Dynamics of the Geospheres to use regional seismic data recorded from Soviet PNE tests to assess the transportability of regional discriminants. More specifically, the goal of the study has been to use these PNE data to derive improved, quantitative bounds on the ranges of regional seismic signal characteristics which might be expected from underground nuclear tests conducted under the variety of source and propagation path conditions which must be considered in global monitoring of the CTBT. Broadband data recorded at the Borovoye Geophysical Observatory in Central Asia from 29 of these PNE tests in the distance range from about 7 to 9 degrees have now been processed and analyzed in detail. The characteristics of the explosion source coupling inferred from this analysis indicate systematic variations with source yield, depth of burial and medium which are generally consistent with those predicted by the Mueller/Murphy source model. Moreover, the Lg/P spectral ratios determined from these observed Borovoye PNE data generally decline to average values over of 1 or less at frequencies above about 3 Hz and, therefore, typically appear explosion-like at high frequencies over this entire range of source and propagation path conditions.
DTIC
Underground Explosions; Seismic Waves; Geophysics; Geophysical Observatories; Nuclear Explosions

19980206720 Los Alamos National Lab., NM USA

Satellite-based laser windsounder

Schultz, J. F., Los Alamos National Lab., USA; Czuchlewski, S. J., Los Alamos National Lab., USA; Quick, C. R., Los Alamos National Lab., USA; [1997]; 16p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2103; DE97-008587; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a one-year, Laboratory-Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The project's primary objective is to determine the technical feasibility of using satellite-based laser wind sensing systems for detailed study of winds, aerosols, and particulates around and downstream of suspected proliferation facilities. Extensive interactions with the relevant operational organization resulted in enthusiastic support and useful guidance with respect to measurement requirements and priorities. Four candidate wind sensing techniques were evaluated, and the incoherent Doppler technique was selected. A small satellite concept design study was completed to identify the technical issues inherent in a proof-of-concept small satellite mission. Use of a Mach-Zehnder interferometer instead of a Fabry-Perot would significantly simplify the optical train and could reduce weight, and possibly power, requirements with no loss of performance. A breadboard Mach-Zehnder interferometer-based system has been built to verify these predictions. Detailed plans were made for resolving other issues through construction and testing of a ground-based lidar system in collaboration with the University of Wisconsin, and through numerical lidar wind data assimilation studies.

DOE

Aerosols; Breadboard Models; Mach-Zehnder Interferometers; Meteorological Radar; Wind (Meteorology); Wind Measurement

19980209885 Communications Research Lab., Koganei, Japan

Oil Pollution Detection Experiments By The Synthetic Aperture Radar On The European Remote Sensing Satellite-1

Okamoto, Ken'ichi, Communications Research Lab., Japan; Kobayashi, Tatsuharu, Communications Research Lab., Japan; Masuko, Harunobu, Communications Research Lab., Japan; Shimada, Masanobu, National Space Development Agency, Japan; Journal of the Communications Research Laboratory; Nov. 1994; ISSN 0914-9260; Volume 41, No. 3, pp. 161-166; In English; Copyright; Avail: Issuing Activity (Communications Research Laboratory, Ministry of Posts and Telecommunications, Nukui-Kitamachi, 4-chome, Koganei, Tokyo, 184 Japan), Hardcopy, Microfiche

We conducted experiments on detecting artificial oil pollution areas using the C-band Synthetic Aperture Radar on the European Remote Sensing Satellite-1 in November 1991 and in October and November 1992. Artificial oil pollution areas were produced by spilling oleyl alcohol from a small ship in the Pacific ocean about 100 km off the coast of Japan. Sea truth data were collected by the research vessel and the small ship used to spill the alcohol. The ERS-1 SAR images were processed by NASDA. The artificial oil pollution areas were clearly detected by ERS- 1 SAR under various wind speeds of less than 11 m/s. The maximum damping of the scattered power was nearly the same (4 to 5 dB) for the wind speeds of less than 11 m/s. However, the ERS-1 SAR did not detect the artificial oil pollution areas when the wind speed was 13.7 m/s.

Author

Synthetic Aperture Radar; Satellite Observation; Remote Sensing; Oil Slicks; ERS-1 (ESA Satellite); Radar Detection

19980210010 California Univ., Inst. for Computational Earth System Science, Santa Barbara, CA USA

Land Surface Temperature Measurements from EOD MODIS Data ***Semiannual Report, Jan. - Jun. 1998***

Wan, Zheng-Ming, California Univ., USA; 1998; 28p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-31370; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We made more tests of the version 2.0 daily Level 2 and Level 3 Land-Surface Temperature (LST) code (PGE 16) jointly with the MODIS Science Data Support Team (SDST). After making minor changes a few times, the PGE16 code has been successfully integrated and tested by MODIS SDST, and recently has passed the inspection at the Goddard Distributed Active Archive Center (DAAC). We conducted a field campaign in the area of Mono Lake, California on March 10, 1998, in order to validate the MODIS LST algorithm in cold and dry conditions. Two MODIS Airborne Simulator (MAS) flights were completed during the field campaign, one before noon, and another around 10 pm PST. The weather condition for the daytime flight was perfect: clear sky, the column water vapor measured by radiosonde around 0.3 cm, and wind speed less than a half meter per second. The quality of MAS data is good for both day and night flights. We analyzed the noise equivalent temperature difference (NE(delta)T) and the calibration accuracy of the seven MAS thermal infrared (TIR) bands, that are used in the MODIS day/night LST algorithm, with daytime MAS data over four flat homogeneous study areas: two on Grant Lake (covered with ice and snow, respectively), one on Mono Lake, and another on the snow field site where we made field measurements. NE(delta)T ranges from 0.2 to 0.6 k for bands 42, 45, 46, and 48. It ranges from 0.8 to 1.1 K for bands 30-32. The day and night MAS data have been used to retrieve

surface temperature and emissivities in these bands. A simple method to correct the effect of night thin cirrus has been incorporated into the day/night LST algorithm in dry atmospheric conditions. We compared the retrieved surface temperatures with those measured with TIR spectrometer, radiometers and thermistors in the snow test site, and the retrieved emissivity images with topographic map. The daytime LST values match well within 1 K. The night LST retrieved from MAS data is 3.3 K colder than those from field measurements most likely because of the effect of haze at night. The good agreement among the regional averaged surface temperatures obtained from LST values retrieved at different resolutions increased our confidence in the MODIS day/night LST algorithm.
Author
Temperature Measurement; Land Surface Temperature; Imaging Spectrometers; Infrared Radiation; Temperature Gradients; Surface Temperature

19980210292 University of Western Washington, Huxley Coll. of Environmental Studies, Bellingham, WA USA
Analysis of Land-Use Effects on Landscape Patterns and Biological Diversity in Pacific North Forests: 1972-1991 ***Final Report, 1993-1998***
Wallin, David O., University of Western Washington, USA; Cohen, Warren B., Forest Service, USA; Bradshaw, G. A., Oregon State Univ., USA; Spies, T. A., Forest Service, USA; Hansen, A., University of Western Washington, USA; Huff, M. H., Forest Service, USA; Lehmkuhl, J. F., University of Western Washington, USA; Raphael, M. G., University of Western Washington, USA; Ripple, W. J., Oregon State Univ., USA; Jul. 10, 1998; 4p; In English
Contract(s)/Grant(s): NAGw-3745; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

While there is widespread recognition of the importance of preserving biological diversity there is considerable uncertainty about how to map current patterns of diversity and monitor changes through time. Ground-based approaches are impractical for examining regional patterns of biological diversity, for monitoring change, and they may actually overlook important higher-order phenomena. Thus, there is a critical need for innovative techniques to examine land-use effects on biological diversity at the landscape and regional scales. In this project, we have used satellite-based remote sensing to examine land-use effects on forest ecosystems in the Pacific NorthWest region (PNW) of the U.S.A. Rates and patterns of forest change throughout the region were quantified for the period from 1972 to 1993. This information was then used to map changes in the abundance and distribution of potential habitat for selected vertebrate species. The results of this project will be useful for identifying ”keystone” stands that are important in maintaining habitat connectivity at the regional scale and for evaluating the impact of future land-use on vertebrate diversity throughout the region. The approaches developed here will also be useful in other forested regions throughout the world.
Author
Land Use; Evaluation; Biological Diversity; Forests; Pattern Method (Forecasting)

19980210395 Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil
Evaluation of the Segmentation and Classification Techniques by Regions Using LANDSAT-TM Images Searching for Mapping Unities of the Landscape in Amazonia ***Avaliacao de Tecnicas de Segmentacao e Classificacao por Regioes em Imagens LANDSAT-TM Visando o Mapamento de Unidades de Paisagem na Amazonia***
deRezendeNascimento, Paulo Sergio, Instituto de Pesquisas Espaciais, Brazil; Feb. 1997; 122p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6391-TDI/607; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

To monitor the land surface of a country with continental dimensions such as Brazil, it is important to explore a number of ways to decrease the cost/benefit relation in the study of such large areas. Thus, the mapping of landscape units in Amazon using remote sensing techniques is essential. The remote sensing methods commonly used to monitor tropical forest are based either on visual interpretation or digital classification of satellite imagery. The visual interpretation, followed by manual digitalization both are costly and time-consuming, and many times are repetitive and monotonous. Commonly used digital classification techniques are limited because they are based on a pixel-by-pixel analysis, without contextual information. The objective of this work is to investigate the segmentation and region classification techniques and to evaluate their use to map Amazon landscape units. The study area is located at the north of Manaus (AM) and has several land cover classes such as primary forests, secondary growth forests and pastures typical of large regions of the Amazon which are suffering rapid land use and cover changes. Bands 3,4 and 5 of the TM/LANDSAT, fraction images of vegetation, soil, woody material and shadow endmembers, derived from the TM images were used in this study. A segmentation and classification algorithms, developed at INPE, were applied to those images (before and after applying a median filter and adjusting the mean and the standard deviation of each band). The classification results were analyzed both visually and through contingence matrix and Kappa statistics techniques. The results show that the

classification technique was satisfactory to map and assess the areal extent of the cover classes studied. The thresholds of similarity equals to 12 and of area equals to 10 for the segmentation and the threshold of acceptance equals to 75% for the classification provided the best results. Adjusted images and the fraction images allowed better results than the original and filtered set of images.
Author
Evaluation; Amazon Region (South America); Image Classification; Monitors

19980210400 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Vegetation Physiognomy and Land Use Mapping in Part of Alto Taquari (MS) River Basin Using TM/LANDSAT and HRV/SPOT Images ***Mapeamentos Fitofisionomico e de Uso da Terra de Parte da Bacia do Alto Taquaris (MS) Mediante o USO de Imagens TM/LANDSAT e HRV/SPOT***
Filho, Pedro Hernandez, Instituto Nacional de Pesquisas Espacias, Brazil; Ponzoni, Flavio Jorge, Instituto Nacional de Pesquisas Espacias, Brazil; Pereira, Madalena Niero, Instituto Nacional de Pesquisas Espacias, Brazil; Pott, Arnildo, Empresa Brasileira de Pesquisa Agropecuaria, Brazil; Pott, Vali Joana, Empresa Brasileira de Pesquisa Agropecuaria, Brazil; daSilva, Marta Pereira, Instituto Nacional de Pesquisas Espacias, Brazil; 1997; 39p; In Portuguese
Report No.(s): INPE-6388-RPQ/679; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

TM/LANDSAT temporal images (dry and wet seasons) and HRV/SPOT images from a dry season, in analogical and digital presentation forms, were used in a physiognomic vegetation and land use mapping in part of Alto Taquari (MS) river basin. The analogical images were available in color compositions form, considering TM3 (B), TM4 (G) and TM5(R) bands, and HRVI (B), HRV2 (G) and HRV3(R) bands. Visual interpretation was carried out using these color compositions considering the following vegetation and land use classes: ”Campo”, ”Cerrado”, ”Cerradio”, ”Cerrado” and ”Mata Aluvial”, ”Mata aluvial”, ”Formacao alterada”, ”Areas destinadas a Agropecuaria”, ”Cukuras Agricolas Implantadas” and ”Espelho d’agua”. The perfbrmance evaluation of TM and HRV products has shown a small superiority of HRV images, comparing TM images. The area of six topographic charts was interpreted (1: 100000 mapping scale), which results were transfered to a Geographic Information System (SIG). The digital image processing was carried out over the Pedro Gomes topographic chart area, considering only the TM images. Principal components technique was applied in order to generate new images from visible bands (TM1, TM2 and TM3) and middle infrared bands (TM5 and TM7). These two new unages were added to TM4 unage, which were used in order to identify through visual interpretation, the map categories, MAXVER digital classification procedure was carried out considering the six TM image bands available. The result of that classification was also transfered to the GIS and it was compared with that visual thematic map through Kappa (KHAT) statistical parameter. The results have shown low similarity between these maps.
Author
Analogies; Geographic Information Systems; Vegetation; Topography; Thematic Mapping; River Basins

19980210570 Los Alamos National Lab., NM USA
Optimal detection of near-earth objects
Canavan, G. H., Los Alamos National Lab., USA; Sep. 1997; 10p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3894; DE98-001569; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Improved technology and search strategies could significantly increase debris detection rates and tracking accuracies with modest investment. Improving the focal planes of current telescopes could significantly increase detection rates. For large systems, proportional increases in aperture area and array size are appropriate.
DOE
Interplanetary Space; Detection; Space Debris; Telescopes; Remote Sensing

19980210653 Physics and Electronics Lab. TNO, The Hague, Netherlands
Multi-Sensor Remote Sensing for Military Cartography
vandenBroek, A. C., Physics and Electronics Lab. TNO, Netherlands; Hoogeboom, P., Physics and Electronics Lab. TNO, Netherlands; vanPersie, M., National Aerospace Lab., Netherlands; Apr. 1998; 8p; In English; Also announced as 19980210650
Contract(s)/Grant(s): A95/KL/756; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

We have studied remote sensing data from sensors in different wavelength regions (optical, thermal infrared and microwave) and from different platforms (airborne and spaceborne) in order to extract geographical information. By comparing the extracted information with an existing geographical database of a test area in the Netherlands we find that to obtain military relevant carto-

graphic information from remote sensing images resolutions of 5 meter or less are required. For appropriate classification of extended objects like agricultural fields multi-layer imagery is necessary.
Author
Multisensor Applications; Infrared Radiation; Remote Sensing; Microwaves

19980210654 Thomson-CSF, Image and Geographic Information Unit, Malakoff, France
Design of Multi-Sensor System for 3D Site Model Acquisition and Exploitation
Tannous, I., Thomson-CSF, France; Gobert, S., Thomson-CSF, France; Laurencot, T., Thomson-CSF, France; Dulac, J.-M., Thomson Training and Simulation Ltd., France; Goretta, O., Ministry of Defence, France; Apr. 1998; 10p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The increasing number of high resolution image sensors in a near future, as well as the need for realistic 3D site databases for applications like simulation, terrestrial mission preparation and training, has emphasized the need for multi-sensor image-based system dedicated to the production and exploitation of 3D site model. We present here the design of such a system, including the required functionalities for this purpose. The system comprises a geometric reconstruction step, which aims at producing a geometrically reliable 3D model of the site, including the topography, from the aerial or satellite images available. Next step is the exploitation of other images, especially terrestrial photographs, for the mapping of real textures on the faces of the reconstructed objects, as well as the texturation of the terrain. The output of this stage is a realistic 3D site model that can be used by the exploitation module of the system, allowing the real time reconstruction of the scene from any point of view, interactively or according to a pre- defined scenario. This system has been prototyped by SYSECA and THOMSON TRAINING & SIMULATION (both subsidiaries of THOMSON-CSF) using their own software, and the results of an experimentation with real data have demonstrated the feasibility of our approach.
Author
Multisensor Applications; Three Dimensional Models; Topography; Image Analysis; Satellite Imagery

19980210655 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven, Germany
Airborne Dual Sensor Millimeter Wave-Signatures of Maritime Targets and Sea-Clutter
Makaruschka, R., Forschungsinstitut fuer Hochfrequenzphysik, Germany; Essen, H., Forschungsinstitut fuer Hochfrequenzphysik, Germany; Apr. 1998; 7p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In the framework of a NATO measurement campaign airborne signature measurements were conducted over sea with the dual frequency, polarimetric mm W Synthetic Aperture Radar MEMPHIS (Millimeterwave Experimental Multifrequency Polarimetric High Resolution Imaging System) with simultaneous operating front-ends at 35 GHz and 94 GHz onboard a cargo aircraft in side-looking configuration. Both front-ends are tied to the same system reference and are using the same IF pre-processing and radar waveform-generator. So as well a concise comparison between data at relevant mm W bands simultaneously. the two frequency bands, 35 GHz and 94 GHz, can be made The performance data of the front-ends are summarized in as a use of the data for multichannel/multifrequency SAR processing. The paper describes the system configuration and the mm W-SAR processing algorithm and gives representative results for the generated radar images for ship targets, chaff and the sea clutter with emphasis on the multiparameter evaluation.
Author
Airborne Equipment; Aircraft Configurations; Radar Imagery; Synthetic Aperture Radar; Millimeter Waves; Imaging Techniques

19980210659 Universitaet der Bundeswehr, Allgemeine Nachrichtentechnik, Hamburg, Germany
IR-Signatures of Ships: A Classification Feature Within a Sensor Network
vomStein, H. D., Universitaet der Bundeswehr, Germany; Guenther, J., Universitaet der Bundeswehr, Germany; Haese, K., Universitaet der Bundeswehr, Germany; Apr. 1998; 10p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A system is described by which on the basis of IR-signatures ships are classified using methods of varying interactivity. A sequence of images taken with an IR-camera in a sea environment is superimposed so that pixels in corresponding frames match as closely as possible. With this motion compensation and a following long-term filtering the signal-to-noise ration is significantly improved. Subsequently the contour lines of the ship are extracted by a good signal-to-noise ratio this can be done automatically in other cases an interactive component is necessary. The contour of the 'unknown' ship is the feature for a correlative or a neuronal classifier. For both classifiers the reliability and the computing time is strongly dependent upon the size of the reference database.

It is of inestimable benefit to include all the available sensor data (e.g. sonar and radar) in the classification process thus quickly and significantly reducing the initially very large search space.
Author
Signal to Noise Ratios; Infrared Signatures; Infrared Photography

19980210662 Centre d'Etudes et de Recherches, Toulouse, France
Recognition of Dynamic Scenes on the Basis of Data Coming from Detectors: The Perception Project ***Reconnaissance de Scenes Dynamiques a Partir de Donnees Issues de Capteurs: Le Projet Perception***
Tessier, Catherine, Centre d'Etudes et de Recherches, France; Apr. 1998; 9p; In French; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The objective of the Perception Project is to study and develop methods that make it possible - on the basis of the observation of the environment by different detectors - to prepare and update a representation of the real world, suitable for facilitating the adoption of a decision. The project thus contributes to meeting, in a general fashion, the operational needs of monitoring, surveillance, information (intelligence), reconnaissance, be it in the setting of autonomous systems or systems for aiding in decision-making, whose overall function is within the context of a closed perception - decision - action loop.
Author
Pattern Recognition; Perception; Reconnaissance; Surveillance

19980210687 Wright Lab., Wright-Patterson AFB, OH USA
Nonlinear Optical Frequency Conversion Materials for Multi-Band Remote Sensing and Surveillance
Caracci, S., Wright Lab., USA; Fernelius, N., Wright Lab., USA; Ohmer, M., Wright Lab., USA; Zelmon, D., Wright Lab., USA; Apr. 1998; 9p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

There exists many nonlinear frequency conversion materials today which provide access to wavelength bands not previously possible by other means (solid state, gas, or semiconductor lasers). of particular interest are optical sources for the 3-5 (micron) and the 8-12 (micron) wavelength bands. Operation in these optical transmission bands is very advantageous due to the large optical absorption of important chemical and biological materials and the low absorption of the atmosphere. A brief introduction of the uses of optical remote sensing and the unique properties of nonlinear materials for laser frequency conversion are described.
Author
Frequency Converters; Nonlinearity; Light Transmission; Semiconductor Lasers; Surveillance

19980210763 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Image Segmentation and Fuzzy Logic for Training a Neural Network to Characterize Land Use in Tucurui (PA) ***Segmentacao de Imagens e Logica Nebulosa para Treinamento de Uma Rede Neural Artifical na Caracterizacao do Uso da Terra na Regiao de Tucurui (PA)***
Venturieri, Adriano, Instituto Nacional de Pesquisas Espacias, Brazil; Feb. 1996; 144p; In Portuguese
Report No.(s): INPE-6645-TDI/622; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

Neural net-based segmentation and classification techniques of TM/LANDSAT imagery are presently being developed for the evaluation and monitoring of the deforested areas of Amazon. The good results obtained using this approach allowed to direct efforts towards a stratification of deforested areas, presently under agricultural use and fallow. As such, the objective of this work is the development of the process of image segmentation and labeling of the segments, using fuzzy logic sets as the basis for training of artificial neural nets, that are specialized in vegetation and land use classes in the region of Tucurui (PA-Brazil). As a first step for a general evaluation of different image classification processes, including those based on neural nets, a comparison using KAPPA statistics is done between thematic images resulting from the use of traditional classification algorithms (ISOSEG, Maximum Likelihood). The study was developed over a part of the region under influence of the Tucurui dam (SE of Pari State). The segmentation process of the imagery was based on spectral characteristics, using the regions-growth technique. A total of 15.033 segments were individually labeled: as basic categories, Forest, Advanced Secondary Succession, Initial Secondary Succession, Shrub Rangeland, Herbaceous Rangeland, Agricultural Land, Urban Land and Water, besides the interference categories of Shadows and Clouds. In the labeling process of those segments, they were attributed degrees of partial membership (0,0; 0,25; 0,50; 0,75 and 1,0), using the Boolean concepts of true and false, according to the procedures that define the fuzzy logic sets. Spectral characteristics such as average, as well as textural ones, such as variance, correlation and entropy, were considered for class training in the architecture of this neural net classifier system. Mean Square Error (MSE), Sensitivity and Specificity were used to evaluate the preliminary results of the network. The training aimed at minimizing the MSE with the number of seasons, indicating sensitivity and specificity coherent to the identification of geo-classes. The performance of the unsupervised classification algo-

rithm against a reference image when using regions based on the image segmentation was superior when compared to the performance of ISOSEG and Maximum. For an adequate understanding of the stratification of land-cover classes in East Amazon, it is expected in the future, that a comparison of the proposed classification process with the conventional ones (ISOSEG and Maximum Likelihood) can be done after an equalization of the neural net and a new training phase.
Author
Fuzzy Systems; Neural Nets; Training Devices; Evaluation; Deforestation; Imaging Techniques

19980210766 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
JERS Data Analysis With Enphasis in Forest and Land Use: Tapajos National Forest ***Processamento e Analise de Dados JERS Com Enfase em Floresta e Uso da Terra: Floresta Nacional do Tapajos***
Filho, Pedro Hernandez, Instituto Nacional de Pesquisas Espacias, Brazil; Dutra, Luciano Vieira, Instituto Nacional de Pesquisas Espacias, Brazil; Kuntschik, Gerardo, Instituto Nacional de Pesquisas Espacias, Brazil; Soares, Sergio Monteiro, Instituto Nacional de Pesquisas Espacias, Brazil; 1997; 60p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6387-RPQ/687; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A study was carried out in the Tapajos National Forest to evaluate the performance of the JERS SAR images, L-band, to discriminate forest areas and land use types. Control points were obtained with differential GPS, in the terrain and helicopter. A test area was selected, near SAo Jorge community and LANDSAT/TM data and JERS-1 image was submitted to specific segmentation methods. In general TM segmentation showed more consistency with the area a priori knowledge. Samples of three forest types and five land use classes were identified and the mean sample backscatter and sample coefficient of variation were calculated for each sample. While mean sample backscatter is a reasonable discriminator for land use classes, CV is better to discriminate forest types. The joint use of both parameters helps to discriminate all classes. A comparison between coefficient of variation of forest classes and forest volume was carried out. Although completely separated in the vol x CV space, the use of CV alone is not enough to separate Dense Forest of flat relief from the Open Forest of flat relief.
Author
Data Processing; Forests; Land Use; Synthetic Aperture Radar; Radar Imagery

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ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.

19980206472 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Release of impurities from structural defects in polycrystalline silicon solar cells
McHugo, S. A., California Univ., Lawrence Berkeley Lab., USA; Imaizumi, M., Toyota Motor Co., Japan; Apr. 1997; 9p; In English, 31 Mar. - 4 Apr. 1997, San Francisco, CA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): DE-AC03-76SF-00098
Report No.(s): LBNL-40417; LSBL-371; CONF-970302-20; DE97-007898; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

It is critical to understand the behavior of metallic impurities in polycrystalline silicon used for solar cells. These impurities significantly increase the minority carrier recombination rate and, in turn, degrade cell performance. Impurity gettering is a commonly used method to remove these impurities from the material, however, past work has suggested that impurity release from structural defects drastically limits the gettering process. Presently, there is only a limited understanding of impurity release from structural defects. In this work, a correlation between structural defects and the location of metal impurities in as-grown material is established and the release of nickel and copper from structural defects in polycrystalline silicon was studied in as-grown material and after sequential thermal treatments which dissolve the impurities into the silicon matrix. Synchrotron-based x-ray fluorescence impurity mapping with spatial resolution of (approx) 1 (micro)m, was used to determine impurity distributions after each thermal treatment.
DOE
Polycrystals; Silicon; Solar Cells; Impurities; Spatial Resolution

19980206539 Sandia National Labs., Albuquerque, NM USA

Temperature coefficients for PV modules and arrays: Measurement methods, difficulties, and results

King, D. L., Sandia National Labs., USA; Kratochvil, J. A., Sandia National Labs., USA; Boyson, W. E., Sandia National Labs., USA; [1997]; 5p; In English; 26th; Photovoltaic Specialists Conference, 29 Sep. - 3 Oct. 1997, Anaheim, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1169C; CONF-970953-; DE98-001183; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The term temperature coefficient has been applied to several different photovoltaic performance parameters, including voltage, current, and power. The procedures for measuring the coefficient(s) for modules and arrays are not yet standardized, and systematic influences are common in the test methods used to measure them. There are also misconceptions regarding their application. Yet, temperature coefficients, however obtained, play an important role in PV system design and sizing, where often the worst case operating condition dictates the array size. This paper describes effective methods for determining temperature coefficients for cells, modules, and arrays; identifies sources of systematic errors in measurements; gives typical measured values for modules; and provides guidance for their application in system engineering.

DOE

Coefficients; Systematic Errors; Systems Engineering; Arrays; Standardization

19980206541 Sandia National Labs., Albuquerque, NM USA

Simultaneous P and B diffusion, in-situ surface passivation, impurity filtering and gettering for high-efficiency silicon solar cells

Krygowski, T., Georgia Inst. of Tech., USA; Rohatgi, A., Georgia Inst. of Tech., USA; Ruby, D., Sandia National Labs., USA; [1997]; 7p; In English; 26th; Photovoltaic Specialists Conference, 29 Sep. - 3 Oct. 1997, Anaheim, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2620C; CONF-970953-; DE98-001180; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A technique is presented to simultaneously diffuse boron and phosphorus in silicon, and grow an in-situ passivating oxide in a single furnace step. It is shown that limited solid doping sources made from P and B Spin-On Dopant (SOD) films can produce optimal n(sup +) and p(sup +) profiles simultaneously without the deleterious effects of cross doping. A high quality passivating oxide is grown in-situ beneath the thin ((approximately) 60 (angstrom)) diffusion glass, resulting in low J(sub o) values below 100 fA/sq cm for transparent ((approximately) 100 (Omega)/(open square)) phosphorus and boron diffusions. For the first time it is shown that impurities present in the boron SOD film can be effectively filtered out by employing separate source wafers, resulting in bulk lifetimes in excess of 1 ms for the sample wafers. The degree of lifetime degradation in the sources is related to the gettering efficiency of boron in silicon. This novel simultaneous diffusion, in-situ oxidation, impurity filtering and gettering technique was successfully used to produce 20.3% Fz, and 19.1% Cz solar cells, in one furnace step.

DOE

Diffusion; Impurities; Phosphorus; Procedures; Boron; Passivity

19980206572 Sandia National Labs., Albuquerque, NM USA

Measuring solar spectral and angle-of-incidence effects on photovoltaic modules and solar irradiance sensors

King, D. L., Sandia National Labs., USA; Kratochvil, J. A., Sandia National Labs., USA; Boyson, W. E., Sandia National Labs., USA; [1997]; 5p; In English; 26th; Photovoltaic Specialists Conference, 29 Sep. - 3 Oct. 1997, Anaheim, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1183C; CONF-970953-; DE98-001185; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Historically, two time-of-day dependent factors have complicated the characterization of photovoltaic module and array performance; namely, changes in the solar spectrum over the day and optical effects in the module that vary with the solar angle-of-incidence. This paper describes straightforward methods for directly measuring the effects of these two factors. Measured results for commercial modules, as well as for typical solar irradiance sensors (pyranometers) are provided. The empirical relationships

obtained from the measurements can be used to improve the methods used for system design, verification of performance after installation, and diagnostic monitoring of performance during operation.
DOE
Solar Spectra; Photovoltaic Cells; Procedures; Electromagnetic Measurement; Measuring Instruments

19980206578 Argonne National Lab., IL USA
A comparison of two aluminizing methods for corrosion protection in the wet seal of molten carbonate fuel cells
Bloom, I., Argonne National Lab., USA; Indacochea, J. E., Argonne National Lab., USA; Krumpelt, M., Argonne National Lab., USA; Benjamin, T. G., M-C Power Corp., USA; May 1997; 4p; In English; Intersociety Energy Conversion Engineering Conference, 27 Jul. - 2 Aug. 1997, Honolulu, HI, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/CMT/CP-93373; CONF-970701; DE97-053355; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Examination of set 1 and 2 samples reveals an initially serrated interface that consists of iron aluminides. Resolvable, changes in the bulk microstructure occurred after about 500 h. No corrosion layer growth was observed, but some of the aluminum deposit formed Fe-Al phases in both coupons.
DOE
Aluminum Coatings; Molten Carbonate Fuel Cells; Microstructure; Corrosion Prevention; Aluminides

19980206645 National Renewable Energy Lab., Golden, CO USA
Commercial production of thin-film CdTe photovoltaic modules ***Final Report***
Brog, T. K., Golden Photon, Inc., USA; Oct. 1997; 36p; In English
Contract(s)/Grant(s): DE-AC36-83CH-10093; ZAI-3-11294-03
Report No.(s): NREL/SR-520-23733; DE98-000886; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This annual report describes gains made in the manufacturing process for CdS/CdTe thin film photovoltaics deposited on soda/lime glass. The company was forced to restructure following its inability to manufacture modules which did not suffer extensive degradation. Following this the company restructured its manufacturing process line through a better understanding of the materials and materials processing issues. This led to major improvements in the production of cells, both in terms of the effective yield off the manufacturing line, but also in device stability and cell efficiency.
DOE
Cadmium Tellurides; Photovoltaic Cells; Thin Films; Fabrication

19980209741 Washington State Univ., Electronic Materials Lab., Richland, WA USA
ZnSe Window Layers for GaAs and GaInP2 Solar Cells ***Final Report, 1 Jun. 1996 - 31 May 1997***
Olsen, Larry C., Washington State Univ., USA; 1997; 9p; In English
Contract(s)/Grant(s): NAG3-1881; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report concerns studies of the use of n-type ZnSe as a window layer for n/p GaAs and GaInP2 solar cells. Emphasis was placed in this phase of the project on characterizing the interface between n-type ZnSe films grown on epi-GaAs films grown onto single crystal GaAs. Epi-GaAs and heteroepitaxial ZnSe films were grown by MOCVD with a Spire 50OXT Reactor. After growing epitaxial GaAs films on single crystal GaAs wafers, well-oriented crystalline ZnSe films were grown by MOCVD. ZnSe films were grown with substrate temperatures ranging from 250 C to 450 C. Photoluminescence studies carried out by researchers at NASA Lewis determined that the surface recombination velocity at a GaAs surface was significantly reduced after the deposition of a heteroepitaxial layer of ZnSe. The optimum temperature for ZnSe deposition appears to be on the order of 350 C.
Author
N-Type Semiconductors; Zinc Selenides; Monomolecular Films; Surface Layers; Deposition

19980209849 Pacific Northwest National Lab., Richland, WA USA
R. Lynette and Associates and Pacific Northwest Laboratory staff exchange: Analysis and evaluation of the application of the Pulse Amplitude Synthesis and Control (PASC) converter in a wind power plant
[1998]; 11p; In English
Contract(s)/Grant(s): DE-AC06-76RL-01830
Report No.(s): PNL-10667; DE98-051169; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The main objective of staff exchanges is to facilitate cooperative activities between PNL staff and U.S. private industry. Funding for the projects is provided by the DOE Office of Energy Research Laboratory Technology Transfer Program. Dr. Matthew Donnelly, a Research Engineer in the Applied Physics Center, Initiated a PNL disclosure for Pulse Amplitude Synthesis and Control (PASC) converter intellectual property protection in 1993. PASC converter research at the Pacific Northwest Laboratory (PNL) has been funded through the ETDI LDRD program. Recent work has centered on building the three-phase 20kW laboratory unit, the development of control algorithms and the study of the application of PASC converters in a 25MW wind power plant (through the staff exchange with RLA reported on here). An overview and description of the PASC converter is included as Appendix A.

DOE

Energy Technology; Electric Equipment; Pulse Amplitude; Windpower Utilization

19980209863 Sandia National Labs., Albuquerque, NM USA

Development of inexpensive metal macrocyclic complexes for use in fuel cells

Doddapaneni, N., Sandia National Labs., USA; Ingersoll, D., Sandia National Labs., USA; Kosek, J. A., GINER, Inc., USA; Cropley, C. C., GINER, Inc., USA; Hamdan, M., GINER, Inc., USA; Jan. 1998; 18p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-98-0069; DE98-002602; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Several metal macrocyclic complexes were synthesized for use as catalysts in fuel cells. An initial evaluation of their ability to catalyze the fuel cell reactions were completed. Based on this initial evaluation, one metal macrocyclic catalyst was selected and long-term stability testing in a fuel cell was initiated. The fuel cell employing this catalyst was operated continuously for one year with little signs of catalyst degradation. The effect of synthetic reformates on the performance of the catalyst in the fuel cell environment also demonstrated high tolerance of this catalyst for common contaminants and poisons.

DOE

Complex Compounds; Fuel Cells

19980210089 Lawrence Livermore National Lab., Livermore, CA USA

Thermal recovery of NIF amplifiers

Sutton, S., Lawrence Livermore National Lab., USA; Marshall, C., Lawrence Livermore National Lab., USA; Petty, C., Lawrence Livermore National Lab., USA; Smith, L., Lawrence Livermore National Lab., USA; vanWonterghem, B., Lawrence Livermore National Lab., USA; Mills, S., Lawrence Livermore National Lab., USA; Feb. 1997; 14p; In English; 2nd; Annual Solid State Lasers for Applications to Inertial Confinement Fusion (LCF), 22 - 25 Oct. 1996, Paris, France

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-124528; CONF-9610225-40; DE97-053197; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The issue of thermal recovery of the NIF amplifiers has taken on increased emphasis as program goals move toward increasing the shot rate to once every four hours. This paper addresses the technical issues associated with achieving thermal recovery in the NIF amplifiers. We identify two temperature related thermal recovery quantities: (1) the difference between the average slab temperature and the temperature of other surfaces in the amplifier cavity, and (2) the temperature difference in the slab over the aperture. The first quantity relates to optical disturbances in the gas column in the system, while the second quantity is associated with optical aberrations in the laser media itself. Calculations and experiments are used to quantify recovery criteria, and develop cooling approaches. The cooling approaches discussed are (1) active cooling of the flashlamps with ambient gas and chilled gas, and (2) active cooling of the slab edge cladding. Calculations indicate that the NIF baseline cooling approach of 20 cfm per lamp ambient temperature gas flow in both the central and side flashlamp cassettes is capable of meeting thermal recovery requirements for an 8 hour shot period, while to achieve a 4 hour shot period requires use of chilled gas and edge cladding cooling. In addition, the effect of changing the amplifier cavity and beamtube fill gas from nitrogen to helium is addressed, showing that a factor of 8 reduction in the sensitivity to thermal disturbances is possible.

DOE

Aberration; Temperature Gradients; Flash Lamps; Laser Materials; Ambient Temperature; Apertures; Gas Flow

19980210111 Sandia National Labs., Albuquerque, NM USA

Estimation of uncertain material parameters using modal test data

Veers, P. S., Sandia National Labs., USA; Laird, D. L., Sandia National Labs., USA; Carne, T. G., Sandia National Labs., USA; Sagartz, M. J., Sandia National Labs., USA; [1997]; 11p; In English; 17TH; Wind Energy, 12-15 Jan. 1998, Reno, NV, USA;

Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2837C; CONF-980104; DE98-001263; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Analytical models of wind turbine blades have many uncertainties, particularly with composite construction where material properties and cross-sectional dimension may not be known or precisely controllable. In this paper the authors demonstrate how modal testing can be used to estimate important material parameters and to update and improve a finite-element (FE) model of a prototype wind turbine blade. An example of prototype blade is used here to demonstrate how model parameters can be identified. The starting point is an FE model of the blade, using best estimates for the material constants. Frequencies of the lowest fourteen modes are used as the basis for comparisons between model predictions and test data. Natural frequencies and mode shapes calculated with the FE model are used in an optimal test design code to select instrumentation (accelerometer) and excitation locations that capture all the desired mode shapes. The FE model is also used to calculate sensitivities of the modal frequencies to each of the uncertain material parameters. These parameters are estimated, or updated, using a weighted least-squares technique to minimize the difference between test frequencies and predicted results. Updated material properties are determined for axial, transverse, and shear moduli in two separate regions of the blade cross section: in the central box, and in the leading and trailing panels. Static FE analyses are then conducted with the updated material parameters to determine changes in effective beam stiffness and buckling loads.

DOE

Turbine Blades; Transverse Loads; Shear Stress; Shear Properties; Modulus of Elasticity; Finite Element Method; Accelerometers

19980210122 National Renewable Energy Lab., Golden, CO USA

New approaches for high-efficiency solar cells ***Final Report***

Bedair, S. M., North Carolina State Univ., USA; El-Masry, N. A., North Carolina State Univ., USA; Dec. 1997; 116p; In English
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/SR-520-23266; DE98-001775; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report summarizes the activities carried out in this subcontract. These activities cover, first the atomic layer epitaxy (ALE) growth of GaAs, AlGaAs and InGaP at fairly low growth temperatures. This was followed by using ALE to achieve high levels of doping both n-type and p-type required for tunnel junctions (TJ) in the cascade solar cell structures. Then the authors studied the properties of AlGaAs/InGaP and AlGaAs/GaAs tunnel junctions and their performances at different growth conditions. This is followed by the use of these tunnel junctions in stacked solar cell structures. The effect of these tunnel junctions on the performance of stacked solar cells was studied at different temperatures and different solar fluences. Finally, the authors studied the effect of different types of black surface fields (BSF), both p/n and n/p GaInP solar cell structures, and their potential for window layer applications. Parts of these activities were carried in close cooperation with Dr. Mike Timmons of the Research Triangle Institute.

DOE

Solar Cells; Semiconductors (Materials)

19980210137 National Renewable Energy Lab., Golden, CO USA

Wind turbine design codes: A preliminary comparison of the aerodynamics

Buhl, M. L., Jr., National Renewable Energy Lab., USA; Wright, A. D., National Renewable Energy Lab., USA; Tangler, J. L., National Renewable Energy Lab., USA; Dec. 1997; 9p; In English; 17th; Wind Energy Symposium, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/CP-500-23975; CONF-980104; DE98-001789; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The National Wind Technology Center of the National Renewable Energy Laboratory is comparing several computer codes used to design and analyze wind turbines. The first part of this comparison is to determine how well the programs predict the aerodynamic behavior of turbines with no structural degrees of freedom. Without general agreement on the aerodynamics, it is futile to try to compare the structural response due to the aerodynamic input. In this paper, the authors compare the aerodynamic loads

for three programs: Garrad Hassan's BLADED, their own WT-PERF, and the University of Utah's YawDyn. This report documents a work in progress and compares only two-bladed, downwind turbines.
DOE
Wind Turbines; Computer Programs; Computer Aided Design; Aerodynamics; Computerized Simulation

19980210141 National Renewable Energy Lab., Golden, CO USA
Results from the NREL Variable-Speed Test bed
Fingersh, L. J., National Renewable Energy Lab., USA; Carlin, P. W., National Renewable Energy Lab., USA; Nov. 1997; 5p; In English; 17th; Wind Energy, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/CP-500-23811; CONF-980104; DE98-001269; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The NREL Variable-Speed Test bed turbine has been used to examine the performance and controllability of a variable-speed, variable-pitch turbine. Control strategies that eliminate drive-train torque fluctuations in high winds have been published before and example data are given here. The energy capture of a variable-speed wind turbine depends in part on its ability to successfully operate at the peak of the C(sub p)-(lambda) curve. The losses associated with the inability of the rotor to stay exactly on top of the curve at all have been found and quantified. New control strategies for improving energy capture in moderate winds are also proposed. The potential exists to improve overall energy capture by 5% or more.
DOE
Performance Tests; Controllability; Research Facilities; Wind Turbines

19980210142 National Renewable Energy Lab., Golden, CO USA
Systematic approach for PID controller design for pitch-regulated, variable-speed wind turbines
Hand, M. M., National Renewable Energy Lab., USA; Balas, M. J., Colorado Univ., USA; Nov. 1997; 11p; In English; 17th; Wind Energy, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/CP-440-23539; AIAA Paper 98-0031; CONF-980104; DE98-001248; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Variable-speed, horizontal axis wind turbines use blade-pitch control to meet specified objectives for three regions of operation. This paper focuses on controller design for the constant power production regime. A simple, rigid, non-linear turbine model was used to systematically perform trade-off studies between two performance metrics. Minimization of both the deviation of the rotor speed from the desired speed and the motion of the actuator is desired. The robust nature of the proportional-integral-derivative (PID) controller is illustrated, and optimal operating conditions are determined. Because numerous simulation runs may be completed in a short time, the relationship of the two opposing metrics is easily visualized.
DOE
Design Analysis; Speed Control; Wind Turbines; Longitudinal Control

19980210143 Argonne National Lab., IL USA
Proceedings of the Fifteenth Symposium on Energy Engineering Sciences
1997; 285p; In English, 14-16 May 1997, Argonne, IL, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): CONF-9705121; DE98-000902; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This Proceedings Volume includes the technical papers that were presented during the Fifteenth Symposium on Energy Engineering Sciences on May 14-15, 1997, at Argonne National Laboratory, Argonne, Illinois. The Symposium was organized into eight technical sessions, which included 32 individual presentations followed by discussion and interaction with the audience. The topics of the eight sessions are: multiphase flows 1; multiphase flows 2; mostly optics; fluid mechanics; nonlinear fields; welding and cracks; materials; and controls. The DOE Office of Basic Energy Sciences, of which Engineering Research is a component program, is responsible for the long-term mission-oriented research in the Department. It has the prime responsibility for establishing the basic scientific foundation upon which the Nation's future energy options will have to be identified, developed, and built. It is committed to the generation of new knowledge necessary for the solution of present and future problems of energy

exploration, production, conversion, and utilization, consistent with respect for the environment. Separate abstracts have been indexed into the energy database for contributions to this Symposium.
DOE
Conferences; Welding; Fluid Mechanics; Crack Propagation; Hydrodynamics

19980210146 Sandia National Labs., Albuquerque, NM USA
Development of a light-weight, wind-turbine-rotor-based data acquisition system
Berg, D. E., Sandia National Labs., USA; Rumsey, M., Sandia National Labs., USA; Robertson, P., Sandia National Labs., USA; Kelley, N., National Renewable Energy Lab., USA; McKenna, E., National Renewable Energy Lab., USA; Gass, K., Utah State Univ., USA; [1997]; 12p; In English; Wind Energy, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3003C; CONF-980104; DE98-001368; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Wind-energy researchers at Sandia National Laboratories (SNL) and the National Renewable Energy Laboratory (NREL) are developing a new, light-weight, modular system capable of acquiring long-term, continuous time-series data from current-generation small or large, dynamic wind-turbine rotors. Meetings with wind-turbine research personnel at NREL and SNL resulted in a list of the major requirements that the system must meet. Initial attempts to locate a commercial system that could meet all of these requirements were not successful, but some commercially available data acquisition and radio/modem subsystems that met many of the requirements were identified. A time synchronization subsystem and a programmable logic device subsystem to integrate the functions of the data acquisition, the radio/modem, and the time synchronization subsystems and to communicate with the user have been developed at SNL. This paper presents the data system requirements, describes the four major subsystems comprising the system, summarizes the current status of the system, and presents the current plans for near-term development of hardware and software.
DOE
Computer Programming; Computer Programs; Data Acquisition; Rotors

19980210165 Acurex Environmental Corp., Research Triangle Park, NC USA
Thermodynamic, Energy-Efficient and Economic Criteria for Evaluation of Alternative Refrigerants for Heat Pumps
Kazachki, G., Acurex Environmental Corp., USA; Gage, C. L., Environmental Protection Agency, USA; 1998; 12p; In English; Heat Pump Systems, Energy Efficiency and Global Warming, 28 Sep. - 1 Oct. 1997, Linz, Austria
Contract(s)/Grant(s): EPA-68-D4-0005
Report No.(s): PB98-145568; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper discusses thermodynamic, energy-efficient, and a economic criteria for evaluting alternative refrigerants for heat pumps. (NOTE: Thermodynamic properties have traditionally played a major role in evaluating a fluid as a potential refrigerant).
NTIS
Heat Pumps; Thermodynamic Properties; Thermodynamics

19980210314 Ford Motor Co., Dearborn, MI USA
Direct-hydrogen-fueled proton-exchange-membrane fuel cell system for transportation applications
Oei, D., Ford Motor Co., USA; Adams, J. A., Ford Motor Co., USA; Kinnelly, A. A., Ford Motor Co., USA; Jul. 1997; 45p; In English
Contract(s)/Grant(s): DE-AC02-94CE-50389
Report No.(s): DOE/CE/50389-503; DE98-001983; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In partial fulfillment of the U.S. Department of Energy Contract No. DE-ACO2-94CE50389, 'Direct Hydrogen-Fueled Proton-Exchange-Membrane (PEM) Fuel Cell System for Transportation Applications', this conceptual vehicle design report addresses the design and packaging of battery augmented fuel cell powertrain vehicles. This report supplements the 'Conceptual Vehicle Design Report - Pure Fuel Cell Powertrain Vehicle' and includes a cost study of the fuel cell power system. The three classes of vehicles considered in this design and packaging exercise are the same vehicle classes that were studied in the previous report: the Aspire, representing the small vehicle class; the AIV (Aluminum Intensive Vehicle) Sable, representing the mid-size vehicle; and the E-150 Econoline, representing the van-size class. A preliminary PEM fuel cell power system manufacturing cost study is also presented. As in the case of the previous report concerning the 'Pure Fuel Cell Powertrain Vehicle', the same assumptions are made for the fuel cell power system. These assumptions are fuel cell system power densities of 0.33 kW/ka and 0.33 kW/l,

platinum catalyst loading of less than or equal to 0.25 mg/sq cm total, and hydrogen tanks containing compressed gaseous hydrogen under 340 atm (5000 psia) pressure. The batteries considered for power augmentation of the fuel cell vehicle are based on the Ford Hybrid Electric Vehicle (HEV) program. These are state-of-the-art high power lead acid batteries with power densities ranging from 0.8 kW/kg to 2 kW/kg. The results reported here show that battery augmentation provides the fuel cell vehicle with a power source to meet instant high power demand for acceleration and start-up. Based on the assumptions made in this report, the packaging of the battery augmented fuel cell vehicle appears to be as feasible as the packaging of the pure fuel cell powered vehicle.
DOE
Compressed Gas; Membranes; Electric Motor Vehicles; Aluminum

19980210419 National Renewable Energy Lab., Golden, CO USA
Atmospheric tests of trailing-edge aerodynamic devices
Miller, L. S., Wichita State Univ., USA; Huang, S., Wichita State Univ., USA; Quandt, G. A., National Renewable Energy Lab., USA; Jan. 1998; 41p; In English
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/SR-500-22350; DE98-002764; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An experiment was conducted at the National Renewable Energy Laboratory's (NREL's) National Wind Technology Center (NWTC) using an instrumented horizontal-axis wind turbine that incorporated variable-span, trailing-edge aerodynamic brakes. The goal of the investigation was to directly compare results with (infinite-span) wind tunnel data and to provide information on how to account for device span effects during turbine design or analysis. Comprehensive measurements were used to define effective changes in the aerodynamic and hinge-moment coefficients, as a function of angle of attack and control deflection, for three device spans (7.5%, 15%, and 22.5%) and configurations (Spoiler-Flap, vented sileron, and unvented aileron). Differences in the lift and drag behavior are most pronounced near stall and for device spans of less than 15%. Drag performance is affected only minimally (about a 30% reduction from infinite-span) for 15% or larger span devices. Interestingly, aerodynamic controls with vents or openings appear most affected by span reductions and three-dimensional flow.
DOE
Aerodynamic Coefficients; Moment Distribution; Three Dimensional Flow; Wind Turbines; Aerodynamic Brakes; Control Equipment; Design Analysis

19980210733 Lawrence Livermore National Lab., Livermore, CA USA
X-ray evidence for capillary pressure driven flow in preserved core from The Geysers
Bonner, B. P., Lawrence Livermore National Lab., USA; Roberts, J. J., Lawrence Livermore National Lab., USA; Schneberk, D. J., Lawrence Livermore National Lab., USA; Mar. 1997; 10p; In English; 22nd; Stanford Workshop on Geothermal Reservoir Engineering, 27-29 Jan. 1997, Stanford, CA, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-126950; CONF-970114-7; DE97-053393; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Improved understanding of fluid storage and transport mechanisms relevant to The Geysers reservoir is fundamental to efficient and economic long term production of steam. X-ray computed tomographs of core from research borehole SB-15D made within 72 hours of drilling show characteristic x-ray attenuation profiles that can only be explained by imbibition of drilling fluid at reservoir conditions. The shape of the profile is highly diagnostic. Early time scans, when interpreted taking into account independent measurements of pore size distribution, permeabilities and capillary pressures for the rock matrix sampled by SB-15D, are consistent with strong capillary suctions for the recovered rocks. This indirect indication of imbibition under reservoir conditions, along with detailed analysis of x-ray attenuation in recovered core, suggests that water content was low in much of the preserved core. These measurements are part of a series of laboratory experiments monitored by x-ray methods intended to evaluate movement of various fluids to determine the relative importance capillarity, Darcy flow and vapor phase diffusion.
DOE
X Rays; Capillary Flow; Geysers; Reservoirs

19980210734 Lawrence Livermore National Lab., Livermore, CA USA
Fracture mapping in geothermal fields with long-offset induction logging
Wilt, M., Electromagnetic Instruments, Inc., USA; Takasugi, Shinji, Geothermal Energy Research and Development Co. Ltd., Japan; Uchida, Toshihiro, New Energy and Industrial Technology Development Organization, Japan; Kasameyer, P., Lawrence

Livermore National Lab., USA; Lee, Ki Ha, California Univ., Lawrence Berkeley Lab., USA; Lippmann, M., California Univ., Lawrence Berkeley Lab., USA; Jan. 1997; 8p; In English; 22nd; Stanford Workshop on Geothermal Reservoir Engineering, 27-29 Jan. 1997, Stanford, CA, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-126397; CONF-970114-5; DE97-053392; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The mapping of producing fractures in a geothermal field is an important technical objective in field development. Locating, orientating, and assessing producing fractures can guide drilling programs and optimize the placement of production and injection wells. A long-offset multicomponent borehole induction resistivity tool capable of surviving the high temperatures encountered in geothermal wells has recently been developed and tested in a high temperature environment. Several characteristics of this device make it ideal for detecting producing fractures. Whereas commercial induction logging devices have strong source-receiver separations of 1 m, this device has multiple sensors with separation of 8 m, allowing for deeper penetrations and the ability to straddle fracture-induced washout zones in boreholes. The three-component measurements also make it possible to map the strike and inclination of nearby fractures and other three-dimensional structures. This in turn allows for accurate projection of these structures into the space between wells.

DOE

Fractures (Materials); Fracturing; Mapping

19980210810 Technische Univ., Lehrstuhl fuer Technische Chemie, Chemnitz, Germany

Development of solar selective absorber layers on aluminium ***Final Report Entwicklung solarselektiver Absorberschichten auf Aluminium fuer Solarkollektoren. Abschlussbericht***

Hoenicke, D., Technische Univ., Germany; Moeller, T., Technische Univ., Germany; Schwarz, T., Technische Univ., Germany; Jan. 31, 1998; 61p; In German
Contract(s)/Grant(s): Foerderkennzeichen BMBF 032810
Report No.(s): ETDE-DE-648; DE98-743657; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

A new electrolytic process was developed to form solar selective layers on aluminium. In the developed process, both the formation of the alumina layer and the deposition of metals into the layer takes place in only one treatment step using a single electrolysis bath. The main step of the so called ISOC-method (impulse structured oxide ceramic) is the anodic oxidation of aluminium which was carried out by using a pulse technique at different voltages. During the anodic polarisation a thin alumina ceramic layer was formed, while the cathodic led to the metal deposition as copper and nickel. The conditions of the electrolysis were varied in order to estimate optimal parameters achieving solar selective layers with high selectivity. Furthermore, a scale-up of the lab scale apparatus to a mini plant was carried out. Finally, the corrosion resistance of the absorber layers was improved by the formation of a thin hydrophobic overlayer using a sol-gel treatment.

DOE

Aluminum Oxides; Sol-Gel Processes; Solar Energy Absorbers; Selective Surfaces; Metallizing; Deposition; Electrolysis; Solar Collectors

19980210814 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Worldwide clean energy system technology using hydrogen (WE-NET), Subtask 5, Development of hydrogen transfer and storage technology (research and development of technologies for hydrogen transport and storage by hydrogen absorbing alloys) ***Suiso riyo kokusai clean energy system gijutsu (WE-NET). subtask 5. Suiso yuso chozo gijutsu no kaihatsu (bunsan yuso chozoyo suiso kyuzo gokin no kaihatsu)***

Mar. 1997; 108p; In Japanese
Report No.(s): NEDO-WE-NET9655; DE98-745413; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report describes a guiding principle of new hydrogen absorbing alloy design, case studies on the stationary hydrogen storage systems for multiple dwelling houses using hydrogen absorbing alloys and on the hydrogen fuel tank systems for a motor vehicle, and survey on development status in the world. As a result of the investigation of alloys, it was concluded that realization of hydrogen absorbing alloys with new target properties of the WE-NET Project is not easy through the current technology. It was found that two kinds of Mg-based and V-based high capacity materials must be selected as target alloys among current alloys, and that three techniques, i.e., ultra-fine microstructure, composite, and amorphousness, are effective for improving the hydrogen discharge property which has been a problem of these alloys. It was desired that the latest techniques are established by integrating

these materials and techniques. It is necessary to promote the development of brake-through new materials by new concepts and technologies through the cooperation of national institutes, universities, and companies.
DOE
Energy Technology; Clean Energy; Hydrogen Fuels; Motor Vehicles; Fuel Tanks; Magnesium Alloys; Vanadium Alloys

45
ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19980206522 Conservation of Clean Air and Water-Europe, Brussels, Belgium
Motor Vehicle Emission Regulations and Fuel Specifications, Part 2, Detailed Information and Historic Review (1970-1996)
Sanger, R. P., Conservation of Clean Air and Water-Europe, Belgium; Aarnink, T. J., Conservation of Clean Air and Water-Europe, Belgium; Floeysand, S. A., Conservation of Clean Air and Water-Europe, Belgium; Gadd, P., Conservation of Clean Air and Water-Europe, Belgium; LeBreton, D., Conservation of Clean Air and Water-Europe, Belgium; Mar. 1997; 246p; In English
Report No.(s): PB98-147788; CONCAWE-6/97; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche
This report details the development of world-wide legislation and regulations governing motor vehicle emissions, fuel specifications and fuel consumption from circa 1970 to 1996. It describes legislation on emissions limits and emissions testing, vehicle inspection and maintenance programs and legislation aimed at controlling in-service emissions performance, fuel consumption and carbon dioxide emissions, plus automotive fuel specifications and fuel characteristics.
NTIS
Motor Vehicles; Air Pollution; Law (Jurisprudence); Regulations; Automobile Fuels; Exhaust Emission

19980206523 Conservation of Clean Air and Water-Europe, Brussels, Belgium
Motor Vehicle Emission Regulations and Fuel Specifications, Part 1, Summary and Annual Update (1996)
Sanger, R. P., Conservation of Clean Air and Water-Europe, Belgium; Aarnink, T. J., Conservation of Clean Air and Water-Europe, Belgium; Floeysand, S. A., Conservation of Clean Air and Water-Europe, Belgium; Gadd, P., Conservation of Clean Air and Water-Europe, Belgium; LeBreton, D., Conservation of Clean Air and Water-Europe, Belgium; Mar. 1997; 94p; In English
Report No.(s): PB98-147770; CONCAWE-5/97; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche
This report summarizes changes in world-wide legislation and regulations governing motor vehicle emissions, fuel specifications and fuel consumption. Specifically, it details current and proposed legislation on emissions limits and emissions testing, vehicle inspection and maintenance programs and legislation aimed at controlling in-service emissions performance, fuel consumption and carbon dioxide emissions, plus fuel specifications and characteristics.
NTIS
Motor Vehicles; Exhaust Emission; Inspection; Regulations; Air Pollution

19980206525 Acurex Environmental Corp., Durham, NC USA
Combined Mercury and Sulfur Oxides Control Using Calcium-Based Sorbents, *Jun. 1996 - Jul. 1997*
Ghorishi, S. Behrooz, Acurex Environmental Corp., USA; Sedman, Charles B., Environmental Protection Agency, USA; 1998; 28p; In English; EPRI-DOE-EPA combined utility air pollutant control, 26-29 Aug. 1997, Washington, DC, USA
Contract(s)/Grant(s): 68-D4-0005
Report No.(s): PB98-147275; EPA/600/13-98/053; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The paper gives results of an examination of the capture of elemental mercury (Hg0) and mercuric chloride (HgCl2) by three types of calcium (CA)-based sorbents in a bench-scale study under conditions prevalent in coal-fired utilities. Ca-based sorbent performances were compared to that of an activated carbon. Mercury capture of about 40% (nearly half that of the activated carbon) was achieved by two of the Ca-based sorbents. The presence of sulfur dioxide (SO2) in the simulated coal combustion flue gas enhanced the capture of Hg-o from about 10 to 40%. Increasing the temperature in the range of 65-100 C also caused an increase in the Hg-o capture by the two Ca-based sorbents. HgCl2 capture exhibited a totally different pattern. The presence of SO2 inhibited the HgCl2 capture by Ca-based sorbents from about 25 to less than 10%. Increasing the temperature in the studied range also caused a decrease in HgCl2 capture.
NTIS
Mercury (Metal); Sorbents; Activated Carbon; Calcium; Mercury Compounds; Sulfur Dioxides; Air Pollution

19980206531 Los Alamos National Lab., NM USA

Integrating chemistry into 3D climate models: Detailed kinetics in the troposphere and stratosphere of a global climate model

Kao, C. Y. J., Los Alamos National Lab., USA; Elliott, S., Los Alamos National Lab., USA; Turco, R. P., California Univ., USA; Zhao, X., California Univ., USA; [1997]; 8p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3076; DE98-001209; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The motivation for the project is to create the first complete, three-dimensional climate model that enfolds atmospheric photochemistry. The LANL chemical global climate model (GCM) not only distributes the trace greenhouse gases and modifies their concentrations within the detailed photochemical web, but also permits them to influence the radiation field and so force their own transport. Both atmospheric chemistry and fluid dynamics are nonlinear and zonally asymmetric phenomena. They can only be adequately modeled in three dimensions on the global grid. The kinetics-augmented GCM is the only program within the atmospheric community capable of investigating interaction involving chemistry and transport. The authors have conducted case studies of timely three-dimensional chemistry issues. Examples include ozone production from biomass burning plumes, kinetic feedbacks in zonally asymmetric transport phenomena with month- to year-long time scales, and volcano sulfate aerosols with respect to their potential effects on tropospheric ozone depletion.

DOE

Three Dimensional Models; Climate Models; Troposphere; Stratosphere; Ecosystems

19980206569 Bonn Univ., Germany

Inter-decade variations of the climate in Central Europe: Influence of the Atlantic Ocean and effects on the daily weather ***Final Report Interdekadenschwankungen des Klimas in Mitteleuropa: Einfluss des atlantischen Ozeans und Auswirkungen im taeglichen Wetter. Endbericht***

Jan. 1997; 112p; In German

Contract(s)/Grant(s): BMBF-07KFT6

Report No.(s): ETDE-DE-525; DE97-762038; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The project had four important scientific aims: (1) The excecution and evaluation of simulations with the ECHAM model for the analysis of the model reaction on changed oceanic water surface temperatures (SST). (2) The production of a hierarchy of simplified models for the statistical evaluation and dynamic interpretation of model and observation data. (3) The analysis of the decade variability of synoptic disturbances ('weather') from the hemispheric geopotential and ground pressure data of the German Weather Service (DWD). (4) The analysis of the long-term variability of synoptic disturbances and the averaged variables form daily radio-sonde ascents.

DOE

Atlantic Ocean; Climate Change; Weather; Climate Models; Atmospheric Circulation

19980206593 Argonne National Lab., IL USA

Enhanced control of mercury emissions through modified speciation

Livengood, C. D., Argonne National Lab., USA; Mendelsohn, M. H., Argonne National Lab., USA; [1997]; 14p; In English; 90th, 8-13 Jun. 1997, Toronto, Canada

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/ES/CP-91309; CONF-970677-12; DE97-006981; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In anticipation of possible regulations regarding mercury emissions, research efforts sponsored by DOE, EPRI, and others are investigating the risks posed by mercury emissions, improved techniques for measuring those emissions, and possible control measures. The focus in the control research is on techniques that can be used in conjunction with existing flue-gas-cleanup (FGC) systems in order to minimize additional capital costs and operational complexity. Argonne National Laboratory has supported the DOE Fossil Energy Program for over 15 years with research on advanced environmental control technologies. The emphasis in Argonne's work has been on integrated systems that combine control of several pollutants. Specific topics have included spray drying for sulfur dioxide and particulate-matter control with high-sulfur coal, combined sulfur dioxide and nitrogen oxides control technologies, and techniques to enhance mercury control in existing FGC systems. The latter area has focused on low-cost dry sorbents for use with fabric filters or electrostatic precipitators and techniques for improving the capture of mercury in wet flue-gas

desulfurization (FGD) systems. This paper presents results from recent work that has studied the effects of several oxidizing agents in combination with typical flue-gas species (e.g., nitrogen oxides and sulfur dioxide) on the oxidation of Hg(0).
DOE
Mercury (Metal); Emission; Flue Gases; Particulates; Air Pollution; Contaminants

19980206617 California Univ., San Diego, BOREAS Group, La Jolla, CA USA
[Sources of Methane in the Boreal Region] ***Final Report***
1998; 38p; In English
Contract(s)/Grant(s): NAG5-2288
Report No.(s): NASA/CR-1998-208204; NAS 1.26:208204; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In determining the global methane budget the sources of methane must be balanced with the sinks and atmospheric inventory. The approximate contribution of the different methane sources to the budget has been establish showing the major terrestrial inputs as rice, wetlands, bogs, fens, and tundra. Measurements and modeling of production in these sources suggest that temperature, water table height and saturation along with substratum composition are important in controlling methane production and emission. The isotopic budget of 13 C and D/H in methane can be used as a tool to clarify the global budget. This approach has achieved success at constraining the inputs. Studies using the isotopic approach place constraints on global methane production from different sources. Also, the relation between the two biogenic production pathways, acetate fermentation and CO2 reduction, and the effect of substratum composition can be made using isotope measurements shows the relation between the different biogenic, thermogenic and anthropogenic sources of methane as a function of the carbon and hydrogen isotope values for each source and the atmosphere, tropospheric composition. Methane emissions from ponds and fens are a significant source in the methane budget of the boreal region. An initial study in 1993 and 1994 on the isotopic composition of this methane source and the isotopic composition in relation to oxidation of methane at the sediment surface of the ponds or fen was conducted as part of our BOREAS project. The isotopic composition of methane emitted by saturated anoxic sediment is dependent on the sediment composition and geochemistry, but will be influenced by in situ oxidation, in part, a function of rooted plant activity. The influence of oxidation mediated by rooted plant activities on the isotopic composition of methane is not well known and will depend on the plant type, sediment temperature, and numerous other variables. Information on this isotopic composition is important in both understanding the bio-geochemistry of the system and also in determining the regional and global inputs for the methane isotope budget. In determining the destruction of methane for balancing the atmospheric methane budget soil oxidation must be considered.
Derived from text
Methane; Models; Chemical Analysis; Air Pollution; Atmospheric Composition; Methanation; Pollution Control

19980206644 Nevada Univ., Reno, NV USA
Linkage of anthropogenic aerosol to clouds and climate ***Final Report***
Hudson, J. G., Nevada Univ., USA; [1997]; 3p; In English
Contract(s)/Grant(s): DE-FG08-90ER-61012
Report No.(s): DOE/ER/61012-4; DE98-000932; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Work performed between July 1991 and June 1994 is very briefly summarized in this report. The work done concerns differences between clouds and the aerosol particles, or cloud condensation nuclei (CCN), upon which the cloud droplets condense. In particular, the substantial contribution of anthropogenic sources to CCNs and their effects on clouds were examined. Ship board measurements of CCN concentrations in clouds were taken in July 1991. In June 1992, aircraft measurements and analyses of CCN concentrations showed substantial influences of anthropogenic aerosol on clouds through long-range transport of polluted air. A June 1994 study indicated that CCN produced by ships caused ship trail clouds even in moderately polluted clouds.
DOE
Aerosols; Air Pollution; Clouds (Meteorology); Condensation Nuclei; Climatology

19980206699 Naval Facilities Engineering Command, San Diego, CA USA
Final Environmental Impact Statement for the Realignment of E-2 Squadrons from Marine Corps Air Station (MCAS) Miramar, Volume 2, Technical Appendices ***Final Report***
Mar. 1998; 335p; In English
Report No.(s): AD-A341658; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

Public Involvement Process of this document, the NEPA process is designed to involve the public in the decision-making process. This appendix contains copies of the public involvement materials used to inform federal, state, and local agencies, elected officials, organizations, and individuals about the preparation of this document. A scoping letter and project summary was

distributed to announce the Navy's intent to prepare this environmental impact statement (EIS), the start of the public scoping period, the dates and locations of the public scoping meetings, and the address and deadline to provide scoping comments. A notice of intent (NOI) was published in the Federal Register on May 1, 1996 (Volume 61, Number 85). A copy of the NOI is provided in Section A.3. The NOI was published in nine local newspapers - Hanford Sentinel, Lemoore Advance, Fresno Bee, Imperial Valley Press, San Diego Union Tribune, Eagle (Coronado), Coronado Journal, Ventura County Star, and the Los Angeles Times, Ventura County Edition. A notice of availability (NOA) for the draft EIS (DEIS) was published in the Federal Register on November 21, 1997 (Volume 62, Number 225). A copy of the NOA is provided in Section A.4. The NOA was published in seven local newspapers - Hanford Sentinel, Lemoore Advance, Fresno Bee, Imperial Valley Press, San Diego Union Tribune, Ventura County Star, and the Los Angeles Times, Ventura County Edition. Sample newspaper advertisements and the dates of publication are provided in Section A.5.
DTIC
Public Relations; Relocation; Environmental Surveys; Decision Making

19980206787 Environmental Protection Agency, Washington, DC USA
Federal Register Volume 63, Number 93, Thursday, May 14, 1998, Notices, Part 3, Environmental Protection Agency: Guidelines for Neurotoxicity Risk Assessment
May 14, 1998; 36p; In English
Report No.(s): PB98-117831; EPA/630/R-95/001F; NCEA-F-0248; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Guidelines set forth principles and procedures to guide EPA scientists in evaluating environmental contaminants that may pose neurotoxic risks, and inform Agency decision makers and the public about these procedures. Developed by a cross-Agency Technical Panel organized by the Risk Assessment Forum, these Guidelines are the Agency's first statement on setting principles and procedures to guide EPA scientists in conducting neurotoxicity risk assessments. A link between human exposure to some chemical substances and neurotoxicity has been firmly established. The Guidelines emphasize that risk assessment will be conducted on a case-by-case basis. They stress that information will be fully presented in Agency risk assessment documents and that Agency scientists will identify the strengths and weaknesses of each assessment by describing uncertainties, assumptions, and limitations, as well as the scientific basis and rationale for each assessment. The Guidelines bridge gaps in risk assessment methodology and data by identifying these gaps and the importance of the missing information to the risk assessment process, encouraging research and analysis that will lead to new risk assessment methods and data. The Guidelines specifically note the special vulnerability of the nervous system of infants and children to environmentally relevant chemicals and provide guidance for the interpretation of data from developmental and reproductive studies involving assessment of nervous system structure and function.
NTIS
Assessments; Nervous System; Risk

19980206794 Environmental Protection Agency, Office of Air and Radiation, Washington, DC USA
Final Revisions to the Ozone and Particulate Matter Air Quality Standards
Jul. 1997; 6p; In English
Report No.(s): PB98-147283; EPA/456/F-97/004; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Recently EPA completed its review of the current air quality standards for ground-level ozone (commonly known as smog) and particulate matter (or PM). Based on new scientific evidence, EPA has issued final revisions to strengthen both sets of standards.
NTIS
Particulates; Ozone; Air Quality; Air Pollution

19980209651 Environmental Protection Agency, Office of Air and Radiation, Washington, DC USA
Compliance Report, 1996: Acid Rain Program. Plants Affected by Phase 1 of the Acid Rain Program in 1996
Jun. 1997; 90p; In English
Report No.(s): PB98-142151; EPA/430/R-97/025; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The 1996 Compliance Report highlights the progress under EPA's Acid Rain Program during the first year of compliance with the NO(x) program and the second year with the SO2 program. Affected facilities demonstrated 100 percent compliance for both pollutants and even exceeded in the compliance targets set by the Clean Air Act Amendments of 1990. With respect to NOx affected utility units reduced emission rates by an average of 40 percent below 1990 levels, emitting 33 percent less NOx in the

process, and demonstrating an average of 18 percent overcompliance with the regulations. For SO2, utilities nearly matched their extraordinary overcompliance of 1995 with emissions that were 35 percent below 1996 allocated levels.
NTIS
Acid Rain; Air Quality; Air Pollution; Pollution Control; Emission; Electric Power Plants

19980209662 Acurex Environmental Corp., Research Triangle Park, NC USA
On-Line Detection of Dichlorodibenzodioxins by DLR Jet-REMPI
Oser, H., Acurex Environmental Corp., USA; Thanner, R., Acurex Environmental Corp., USA; Grotheer, H. H., Acurex Environmental Corp., USA; Gullett, B. K., Acurex Environmental Corp., USA; French, N. B., Acurex Environmental Corp., USA; 1998; 18p; In English
Report No.(s): PB98-145543; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper describes a Jet-REMPI (resonance enhanced multiphoton ionization) apparatus and presents spectra for 2,7-dichlorodibenzodioxin (DCDD). The apparatus is a product of Deutsche Forschungsanstalt fur Luft und Raumfahrt (DLR). Detection limits on the order of parts per trillion by volume (pptv) units have been determined. The small number of isomers (10) and the lower degree of chlorination make the DCDD compounds a favorable class of surrogates.
NTIS
Photochemical Reactions; Air Pollution; Detection; Pollution Control; Photoionization

19980209664 Swedish Water and Air Pollution Research Lab., Goeteborg, Sweden
Experimental Investigation of Sorbent and Biofilter Materials Used for Cleaning of Volatile Organic Compounds *Experimentell Utvaerdering av Sorbent- och Biofiltermaterial vid Rening av Flyktiga Organiska Aemnen*
Tjus, K., Swedish Water and Air Pollution Research Lab., Sweden; Ekengren, O., Swedish Water and Air Pollution Research Lab., Sweden; Fortkamp, U., Swedish Water and Air Pollution Research Lab., Sweden; Oct. 1997; 52p; In Swedish
Report No.(s): PB98-147556; IVL-B-1247; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

There is a need to evaluate commercial adsorbents used for removing volatile organic compounds emanating from lacquering, wood impregnation, flexographic printing and rolling etc. For such evaluations equipment for measurement of the uptake of different substances by adsorbants has been built up as well as equipment for biofilter experiments. The equipment consists of: (1) a gravimetric device by which the absorbents are investigated; a laboratory column for repeated adsorption and desorption test; and equipment for biofiltration in which different biological materials can be tested. Gases were analyzed with a Flame Ionization Detector (FID) and by Fourier Transform InfraRed technique (FTIR). In this project adsorbants and biofilters were evaluated.
NTIS
Absorbents; Gravimetry; Adsorbents; Air Pollution; Pollution Control; Emission

19980209793 Environmental Protection Agency, Air Pollution Prevention and Control Div., Research Triangle Park, NC USA
Air Pollution and Air Toxics: US Regulatory Framework and Control Technologies
Martin, G. B., Environmental Protection Agency, USA; Mar. 1998; 12p; In English
Report No.(s): PB98-145550; EPA/600/A-98/069; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper summarizes the U.S. regulatory approach for a variety of pollutants and major air-related environmental issues; discusses major emission source contributions; and describes various control technologies.
NTIS
Air Pollution; Contaminants; Combustion Products; Emission

19980209835 Environmental Protection Agency, Air Pollution Prevention and Control Div., Research Triangle Park, NC USA
Air Pollution Control Technologies, Chapter 65
Miller, Charles A., Environmental Protection Agency, USA; 1998; 30p; In English
Report No.(s): PB98-147242; EPA/600/A-98/059; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The chapter discusses the use of technologies for reducing air pollution emissions from stationary sources, with emphasis on the control of combustion generated air pollution. Major stationary sources include utility power boilers, industrial boilers and heaters, metal smelting and processing plants, and chemical and other manufacturing plants. The three primary approaches are pre-process control, process modification, and post-process control. Early work in the field of air pollution technology focused on sulfur dioxide, nitrogen oxides, and particulates. Work continues to improve performance as measured by pollutant reduction efficiency and operating and maintenance cost. These mature technologies are also being evaluated for their performance as con-

trol devices for hazardous air pollutants, and as the basis for new hybrid technologies that seek to reduce pollutant emissions by 90% or more.
NTIS
Air Pollution; Control Equipment; Pollution Control; Technologies

19980209998 Argonne National Lab., IL USA
Fuel-cycle energy and emissions impacts of tripled fuel economy vehicles
Mintz, M. M., Argonne National Lab., USA; Wang, M. Q., Argonne National Lab., USA; Vyas, A. D., Argonne National Lab., USA; 1998; 16p; In English; 1998 Annual Meeting of the Transporation Research Board, 11-15 Jan. 1998, Washington, DC, USA
Contract(s)/Grant(s): W-31109-eng-38
Report No.(s): ANL/ES/CP-94251; CONF-980112; DE97-008668; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This paper presents estimates of the full cycle energy and emissions impacts of light-duty vehicles with tripled fuel economy (3X vehicles) as currently being developed by the Partnership for a New Generation of Vehicles (PNGV). Seven engine and fuel combinations were analyzed: reformulated gasoline, methanol, and ethanol in spark-ignition, direct-injection engines; low sulfur diesel and dimethyl ether in compression-ignition, direct-injection engines; and hydrogen and methanol in fuel-cell vehicles. The fuel efficiency gain by 3X vehicles translated directly into reductions in total energy demand, petroleum demand, and carbon dioxide emissions. The combination of fuel substitution and fuel efficiency resulted in substantial reductions in emissions of nitrogen oxide, carbon monoxide, volatile organic compounds, sulfur oxide, and particulate matter smaller than 10 microns, particularly under the High Market Share Scenario.
DOE
Internal Combustion Engines; Fuel Cells; Ethyl Alcohol; Diesel Engines; Crude Oil; Carbon Monoxide; Carbon Dioxide; Air Pollution; Automobiles

19980210104 Sandia National Labs., Albuquerque, NM USA
A reevaluation of the National Emission Standards for Hazardous Air Pollutants (NESHAP - 40 CFR 61, Subpart H) program at Sandia National Laboratories, New Mexico
Culp, T. A., Sandia National Labs., USA; Hylko, J. M., Weston (Roy F.), Inc., USA; [1997]; 9p; In English, 8-11 Feb. 1998, Mobile, AL, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2449C; CONF-980203; DE98-000414; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The initial National Emission Standards for Hazardous Air Pollutants (NESHAP - 40 CFR 61, Subpart H) Program at Sandia National Laboratories, New Mexico (SNL/NM) required: (1) continuous air monitoring of sources if the calculated effective dose equivalent (EDE) to the maximum exposed individual (MEI) was greater than 0.1 mrem/yr; (2) the determination of emissions based on measurements or measured parameters if the EDE to the MEI was less than 0.1 mrem/yr; and (3) the calculation of worst case releases when the expected air concentrations were below detection limits using standard monitoring equipment. This conservative interpretation of the regulation guided SNL/NM to model, track, and trend virtually all emission sources with the potential to include any radionuclides. The level of effort required to implement these activities was independent of the EDE contributing from individual sources. A recent programmatic review found the NESHAP program to be in excess of the legal requirements. A further review found that, in summation, 13 of 16 radionuclide sources had a negligible impact on the final calculated EDE to the MEI used to demonstrate compliance at 20 separate on-site receptor locations. A reevaluation was performed to meet the legal requirements of 40 CFR 61, Subpart H, and still be reasonable and appropriate under the existing circumstances.
DOE
Environmental Monitoring; Exhaust Emission; Air Pollution; Air Quality; Pollution Control; Position (Location)

19980210110 Country Studies Management Team, Washington, DC USA
National climate change action plans: Developing and transition countries ***Interim Report***
Benioff, R., Editor, Country Studies Management Team, USA; Ness, E., Editor, Country Studies Management Team, USA; Hirst, J., Editor, Country Studies Management Team, USA; Oct. 1997; 168p; In English
Report No.(s): USCSP-98001282; DE98-001282; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Under its Support for National Action Plans (SNAP) initiative, the U.S. Country Studies Program is providing financial and technical assistance to 18 countries for the development of climate change action plans. Although most of the countries have not

yet completed their plans, the important lessons learned thus far are valuable and should be shared with other countries and international institutions that have an interest in the process of action plan development. This interim report describes the experience of 11 countries that are the furthest along in their planning activity and who have offered to share their results to date with the larger community of interested nations. These action plans delineate specific mitigation and adaptation measures that the countries will implement and integrate into their ongoing development programs. This report focuses on the measures the countries have selected and the methods they used to prepare their action plans. This executive summary presents key lessons and common themes using a structure similar to that used in the individual country chapters.
DOE
Climate Change; Global Warming

19980210116 Wyoming Univ., Dept. of Atmospheric Science, Laramie, WY USA
Aerosol Size Distributions Obtained from HALOE Spectral Extinction Measurements
Hervig, Mark E., Wyoming Univ., USA; Deshler, Terry, Wyoming Univ., USA; Russell, James M., III, Hampton Univ., USA; Journal of Geophysical Research; Jan. 20, 1998; ISSN 0148-0227; Volume 103, No. D1, pp. 1573-1583; In English
Contract(s)/Grant(s): NAG1-1623
Report No.(s): Paper-97JD03081; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A technique was developed to use multiwavelength aerosol extinction measurements from the Halogen Occultation Experiment (HALOE) to determine the size distribution of stratospheric H2O-H2SO4 aerosols. Although the HALOE extinction spectrum alone cannot be used to reliably infer the aerosol size distribution (except when the aerosol population contains particles larger than about 0.5 micron), the inverse problem becomes highly defined when the effective radius is known. Using theoretical relationships derived from in situ aerosol measurements, we found that the effective radius can be determined from the HALOE 2.45 micron extinction with uncertainties of about +/- 15%. Using extinction ratios with the effective radii determined from the HALOE extinctions, we obtained unimodal lognormal size distributions. The HALOE size distributions are generally unbiased with respect to coincident in situ aerosol measurements. Error analysis reveals that uncertainties in the inferred surface areas and volumes are less than 30% and 15%, respectively. Inferring size distributions from the HALOE data set provides global and temporal aerosol information, which can satisfy important needs for investigations of the Earth's radiative and chemical balance.
Author
Aerosols; Size Distribution; Spectrum Analysis; Procedures

19980210126 Los Alamos National Lab., NM USA
Preliminary investigations on the carbon dioxide sequestering potential of the ultramafic rock
Goff, F., Los Alamos National Lab., USA; Guthrie, G., Los Alamos National Lab., USA; Counce, D., Los Alamos National Lab., USA; Kluk, E., Los Alamos National Lab., USA; Bergfeld, D., Los Alamos National Lab., USA; Snow, M., Los Alamos National Lab., USA; Aug. 1997; 23p; In English
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-13328-MS; DE98-001882; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Fossil fuels continue to provide major sources of energy to the modern world even though global emissions of CO2 are presently at levels of 19 Gt/yr. Future antipollution measures may include sequestering of waste CO2 as magnetite (MgCO3) by processing ultramafic rocks to obtain reactable Mg. Huge ultramafic deposits consisting of relatively pure Mg-rich silicates exist throughout much of the world in ophiolites and layered intrusions. Peridotites (especially dunites) and serpentinites comprise the best ores because they contain the most Mg by weight and are relatively reactive to hot acids such as HCl. Although mining such deposits on a large scale would have environmental impacts, the sequestering process could provide Cr, Ni, and other metals as byproducts and could dispose of existing waste (white) asbestos. Small ultramafic bodies (approximately 1 km(exp 3)) can potentially sequester about 1 Gt of CO2 or about 20% of annual US emissions. A single large deposit of dunite (approximately 30 km(exp 3)) could dispose of about 20 yr of current US CO2 emissions. The cost and environmental impact of mining these deposits must be weighed against the increased costs of energy and benefits to the atmosphere and climate.
DOE
Carbon Dioxide; Fossil Fuels; Environmental Surveys; Peridotite

19980210169 Pechan (E. H.) and Associates, Inc., Durham, NC USA
Greenhouse Gases from Anaerobic Decomposition of Waste
Doorn, M. R. J., Pechan (E. H.) and Associates, Inc., USA; Thorneloe, S. A., Environmental Protection Agency, USA; Eklund, B., Radian Corp., USA; LaCosse, J., Radian Corp., USA; 1998; 8p; In English

Contract(s)/Grant(s): EPA-68-D1-0146T; EPA-68-D1-0031T
Report No.(s): PB98-147143; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper gives an overview of EPA/Air and Energy Engineering Research Laboratory's (AEERL's) programs to characterized emissions of greenhouse gases GHGs from wastewater treatment and disposal (WWT/D) sources in industrialized and developing countries.

NTIS

Developing Nations; Energy Technology; Greenhouse Effect

19980210170 Environmental Protection Agency, Air Pullution Prevention and Control Div., Research Triangle Park, NC USA

Evaluation of an IAQ Source Management Strategy for a Large Building

Mason, M. A., Environmental Protection Agency, USA; Tichenor, B. A., Environmental Protection Agency, USA; Sparks, L. E., Environmental Protection Agency, USA; Henschel, D. B., Environmental Protection Agency, USA; Kulp, R. N., Environmental Protection Agency, USA; 1998; 14p; In English

Report No.(s): PB98-155047; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Environmental Protection Agency (EPA) conducted a pilot study to evaluate source management and control strategies used in the design, construction, and commissioning of a new large building. Strategies employed to minimize volatile organic compound (VOC) contamination in the occupied building included selection of low emitting materials, staged construction and installation of materials and furnishings, and a 90-day 100% outdoor air flush prior to occupancy. Air Quality Science (AQS) collected both the source emission rate data generated in product compliance testing and those to characterize building ventilation rates and VOC concentrations before, during, and after the flush out. The source loading and emission rate data, building characteristics, and ventilation data were input into an indoor air model. Predicted VOC concentrations were compared with those observed which remained above predicted for at least 30 days beyond the 90-day flush out. Predominant VOC emissions were characteristic of a carpet tile installed on four of six floors. It is concluded that long term product emissions tests may be necessary to characterize some products and that a strategy is needed to ensure that installed products are representative of products tested for compliance.

NTIS

Environment Protection; Air Quality; Management Planning; Indoor Air Pollution

19980210174 National Renewable Energy Lab., Golden, CO USA

Determination of alternative fuels combustion products, Phase 3, report

Whitney, K. A., Southwest Research Inst., USA; Dec. 1997; 100p; In English

Contract(s)/Grant(s): DE-AC36-83CH-10093; Subcontract YAW-3-13253-01

Report No.(s): NREL/SR-540-23594; DE98-001888; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report describes the laboratory efforts to characterize particulate and gaseous exhaust emissions from a passenger vehicle operating on alternative fuels. Tests were conducted at room temperature (nominally 72 F) and 20 F utilizing the chassis dynamometer portion of the FTP for light-duty vehicles. Fuels evaluated include Federal RFG, LPG meeting HD-5 specifications, a national average blend of CNG, E85, and M85. Exhaust particulate generated at room temperature was further characterized to determine polynuclear aromatic content, trace element content, and trace organic constituents. For all fuels except M85, the room temperature particulate emission rate from this vehicle was about 2 to 3 mg/mile. On M85, the particulate emission rate was more than 6 mg/mile. In addition, elemental analysis of particulate revealed an order of magnitude more sulfur and calcium from M85 than any other fuel. The sulfur and calcium indicate that these higher emissions might be due to engine lubricating oil in the exhaust. For RFG, particulate emissions at 20 F were more than six times higher than at room temperature. For alcohol fuels, particulate emissions at 20 F were two to three times higher than at room temperature. For CNG and LPG, particulate emissions were virtually the same at 72 F and 20 F. However, PAH emissions from CNG and LPG were higher than expected. Both gaseous fuels had larger amounts of pyrene, 1-nitropyrene, and benzo(g,h,i)perylene in their emissions than the other fuels.

DOE

Combustion Products; Exhaust Gases; Chemical Analysis; Exhaust Emission; Passengers; Air Pollution; Gaseous Fuels

19980210175 National Renewable Energy Lab., Golden, CO USA

Urban airshed modeling of air quality impacts of alternative transportation fuel use in Los Angeles and Atlanta

Dec. 1997; 100p; In English

Contract(s)/Grant(s): DE-AC36-83CH-10093; Subcontract ACI-7-17013-01

Report No.(s): NREL/SR-540-23960; DE98-001889; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The main objective of NREL in supporting this study is to determine the relative air quality impact of the use of compressed natural gas (CNG) as an alternative transportation fuel when compared to low Reid vapor pressure (RVP) gasoline and reformulated gasoline (RFG). A table lists the criteria, air toxic, and greenhouse gas pollutants for which emissions were estimated for the alternative fuel scenarios. Air quality impacts were then estimated by performing photochemical modeling of the alternative fuel scenarios using the Urban Airshed Model Version 6.21 and the Carbon Bond Mechanism Version IV (CBM-IV) (Geary et al., 1988) Using this model, the authors examined the formation and transport of ozone under alternative fuel strategies for motor vehicle transportation sources for the year 2007. Photochemical modeling was performed for modeling domains in Los Angeles, California, and Atlanta, Georgia.

DOE

Urban Research; Air Quality; Transportation; Natural Gas; Low Pressure; Compressed Gas; Vapor Pressure

19980210259 Argonne National Lab., IL USA

Modeling air pollution in the Tracking and Analysis Framework (TAF)

Shannon, J. D., Argonne National Lab., USA; [1998]; 5p; In English; 10th; Applications of Air Pollution Meteorology, 11-16 Jan. 1998, Phoenix, AZ, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/ER/CP-93572; CONF-980116; DE98-050239; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Tracking and Analysis Framework (TAF) is a set of interactive computer models for integrated assessment of the Acid Rain Provisions (Title IV) of the 1990 Clean Air Act Amendments. TAF is designed to execute in minutes on a personal computer, thereby making it feasible for a researcher or policy analyst to examine quickly the effects of alternate modeling assumptions or policy scenarios. Because the development of TAF involves researchers in many different disciplines, TAF has been given a modular structure. In most cases, the modules contain reduced-form models that are based on more complete models exercised off-line. The structure of TAF as of December 1996 is shown. Both the Atmospheric Pathways Module produce estimates for regional air pollution variables.

DOE

Acid Rain; Air Pollution; Air Quality; Mathematical Models

19980210262 Argonne National Lab., IL USA

Expanding the horizons of the Visibility Assessment Scoping Model (VASM)

Shannon, J. D., Argonne National Lab., USA; [1998]; 5p; In English; 10th; Applications of Air Pollution Meteorology, 11-16 Jan. 1998, Phoenix, AZ, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/ER/CP-93573; CONF-980116; DE98-050329; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Visibility Assessment Scoping Model (VASM) has successfully simulated seasonal distributions of hourly visual impairment, or haziness, that compare favorably with observations for both relatively polluted eastern sites and relatively pristine western sites in the US. The VASM approach combines regional modeling of seasonal mean concentrations of key anthropogenic particle species with Monte Carlo statistical techniques using past monitoring data and relative humidity (RH) climatology. The Monte Carlo method requires as input the seasonal geometric mean and standard deviation of daily concentrations of six particle species: sulfate, nitrate, organic carbon, elemental carbon, and dust in the fine particle mode, and dust in the coarse particle mode. In addition, the Monte Carlo method uses inter-species seasonal correlations of daily concentrations, RH climatology (seasonal means, standard deviations of daily averages, and typical diurnal patterns), and predicted future mean seasonal concentrations for one or more particle species.

DOE

Climatology; Air Pollution; Pollution Control; Diurnal Variations; Monte Carlo Method; Mathematical Models; Statistical Analysis

19980210263 Argonne National Lab., IL USA

Noise control of radiological monitoring equipment

Rubick, R. D., Argonne National Lab., USA; Stevens, W. W., Argonne National Lab., USA; Burke, L. L., Argonne National Lab., USA; [1998]; 6p; In English, 8-11 Feb. 1998, Mobile, AL, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/RA/CP-94688; CONF-980203; DE98-050503; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Although vacuum pumps on continuous air monitors (CAMs) do not produce noise levels above regulatory limits, engineering controls were used to establish a safer work environment. Operations performed in areas where CAMs are located are highly specialized and require precision work when handling nuclear materials, heavy metals, and inert gases. Traditional methods for controlling noise such as enclosing or isolating the source and the use of personal protection equipment were evaluated. An innovative solution was found by retrofitting CAMs with air powered multistage ejectors pumps. by allowing the air to expand in several chambers to create a vacuum, one can eliminate the noise hazard altogether. In facilities with adequate pressurized air, use of these improved ejector pumps may be a cost-effective replacement for noisy vacuum pumps. A workplace designed or engineered with noise levels as low as possible or as close to background adds to increased concentration, attention to detail, and increased production.

DOE

Radiology; Noise Reduction; Noise (Sound); Noise Pollution; Radiation Measuring Instruments

19980210264 Argonne National Lab., IL USA

Ozone chemiluminescent detection of olefins: Potential applications for real-time measurements of natural hydrocarbon emissions

Marley, N. A., Argonne National Lab., USA; Gaffney, J. S., Argonne National Lab., USA; Cunningham, M. M., Argonne National Lab., USA; Oct. 1997; 4p; In English; 10th; Applications of Air Pollution Meteorology, 11-16 Jan. 1998, Phoenix, AZ, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/ER/CP-94819; CONF-980116; DE98-050538; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A chemiluminescence analyzer has been constructed that takes advantage of the temperature dependence of the ozone-hydrocarbon reaction. When operated at a temperature of 170 C, the analyzer functions as a total nonmethane hydrocarbon analyzer with sensitivities 10--1,000 times better than a conventional FID. However, with operation at varying temperatures, the chemiluminescent signal reflects the differences in rates of reaction of the hydrocarbons with ozone. Preliminary studies at room temperature indicated that the relative rates of reaction of isoprene, alpha-pinene, beta-pinene, and limonene with ozone correlated with the observed chemiluminescence signal. When hydrocarbons are grouped in classes of similar structure, their rates of reaction with electrophilic atmospheric oxidants (e.g., OH, O3, NO3) can be correlated with each other. by varying the temperature of the reaction chamber, the chemiluminescence analyzer can be tuned to more reactive classes of hydrocarbons. Therefore, the chemiluminescence analyzer has the ability to determine atmospheric hydrocarbon concentrations as a function of class and will also provide a measure of the atmospheric reactivity of the hydrocarbons.

DOE

Air Pollution; Ozone; Atmospheric Composition; Alkenes; Measuring Instruments; Reaction Kinetics; Real Time Operation

19980210357 National Renewable Energy Lab., Golden, CO USA

Air quality effects of alternative fuels ***Final Report***

Guthrie, P., National Renewable Energy Lab., USA; Ligocki, M., National Renewable Energy Lab., USA; Looker, R., National Renewable Energy Lab., USA; Cohen, J., National Renewable Energy Lab., USA; Nov. 1997; 243p; In English

Contract(s)/Grant(s): DE-AC36-83CH-10093

Report No.(s): NREL/SR-540-23896; DE98-002768; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

To support the Alternative Fuels Utilization Program, a comparison of potential air quality effects of alternative transportation fuels is being performed. This report presents the results of Phase 1 of this program, focusing on reformulated gasoline (RFG), methanol blended with 15 percent gasoline (M85), and compressed natural gas (CNG). The fuels are compared in terms of effects on simulated future concentrations of ozone and mobile source air toxics in a photochemical grid model. The fuel comparisons were carried out for the future year 2020 and assumed complete replacement of gasoline in the projected light-duty gasoline fleet by each of the candidate fuels. The model simulations were carried out for the areas surrounding Los Angeles and Baltimore/DC, and other (non-mobile) sources of atmospheric emissions were projected according to published estimates of economic and population growth, and planned emission control measures specific to each modeling domain. The future-year results are compared to a future-year run with all gasoline vehicle emissions removed. The results of the comparison indicate that the use of M85 is likely to produce similar ozone and air toxics levels as those projected from the use of RFG. Substitution of CNG is projected to produce significantly lower levels of ozone and the mobile source air toxics than those projected for RFG or M85. The relative benefits of CNG substitution are consistent in both modeling domains. The projection methodologies used for the comparison

are subject to a large uncertainty, and modeled concentration distributions depend on meteorological conditions. The quantitative comparison of fuel effects is thus likely to be sensitive to alternative assumptions. The consistency of the results for two very different modeling domains, using very different base assumptions, lends credibility to the qualitative differentiation among these fuels.
DOE
Air Quality; Combustion Products; Exhaust Emission; Exhaust Gases; Fuels; Gasoline; Methyl Alcohol; Natural Gas

19980210420 Argonne National Lab., IL USA
Aircraft measurements of nitrogen dioxide and peroxyacyl nitrates using luminol chemiluminescence with fast capillary gas chromatography
Gaffney, J. S., Argonne National Lab., USA; Marley, N. A., Argonne National Lab., USA; Drayton, P. J., Chicago Univ., USA; Sep. 1997; 3p; In English; 10th; Meteorological Observations and Instrumentation, 11-16 Jan. 1998, Phoenix, AZ, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/ER/CP-93863; CONF-980124; DE98-050018; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Peroxyacyl nitrates (PANs) and nitrogen dioxide (NO2) are important trace gas species associated with photochemical air pollution. The PANs are in thermal equilibrium with the peroxyacetyl radical and NO2. Because PANs are trapped peroxy radicals, they are an important indicator species of the photochemical age of an air parcel, as well as being a means of long-range transporting of NO2, leading to the formation of regional ozone and other oxidants. Typically, PANs are measured by using a gas chromatograph with electron-capture detection (ECD). Once automated, this method has been shown to be reliable and quite sensitive, allowing the levels of PANs to be measured at low parts per trillion in the troposphere. Unfortunately, a number of other atmospheric gases also have strong ECD signals or act as inferences and limit the speed in which the analysis can be completed. Currently, the shortest analysis time for PAN is approx. 5 minutes with ECD. The authors recent examined the luminol detection of NO2 and PANs using gas capillary chromatography for rapid monitoring of these important trace gases. Analysis of the PANs (PAN, PPN, and PBN) and NO2 in one minute has been demonstrated in laboratory studies by using this approach. Reported here are modifications of this instrument for aircraft operation and preliminary results from test flights taken near Pasco, Washington in August of 1997.
DOE
Photochemical Reactions; Atmospheric Chemistry; Nitrogen Dioxide; Trace Elements; Electron Capture; Ozone

19980210425 Argonne National Lab., IL USA
Uncertainty in radiosonde measurements of temperature and relative humidity estimated from dual-sonde soundings made during the September 1996 ARM Water Vapor IOP
Lesht, B. M., Argonne National Lab., USA; [1998]; 4p; In English; 9th; Global Change Studies, 14-16 Jan. 1998, Phoenix, AZ, USA; Sponsored by American Meteorological Society, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/ER/CP-93862; CONF-980121; DE98-050095; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Studies of radiosonde accuracy have tended to involve intercomparisons among different radiosonde types. One goal of these intercomparisons has been to quantify biases or other systematic errors related to the kinds of sensors employed. Little apparent attention has been paid, however, to the operational uncertainty associated with a single sensor type. The US Department of Energy's Atmospheric Radiation Measurement (ARM) Program has used a single radiosonde type since beginning field operations in 1992 at its Cloud and Radiation Testbed (CART) site. Because of the dependence of ARM Science Team experiments on measurements of the atmospheric state, considerable interest exists within the program in quantifying the uncertainty associated with radiosonde measurements. The September 1996 Water Vapor Intensive Operations Period (WVIOP) provided an excellent opportunity to investigate further the operational performance of the radiosondes used by ARM.
DOE
Radiosondes; Radiation Measurement; Systematic Errors; Water Vapor; Atmospheric Radiation; Atmospheric Temperature

19980210462 Energia Nucleare e Delle Energie Alternative, Dipt. Ambiente, Rome, Italy
Lichens and mosses in air quality monitoring: A biological model proposal *Licheni e briofite nella valutazione della qualita' ambientale: Proposta di un modello di bioaccumulo*
Bari, A., Energia Nuclear e Delle Energie Alternative, Italy; Minciardi, M. R., Energia Nuclear e Delle Energie Alternative, Italy; Troiani, F., Energia Nuclear e Delle Energie Alternative, Italy; Bonotto, F., Energia Nuclear e Delle Energie Alternative, Italy; Paonessa, F., Energia Nuclear e Delle Energie Alternative, Italy; Leone, D., Energia Nuclear e Delle Energie Alternative, Italy;

Piervittori, R., Turin Univ., Italy; Fossa, V., Turin Univ., Italy; Laccisaglia, A., Turin Univ., Italy; Sep. 1997; ISSN 1120-5555; 57p; In Italian
Report No.(s): ENEA-RT-AMB-97-14; DE98-728542; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)): US Sales Only, Hardcopy, Microfiche

In the National Agency for New Technology, Energy and the Environment's environmental monitoring studies, a research about the biomonitoring of metal pollution (Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Zn) by lichens and mosses, in the extra-urban area of Saluggia (VC) was carried out in collaboration with University of Turin. The research, following a methodological approach, involved different plants and monitoring techniques. The mosses Grimmia pulvinata used as biomonitors were growing ''in situ'' on the contrary the lichens were transplanted. Several thallus of Pseudevernia furfuracea were collected from an uncontaminated area and exposed using two different techniques. The results confirmed the validity of such species as biomonitors of metal pollution. Although meaningful differences were pointed out between the different techniques, in many cases high accumulation rates were observed. A mathematical model of bioaccumulation was proposed, mainly to correlate the in-take of metals in the vegetal matrices with air metal concentrations and exposure time, obtaining a good experimental relationship.
DOE
Bryophytes; Air Quality; Air Pollution; Pollution Monitoring; Lichens; Bionics

19980210491 Argonne National Lab., IL USA
The ARM eddy correlation system for monitoring surface fluxes
Hart, R. L., Argonne National Lab., USA; Cook, D. R., Argonne National Lab., USA; Wesely, M. L., Argonne National Lab., USA; [1998]; 2p; In English; 9th; Global Change Studies, 14-16 Jan. 1998, Phoenix, AZ, USA; Sponsored by American Meteorological Society, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/ER/CP-93974; CONF-980121; DE98-050096; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Atmospheric Radiation Measurement (ARM) Program was established by the Department of Energy as part of the US Global Climate Change Research Program to improve methods of determining radiative transfer and cloud processes in large-scale models. The ARM observational facility in the Southern Great Plains (SGP) of the US uses various types of instrument systems to make continuous measurements of the state of the atmosphere, cloud properties, radiative transfer, and other forms of energy transfer. Most of the instrument systems for these continuous observations come from commercial sources; many are adaptations of systems that have been used previously, mostly in short-term field campaigns. Eddy correlation systems (ECORs) are used to measure the air-surface exchange rates of heat, moisture, and momentum at eight locations in the overall area (350 km by 400 km) of the SGP site. At most locations, measurements are made at a height of about three meters above the ground over tilled agricultural land. At 14 other locations, air-surface exchange is measured above grasslands with an energy balance Bowen ratio system.
DOE
Atmospheric Radiation; Grasslands; Agriculture; Climate Change; Radiation Measurement; Energy Transfer; Radiative Transfer

19980210704 Lawrence Livermore National Lab., Livermore, CA USA
Modeling the spectral optical properties of ammonium sulfate and biomass burning aerosols
Grant, K. E., Michigan Univ., USA; Chuang, C. C., Michigan Univ., USA; Grossman, A. S., Michigan Univ., USA; Penner, J. E., Michigan Univ., USA; Sep. 01, 1997; 8p; In English; 6th; Carbonaceous Particles In the Atmosphere, 22-24 Sep. 1997, Vienna, Austria
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-128493; CONF-9709205; DE98-052268; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The importance of including the global and regional radiative effects of aerosols in climate models has increasingly been realized. Accurate modeling of solar radiative forcing due to aerosols from anthropogenic sulfate and biomass burning emissions requires adequate spectral resolution and treatment of spatial and temporal variability. The variation of aerosol spectral optical properties with local relative humidity and dry aerosol composition must be considered. Because the cost of directly including Mie calculations within a climate model is prohibitive, parameterizations from offline calculations must be used. Starting from a log-normal size distribution of dry ammonium sulfate, we developed optical properties for tropospheric sulfate aerosol at 15 relative humidities up to 99 percent. The resulting aerosol size distributions were then used to calculate bulk optical properties at wavelengths between 0.175 micro m and 4 micro m. Finally, functional fits of optical properties were made for each of 12 wave-

length bands as a function of relative humidity. Significant variations in optical properties occurred across the total solar spectrum. Relative increases in specific extinction and asymmetry factor with increasing relative humidity became larger at longer wavelengths. Significant variation in single-scattering albedo was found only in the longest near-IR band. This is also the band with the lowest albedo. A similar treatment was done for aerosols from biomass burning. In this case, size distributions were taken as having two carbonaceous size modes and a larger dust mode. The two carbonaceous modes were considered to be humidity dependent. Equilibrium size distributions and compositions were calculated for 15 relative humidities and five black carbon fractions. Mie calculations and Chandrasekhar averages of optical properties were done for each of the resulting 75 cases. Finally, fits were made for each of 12 spectral bands as functions of relative humidity and black carbon fraction.
DOE
Spectral Bands; Spectral Resolution; Ammonium Sulfates; Biomass; Aerosols; Optical Properties; Solar Spectra

19980210712 Ames Lab., IA USA
Performance testing of multi-metal continuous emissions monitors
Haas, W. J., Ames Lab., USA; French, N. B., Sky +, USA; Brown, C. H., Oak Ridge National Lab., USA; Burns, D. B., Westinghouse Savannah River Co., USA; Lemieux, P. M., Environmental Protection Agency, USA; Ryan, J. V., Environmental Protection Agency, USA; Priebe, S. J., Idaho National Engineering Lab., USA; Waterland, L. R., Acurex Environmental Corp., USA; Nov. 17, 1997; 70p; In English
Contract(s)/Grant(s): W-7405-ENG-82
Report No.(s): IS-5128; DE98-004610; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Three prototype multi-metals continuous emissions monitors (CEMs) were tested in April 1996 at the Rotary Kiln Incinerator Simulator facility at the US Environmental Protection Agency (EPA) National Risk Management Research Laboratory, Research Triangle Park, North Carolina. The CEM instruments were: Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES); Laser Induced Breakdown Spectrometry-Atomic Emission Spectroscopy (LIBS); and Laser Spark Spectrometry, another LIBS instrument. The three CEMs were tested simultaneously during test periods in which low, medium, and high concentration levels of seven toxic metals -- antimony, arsenic, beryllium, cadmium, chromium, lead, and mercury -- were maintained under carefully controlled conditions. Two methods were used to introduce the test metals into the flue gas: (1) solution atomization, introducing metal-containing aerosol directly into the secondary combustion burner, and (2) injection of fly ash particulates. The testing addressed four measures of CEM performance: relative accuracy (RA), calibration drift, zero drift, and response time. These were accomplished by comparing the toxic metal analyte concentrations reported by the CEMs to the concentrations measured using the EPA reference method (RM) for the same analytes. Overall, the test results showed the prototype nature of the test CEMs and the clear need for further development. None of the CEMs tested consistently achieved RA values of 20% or less as required by the EPA draft performance specification. Instrument size reduction and automation will also likely need additional attention before multi-metal CEMs systems become commercially available for service as envisioned by regulators and citizens.
DOE
Air Pollution; Environmental Monitoring; Emission Spectra; Metals; Performance Tests; Spectroscopy; Particulates; Aerosols

19980210778 Atmospheric and Environmental Research, Inc., Cambridge, MA USA
Coupling Processes Between Atmospheric Chemistry and Climate ***Semiannual Report No. 2***
Ko, Malcolm K. W., Atmospheric and Environmental Research, Inc., USA; Weisenstein, Debra, Atmospheric and Environmental Research, Inc., USA; Shia, Run-Lie, Atmospheric and Environmental Research, Inc., USA; Sze, N. D., Atmospheric and Environmental Research, Inc., USA; Mar. 01, 1998; 68p; In English
Contract(s)/Grant(s): NAS5-97039
Report No.(s): NASA/CR-1998-206865; NAS 1.26:206865; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The overall objective of this project is to improve the understanding of coupling processes between atmospheric chemistry and climate. Model predictions of the future distributions of trace gases in the atmosphere constitute an important component of the input necessary for quantitative assessments of global change. We will concentrate on the changes in ozone and stratospheric sulfate aerosol, with emphasis on how ozone in the lower stratosphere would respond to natural or anthropogenic changes. The key modeling tools for this work are the AER 2-dimensional chemistry-transport model, the AER 2-dimensional stratospheric sulfate model, and the AER three-wave interactive model with full chemistry. We will continue developing our three-wave model so that we can help NASA determine the strength and weakness of the next generation assessment models.
Author
Man Environment Interactions; Ozone; Environment Effects; Climate; Atmospheric Composition; Atmospheric Chemistry

19980210792 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of

Tracer measurements and data analysis

Kim, Hag Seong, Chungbuk National Univ., Korea, Republic of; Joo, Duk Jong, Chungbuk National Univ., Korea, Republic of; Lee, Jeong Sik, Chungbuk National Univ., Korea, Republic of; Byun, Eu Bok, Chungbuk National Univ., Korea, Republic of; Jeong, Young Do, Chungbuk National Univ., Korea, Republic of; Han, Hoon Suk, Chungbuk National Univ., Korea, Republic of; Jo, Sung Yu, Chungbuk National Univ., Korea, Republic of; Lee, Jin Phil, Chungbuk National Univ., Korea, Republic of; Jul. 1997; 54p; In Korean

Report No.(s): KAERI-CM-139/96; DE98-725028; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

This study is done for improvement of accuracy of the atmospheric diffusion model through field experiments. Fundamental atmospheric diffusion experiments are performed on an open plain with SF(sub 6) gas as a tracer. Data on= the distribution of SF(sub 6) gas are collected and used for the verification or improvement of the atmospheric diffusion model developed on the basis of random-walk method. The model has been developed by the relevant research team of the KAERI to establish a system for prediction of the behavior of radioactive effluents and exposure doses on real time bases. Being obtained from experiments done on open plains and littoral areas, the results are valuable for confirming the validity of the model in real situation. In concrete sense, the results are used for the determination of standard deviations of plume, (sigma)(sub j), and diffusivity coefficients of turbulence, K(sub j). For the completion of the model reflecting the site characteristics of given nuclear power plant, it is imperative to conduct more onsite experiments.

DOE

Atmospheric Diffusion; Tracers; Data Processing

46
GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For space radiation see 93 Space Radiation.

19980206532 Los Alamos National Lab., NM USA

Physical properties and mantle dynamics

Shankland, T. J., Los Alamos National Lab., USA; Johnson, P. A., Los Alamos National Lab., USA; McCall, K. R., Los Alamos National Lab., USA; [1997]; 21p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3075; DE98-001208; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). Because planetary interiors are remote, laboratory methods and associated theory are an essential step for interpreting geophysical measurements in terms of quantities that are needed for understanding Earth--temperature, composition, stress state, history, and hazards. One objective is the study of minerals and rocks as materials using experimental methods; another is to develop new methods, as in high pressure research, codes for computation in rock/soil physics, or nuclear-based analysis. Accomplishments include developing a single-crystal x-ray diffraction apparatus with application to materials at extremely high pressure and temperature; P-V-T equations of state and seismic velocity measurements for understanding the composition of Earth's outer 1,000 km; creating computational tools to explain complex stress-strain histories of rocks; and measuring tungsten/thorium ratios W/Th that agree with the hypothesis that Earth accreted heterogeneously. Work performed in this project applies to geosciences, geothermal energy, mineral and rock properties, seismic detection, and isotope dating.

DOE

Dynamical Systems; Research and Development; Planetary Cores; Electromagnetic Properties; Earth Mantle

19980206533 Los Alamos National Lab., NM USA

Lithospheric processes

Baldridge, W. S., Los Alamos National Lab., USA; Wohletz, K., Los Alamos National Lab., USA; Fehler, M. C., Los Alamos National Lab., USA; [1997]; 9p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3083; DE98-001207; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The main objective was to improve understanding of the origin and evolution of the Earth's lithosphere by studying selected processes, such as deformation and magmatic intrusion during crustal extension, formation and extraction of mantle melts, fluid transport of heat and mass, and surface processes that respond to deep-seated events. Additional objectives were to promote and develop innovative techniques and to support relevant educational endeavors. Seismic studies suggest that underplating of crust by mantle melts is an important crustal-growth mechanism, that low-angle faults can be seismogenic, and that shear deformation creates mantle anisotropy near plate boundaries. Results of geochemical work determined that magmas from oceanic intraplate islands are derived from a uniform depth in the upper mantle, whereas melts erupted at mid-ocean ridges are mixed from a range of depths. The authors have determined the extent and style of fluid infiltration and trace-element distribution in natural magmatic systems, and, finally, investigated Ne-21 as a tool for dating of surficial materials.
DOE
Lithosphere; Deformation; Earth Crust; Geochemistry

19980206592 Los Alamos National Lab., NM USA
Modeling of the Arctic boundary layer: Comparisons with measurements from the Arctic Ocean Expedition 1996
ReVelle, D. O., Los Alamos National Lab., USA; Nilsson, E. D., Stockholm Univ., Sweden; Kulmala, M., Helsinki Univ., Finland; [1997]; 3p; In English; 12th; Boundary Layers and Turbulence, 28 Jul. - 1 Aug. 1997, Vancouver, Canada
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1294; CONF-970760-3; DE97-007143; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
During the recent 3 month Arctic Ocean Expedition (AOE-96) to the North Pole during the summer of 1996 an enormous amount of data collected on the Arctic planetary boundary layer. In preparation for the expedition, the authors have developed an expanded and quite flexible 1-D computer code based on the successful work of ReVelle and of ReVelle and Coulter on modeling of boundary layer "bursting". This new code, BLMARC (Boundary Layer, Mixing, Aerosols, Radiation and Clouds), explicitly includes the physical and chemical effects due to the presence of clouds, aerosols and associated air chemistry. Using data from AOE-96 and the model BLMARC, the authors have begun a systematic effort to compare observations of the high Arctic boundary layer against numerical modeling results. The preliminary results for case963 and case964 are quite promising. The second period exhibits what appears to be bursting effects in the temperature, the winds and in the aerosol concentration and the modeling efforts have shown a similar set of features as well. Current work also includes model experiments with BLMARC on the aerosol nucleation and growth in the Arctic PBL and cloud and fog formation.
DOE
Arctic Regions; Climate Models; Climate Change; Boundary Layers; Arctic Ocean; Aerosols

19980206624 Pennsylvania State Univ., Dept. of Geosciences, University Park, PA USA
Improved Location, Green's Functions and Source Discrimination for Regional Events in Korea and Iran ***Final Report, 1 Mar. 1993 - 31 Oct. 1997***
Alexander, Shelton S., Pennsylvania State Univ., USA; Mar. 31, 1998; 95p; In English
Contract(s)/Grant(s): F49620-94-1-0179
Report No.(s): AD-A341568; AFRL-SR-BL-TR-98-0342; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This study has developed new methods for improved discrimination of seismic events and improved hypocenter determinations using regional observations. Their implementation in a form suitable for near-real time applications was also carried out. Most of this research has been reported in technical articles and in three student theses (1 PhD; 1 MS, and 1 BS) completed as part of the project.
DTIC
Seismic Waves; Neural Nets; Green"S FUNCTIONS

19980209698 Pacific Northwest National Lab., Richland, WA USA
Quadratic negative evidence discrimination
Anderson, D. N., Pacific Northwest National Lab., USA; Redgate, T., Pacific Northwest National Lab., USA; Anderson, K. K., Pacific Northwest National Lab., USA; Rohay, A. C., Pacific Northwest National Lab., USA; Ryan, F. M., Pacific Northwest National Lab., USA; May 1997; 30p; In English
Contract(s)/Grant(s): DE-AC06-76RL-01830
Report No.(s): PNNL-11579; DE97-053521; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper develops regional discrimination methods which use information inherent in phase magnitudes that are unmeasurable due to small amplitudes and/or high noise levels. The methods are enhancements to teleseismic techniques proposed by, and are extended to regional discrimination. Events observed at teleseismic distances are effectively identified with the M(sub s) vs m(sub b) discriminant because relative to the pressure wave energy (m(sub b)) of an event, an earthquake generates more shear wave energy (M(sub s)) than does an explosion. For some teleseismic events, the M(sub s) magnitude is difficult to measure and is known only to be below a threshold . With M(sub s) unmeasurable, the M(sub s) vs m(sub b) discriminant cannot be formed. However, if the M(sub s) is sufficiently small relative to a measured m(sub b), then the event is still likely to be an explosion. The methods presented in this report are developed for a single seismic station, and make use of empirical evidence in the regional L(sub g) vs p(sub g) discriminant. The L(sub g) vs p(sub g) discriminant is analogous to the teleseismic M(sub s) vs m(sub b) discriminant.
DOE
Earthquakes; Seismic Waves; Explosions; Signal Analysis

19980209739 Wyoming Univ., Dept. of Atmospheric Science, Laramie, WY USA
An Investigation of Aerosol Measurements from the Halogen Occultation Experiment: Validation, Size Distributions, Composition, and Relation to Other Chemical Species ***Final Report, Feb. 1994 - Jun. 1998***
Deshler, Terry, Wyoming Univ., USA; Hervig, Mark E., Wyoming Univ., USA; Jun. 30, 1998; 5p; In English
Contract(s)/Grant(s): NAG1-1623; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The efforts envisioned within the original proposal (accepted February 1994) and the extension of this proposal (accepted February 1997) included measurement validations, the retrieval of aerosol size distributions and distribution moments, aerosol correction studies, and investigations of polar stratospheric clouds. A majority of the results from this grant have been published. The principal results from this grant are discussed.
Derived from text
Aerosols; Chemical Analysis; Halogen Occultation Experiment; Size Distribution; Proving

19980209887 Communications Research Lab., Koganei, Japan
Crustal Deformation Monitoring In Tokyo Metropolitan Area By Space Geodetic Observation
Yoshino, Taizoh, Communications Research Lab., Japan; Journal of the Communications Research Laboratory; Nov. 1994; ISSN 0914-9260; Volume 41, No. 3, pp. 175-183; In English; Copyright; Avail: Issuing Activity (Communications Research Laboratory, Ministry of Posts and Telecommunications, Nukui-Kitamachi, 4-chome, Koganei, Tokyo, 184 Japan), Hardcopy, Microfiche
In the Key Stone Project (KSP), a crustal deformation monitoring system using VLBI and SLR technology, is being built at four sites in the Tokyo Metropolitan area to detect the precursors of big earthquakes larger than M7. These systems use K4 VLBI techniques and will use advanced SLR systems to obtain high precision. After the completion of this system, changes in baseline length will be monitored daily with a precision of a few mm. According to test VLBI experiments conducted between Koganei and Kashima since 1988, the baseline length has changed by -5 mm/yr.
Author
Very Long Base Interferometry; Laser Range Finders; Crustal Fractures; Earthquakes; Satellite Observation; Predictions

19980210061 NASA Ames Research Center, Moffett Field, CA USA
Thermal emission measurements 2000-400 cm(exp -1) (5-25 microns) of Hawaiian palagonitic soils and their implications for Mars
Roush, Ted L., NASA Ames Research Center, USA; Bell, James F., III, National Academy of Sciences - National Research Council, USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5309-5317; In English; Also announced as 19980210054
Contract(s)/Grant(s): RTOP 151-01-60-01
Report No.(s): Paper-94JE02448; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche
The thermal emission of two palagonitic soils, common visible and near infrared spectral analogs for bright soils on Mars, was measured over the wavelength range of 5 to 25 microns (2000 to 400 cm(exp -1) for several particle size separates. All spectra exhibit emissivity features due to vibrations associated with H2O and SiO. The maximum variability of emissivity is approx. = 20% in the short wavelength region (5 to 6.5 microns, 2000 to 1500 cm(exp -1)), and is more subdued,
Author

Thermal Emission; Emission Spectra; Infrared Spectra; Visible Spectrum; Mars Surface; Emissivity; SOIls; Analogs; Mars (Planet)

19980210062 NASA Johnson Space Center, Houston, TX USA

Hematite, pyroxene, and phyllosilicates on Mars: Implications from oxidized impact melt rocks from Manicouagan Crater, Quebec, Canada

Morris, Richard V., NASA Johnson Space Center, USA; Golden, D. C., Dual, Inc., USA; Bell, James F., III, National Academy of Sciences - National Research Council, USA; Lauer, H. V., Jr., Lockheed Engineering and Sciences Co., USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5319-5328; In English; Also announced as 19980210054

Report No.(s): Paper-95JE01500; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

Visible and near-IR reflectivity, Mossbauer, and X ray diffraction data were obtained on powders of impact melt rock from the Manicouagan Impact Crater located in Quebec, Canada. The iron mineralogy is dominated by pyroxene for the least oxidized samples and by hematite for the most oxidized samples. Phyllosilicate (smectite) contents up to 15 wt % were found in some heavily oxidized samples. Nanophase hematite and/or paramagnetic ferric iron is observed in all samples. No hydrous ferric oxides (e.g., goethite, lepidocrocite, and ferrihydrite) were detected, which implies the alteration occurred above 250 C. Oxidative alteration is thought to have occurred predominantly during late-stage crystallization and subsolidus cooling of the impact melt by invasion of oxidizing vapors and/or solutions while the impact melt rocks were still hot. The near-IR band minimum correlated with the extent of aleration (Fe(3+)/Fe(sub tot)) and ranged from approx. 1000 nm (high-Ca pyroxene) to approx. 850 nm (bulk, well-crystalline hematite) for least and most oxidized samples, respectively. Intermediate band positions (900-920 nm) are attributed to low-Ca pyroxene and/or a composite band from hematite-pyroxene assemblages. Manicouagan data are consistent with previous assignments of hematite and pyroxene to the 850 and 1000 nm bands observed in Martian reflectivity spectra. Manicouagan data also show that possible assignments for intermediate band positions (900-920 nm) in Martian spectra are pyroxene and/or hematite-pyroxene assemblages. by analogy with impact melt sheets and in agreement with observables for Mars, oxidative alteration of Martian impact melt sheets above 250 C and subsequent erosion could produce rocks and soils with variable proportions of hematite (both bulk and nanophase), pyroxene, and phyllosilicates as iron-bearing mineralogies. If this process is dominant, these phases on Mars were formed rapidly at relatively high temperatures on a sporadic basis throughout the history of the planet. The Manicouagan samples also show that this mineralogical diversity can be accomplished at constant chemical composition, which is also indicated for Mars from analyses of soil at the two Viking landing sites.

Author

Mars (Planet); Mars Surface Samples; Hematite; Pyroxenes; Silicates; Impact Melts; Mineralogy; Chemical Composition

19980210338 Alaska Univ., Physics Dept., Fairbanks, AK USA

Influence of IMF B(sub y) on Large-Scale Decreases of O Column Density at Middle Latitudes

Immel, T. J., Alaska Univ., USA; Craven, J. D., Alaska Univ., USA; Frank, L. A., Iowa Univ., USA; Journal of Atmospheric and Solar Terrestrial Physics; 1997; ISSN 1364-6826; Volume 59, No. 6, pp. 725-737; In English; Original contains color illustrations

Contract(s)/Grant(s): NAGw-3441; NAG5-1915; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The interplanetary Magnetic Field (IMF)(sub y) component, B(sub y), has a strong influence on ion convection and, hence, neutral circulation patterns at polar latitudes. This is observed in the Northern Hemisphere as an enhancement in ion and neutral velocities in the dusk (dawn) cell during periods of B(sub y) positive (negative), as well as an increase in the size of that cell relative to its dawn (dusk) counterpart. The effect of B(sub y) on neutral winds and thermospheric composition equatorward of the polar cap and auroral oval is less well established in observations, although it has been investigated through sophisticated numerical modeling. A consequence of the compositional variations is that the spectrum of the dayglow emissions in the sunlit hemisphere is altered. We describe observations of the influence of B(sub y) on the brightness of the 130.4- and 135.6-nm emissions of OI in the far-ultraviolet (FUV) dayglow, that have been obtained with the Dynamics Explorer-1 (DE-1) FUV imaging photometer following auroral substorms. A fortuitous pair of DE-1 observations at approx. 1700 UT on days 267 and 279, 1981, suggests that the sign of B(sub y) influences the brightness and spatial extent of the OI emissions and, hence, the oxygen column density in the morning sector at subauroral latitudes. A series of images taken during four consecutive DE-1 orbits more clearly demonstrates the dependence of the OI dayglow brightness on the sign of B(sub y). Hence, IMF orientation must be taken into consideration when interpreting FUV images of the dayglow and studying the underlying variations in thermospheric composition.

Author

Interplanetary Magnetic Fields; Scale (Ratio); Scale Effect; Latitude Measurement; Gas Density; Neutral Atmospheres; Dayglow; Brightness; Auroral Zones

19980210410 Los Alamos National Lab., NM USA

Analysis and visualization of global magnetospheric processes

Winske, D., Los Alamos National Lab., USA; Mozer, F. S., California Univ., USA; Roth, I., California Univ., USA; [1998]; 10p; In English

Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3604; DE98-001502; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The purpose of this project is to develop new computational and visualization tools to analyze particle dynamics in the Earth's magnetosphere. These tools allow the construction of a global picture of particle fluxes, which requires only a small number of in situ spacecraft measurements as input parameters. The methods developed in this project have led to a better understanding of particle dynamics in the Earth's magnetotail in the presence of turbulent wave fields. They have also been used to demonstrate how large electromagnetic pulses in the solar wind can interact with the magnetosphere to increase the population of energetic particles and even form new radiation belts.
DOE
Earth Magnetosphere; Solar Wind; Energetic Particles; Geomagnetic Tail

19980210422 Argonne National Lab., IL USA
A study of the effects of an additional sound source on RASS performance
Coulter, R. L., Argonne National Lab., USA; [1998]; 5p; In English; 10th; Meteorological Observations and Instrumentation, 11-16 Jan. 1998, Phoenix, AZ, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/ER/CP-93889; CONF-980124; DE98-050020; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site of the Atmospheric Radiation Measurements (ARM) Program continuously operates a nine panel 915 MHz wind profiler with Radio Acoustic Sounding System (RASS), measuring wind profiles for 50 minutes and virtual temperature profiles for the remaining 10 minutes during each hour. It is well recognized that one of the principal limits on RASS performance is high horizontal wind speed that moves the acoustic wave front sufficiently to prevent the microwave energy produced by the radar and scattered from the acoustic wave from being reflected back t the radar antenna. With this limitation in mind, the ARM program purchased an additional, portable acoustic source that could be mounted on a small trailer and placed in strategic locations to enhance the RASS performance (when it was not being used for spare parts). A test of the resulting improvement in RASS performance was performed during the period 1995-1997.
DOE
Sound Generators; Temperature Profiles; Wind Profiles; Acoustic Sounding; Atmospheric Radiation

19980210624 NASA Marshall Space Flight Center, Huntsville, AL USA
Tropospheric Wind Measurements from Space: The SPARCLE Mission and Beyond
Kavaya, Michael J., NASA Marshall Space Flight Center, USA; Emmitt, G. David, Simpson Weather Associates, Inc., USA; 1998; 4p; In English; 19th; Laser Radar, 6-10 Jul. 1998, Annapolis, MD, USA
Report No.(s): NASA/TM-1998-208265; NAS 1.15:208265; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

For over 20 years researchers have been investigating the feasibility of profiling tropospheric vector wind velocity from space with a pulsed Doppler lidar. Efforts have included theoretical development, system and mission studies, technology development, and ground-based and airborne measurements. Now NASA plans to take the next logical step towards enabling operational global tropospheric wind profiles by demonstrating horizontal wind measurements from the Space Shuttle in early 2001 using a coherent Doppler wind lidar system.
Author
Meteorological Parameters; Wind Measurement; Numerical Analysis; Technology Assessment; Airborne Equipment; Troposphere

19980210626 Alaska Univ., Fairbanks, AK USA
MAMI: Modeling of the Magnetosphere-Ionosphere-Atmosphere System ***Final Report, 1 May 1989 - 31 Mar. 1998***
1998; 4p; In English
Contract(s)/Grant(s): NAGw-51097
Report No.(s): NASA/CR-1998-208287; NAS 1.26:208287; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Major emphasis of the investigation was the development of theoretical and numerical models of the aurora and of high latitude ionospheric processes. In particular: (1) the NCAR TIGCM (Thermosphere-Ionosphere Global Circulation Model) was updated to include mid and low latitude electrodynamics (this version is called TIE-GCM); (2) the NCAR TIE-GCM was modified to include a more realistic representation of the aurora; (3) the UAF auroral electron transport model was modified to include local

acceleration processes; (4) a local ionospheric and auroral model (AURORA) was developed to allow detailed studies of the aurora; (5) a proton-hydrogen transport code has been developed to model proton aurora; and (6) a theory for the production of suprathermal atoms and ions in the upper atmosphere was developed and applied to studies of atomic nitrogen transport and helium escape on open field lines. These models enable us to devise schemes for tile interpretation and quantitative analysis of data obtained by the POLAR spacecraft. Parameterizations were formulated and are available to the GGS investigators. The UVI and VIS teams have adopted these parameterizations and include them in their data analysis. We have developed software for the quantitative interpretation of UVI and VIS images. After the launch of the POLAR satellite we used the image data from UVI and VIS in combination with ground based data from SuperDARN and incoherent scatter radars, magnetometers, and in situ observations from DMSP and NOAA satellites to characterize the state of the ionosphere. A number of event studies have been carried out in cooperation with other CGS theory teams.
Derived from text
Numerical Analysis; Mathematical Models; Auroras; Latitude; Ionospheric Composition; Atmospheric Models; Planetary Magnetospheres

19980210628 Boston Univ., Boston, MA USA
Magnetospheric Substorms and Tail Dynamics ***Final Report, 1 Mar. 1989 - 30 Sep. 1997***
Hughes, W. Jeffrey, Boston Univ., USA; May 1998; 5p; In English
Contract(s)/Grant(s): NAGw-6127
Report No.(s): NASA/CR-1998-208223; NAS 1.26:208223; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This grant funded several studies of magnetospheric substorms and their effect on the dynamics of the earth's geomagnetic tail. We completed an extensive study of plasmoids, plasma/magnetic field structures that travel rapidly down the tail, using data from the ISEE 3 and IMP 8 spacecraft. This study formed the PhD thesis of Mark Moldwin. We found that magnetically plasmoids are better described as flux-ropes (twisted magnetic flux tubes) rather than plasma bubbles, as had been generally regarded up to that point (Moldwin and Hughes, 1990; 1991). We published several examples of plasmoids observed first in the near tail by IMP 8 and later in the distant tail by ISEE 3, confirming their velocities down tail. We showed how the passage of plasmoids distorts the plasma sheet. We completed the first extensive statistical survey of plasmoids that showed how plasmoids evolve as they move down tail from their formation around 30 RE to ISEE 3 apogee at 240 RE. We established a one-to-one correspondence between the observation of plasmoids in the distant tail and substorm onsets at earth or in the near tail. and we showed that there is a class of plasmoid-like structures that move slowly earthward, especially following weak substorms during northward IMF. Collectively this work constituted the most extensive study of plasmoids prior to the work that has now been done with the GEOTAIL spacecraft. Following our work on plasmoids, we turned our attention to signatures of substorm onset observed in the inner magnetosphere near geosynchronous orbit, especially signatures observed by the CRRES satellite. Using data from the magnetometer, electric field probe, plasma wave instrument, and low energy plasma instrument on CRRES we were able to better document substorm onsets in the inner magnetosphere than had been possible previously. Detailed calculation of the Poynting flux showed energy exchange between the magnetosphere and ionosphere, and a short burst of tailward convective flow just prior to onset, suggesting the active role of the ionosphere in the onset process, and adding credibility to the ballooning instability theory of substorm onset. This grant also supported a number of other substorm studies and reviews. These are represented by the list of publications and meeting presentations resulting out of this grant.
Derived from text
Magnetospheric Instability; Plasmas (Physics); Magnetic Field Configurations; Electric Fields; Geomagnetic Tail

19980210667 Defence Evaluation Research Agency, Radio Science Propagation Group, Malvern, UK
Non-Linear Prediction of Ionospheric Parameters Important for Forecasting the Battlespace Environment
Francis, N. M., Defence Evaluation Research Agency, UK; Brown, A. G., Defence Evaluation Research Agency, UK; Akram, A., Defence Evaluation Research Agency, UK; Cannon, P. S., Defence Evaluation Research Agency, UK; Broomhead, D. S., Manchester Coll. of Science and Technology, UK; Apr. 1998; 7p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Modelling results from a programme to improve the accuracy of the prediction of ionospheric parameters are presented. Ionosphenc conditions impact upon communications, navigation/GPS, satellite operations and surveillance radar operations. As a result, ionosphenc predictions have an important bearing upon the specification of the battlespace environment. The paper presents a novel and robust technique that can cope with the problems of noise and non-contiguity that are endemic to solar-terrestrial data sets. The method of using non-linear radial basis function (RBF) neural networks (NNs) to model the noon-day variation of the critical frequency of the F2 layer of the ionosphere, foF2, is investigated. A technique based upon singular value decomposition is also adopted for the purposes of noise reduction. The performance of the model is compared with the results obtained from the

reference persistence model predictions. Consecutive noon-day foF2 values from 1957 to 1990 from the Slough ionosonde station (UK) are used to train and test the model. Predictions are made for timescales of one to thirty days ahead, using both the RBF and persistence models. Relative performance is quantified using root mean square error (RMSE) between the RBF and persistence prediction time series compared with the actual time series, over the testing interval. It is found that RBF NNs offer a significant improvement, approximately 60%, over the performance of the reference persistence model.
Author
Surveillance Radar; Military Technology; Military Spacecraft; Global Positioning System

19980210705 Lawrence Livermore National Lab., Livermore, CA USA
Preliminary regional magnitude in the Middle East Region using narrowband Lg coda envelopes
Mayeda, K., Lawrence Livermore National Lab., USA; Walter, W. R., Lawrence Livermore National Lab., USA; Jul. 01, 1997; 8p; In English; Research Symposium on Monitoring a Comprehensive Test Ban Treaty, 23-25 Sep. 1997, Orlando, FL, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-127893; CONF-970967; DE98-052270; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Because many regional seismic discriminants are functions of magnitude, it is important to obtain a stable measurement especially for smaller events that will likely have very limited station coverage. We have collected and analyzed regional broad band waveforms from stations in the middle east region for the purpose of calibrating a stable regional magnitude scale that can be applied to events that are too small to detect teleseismically. Our approach is to obtain frequency-dependent empirical Greens function coda envelopes for narrow frequency bands that can be used to correct for gross path effects. We make the assumption that the moment-rate spectra are generally flat below approximately 2 Hz for these events smaller than Mw approximately 3.5. In a least squares sense, we obtain frequency-dependent corrections to the Lg coda measurements to fit the scalar moment estimates. These frequency-dependent corrections remove the effects of the S-to-Lg coda transfer function, thus correcting back to the S-wave source spectra. Due to the averaging nature of Lg coda waves we are then able to obtain a stable single-station estimate of the source spectra.To avoid regional biases we tie our coda envelope amplitude measurements to seismic moments obtained from long period 1-D waveform modeling for moderate sized earthquakes (A4w-3.5.- 4.5). Most importantly, we can now apply the same corrections to significantly smaller events that cannot be observed teleseismically. Our empirical approach takes into account scattering,absorption, and waveguide losses as well as frequency-dependent site effects.Moreover, the use of the coda envelope mitigates the undesirable effects of source anisotropy, random site interference, path variability, and directivity that plague direct wave measurements. This approach was successfully applied to other regions where it was observed that the coda-derived Mw estimates showed significantly smaller dependence on lateral path variation and source radiation anisotropy than the more conventional approaches such as mb(Pg),mb(Lg),and teleseismic mb.
DOE
Narrowband; Seismic Waves

19980210713 Geological Survey, Denver, CO USA
A hydrogeologic map of the Death Valley region, Nevada, and California, developed using GIS techniques
Faunt, C. C., Geological Survey, USA; DAgnese, F. A., Geological Survey, USA; Turner, A. K., Geological Survey, USA; 1997; 22p; In English
Contract(s)/Grant(s): DE-AI08-92NV-10874
Report No.(s): USGS/WRIR-95-4016; DE98-004708; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In support of Yucca Mountain site characterization studies, a hydrogeologic framework was developed, and a hydrogeologic map was constructed for the Death Valley region. The region, covering approximately 100,000 sq km along the Nevada-California border near Las Vegas, is characterized by isolated mountain ranges juxtaposed against broad, alluvium-filled valleys. Geologic conditions are typical of the Basin and Range Province; a variety of sedimentary and igneous intrusive and extrusive rocks have been subjected to both compressional and extensional deformation. The regional ground-water flow system can best be described as a series of connected intermontane basins in which ground-water flow occurs in basin-fill deposits, carbonate rocks, clastic rocks, and volcanic rocks. Previous investigations have developed more site-specific hydrogeologic relationships; however, few have described all the lithologies within the Death Valley regional ground-water flow system. Information required to characterize the hydrogeologic units in the region was obtained from regional geologic maps and reports. Map data were digitized from regional geologic maps and combined into a composite map using a geographic information system. This map was simplified to

show 10 laterally extensive hydrogeologic units with distinct hydrologic properties. The hydraulic conductivity values for the hydrogeologic units range over 15 orders of magnitude due to the variability in burial depth and degree of fracturing.
DOE
Death Valley (CA); Hydrogeology; Aquifers; Maps; Deposits; Ground Water

19980210715 Geological Survey, Denver, CO USA
Effect of faulting on ground-water movement in the Death Valley region, Nevada and California
Faunt, C. C., Geological Survey, USA; 1997; 47p; In English
Contract(s)/Grant(s): DE-AI08-92NV-10874
Report No.(s): USGS/WRIR-95-4132; DE98-004730; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This study characterizes the hydrogeologic system of the Death Valley region, an area covering approximately 100,000 square kilometers. The study also characterizes the effects of faults on ground-water movement in the Death Valley region by synthesizing crustal stress, fracture mechanics,a nd structural geologic data. The geologic conditions are typical of the Basin and Range Province; a variety of sedimentary and igneous intrusive and extrusive rocks have been subjected to both compressional and extensional deformation. Faulting and associated fracturing is pervasive and greatly affects ground-water flow patterns. Faults may become preferred conduits or barriers to flow depending on whether they are in relative tension, compression, or shear and other factors such as the degree of dislocations of geologic units caused by faulting, the rock types involved, the fault zone materials, and the depth below the surface. The current crustal stress field was combined with fault orientations to predict potential effects of faults on the regional ground-water flow regime. Numerous examples of fault-controlled ground-water flow exist within the study area. Hydrologic data provided an independent method for checking some of the assumptions concerning preferential flow paths. 97 refs., 20 figs., 5 tabs.
DOE
Death Valley (CA); Ground Water; Water Flow; Hydrogeology; Maps; Geological Faults; Crusts

47
METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19980209652 Wind Research Services, Poolesville, MD USA
Hurricane FRAN in North Carolina, September 5-6, 1996
Marshall, R. D., Wind Research Services, USA; Jan. 1998; 62p; In English
Report No.(s): PB98-142193; NIST-GCR-98-734; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes the surface wind speeds and structural damage caused by Hurricane Fran during its passage across North Carolina and Virginia on 5-6 September, 1996. Fran was a category 3 hurricane on the Saffir-simpson scale, and estimated maximum sustained wind speed were approximately 36 m/s at Kure Beach, NC, directly north of Cape Fear, the point of landfall.
NTIS
Hurricanes; Structural Engineering; Dynamic Structural Analysis; Damage Assessment; Ground Wind

19980209721 Army Topographic Engineering Center, Alexandria, VA USA
Weather and Climate Extremes, *Oct. 1995 - Dec. 1996*
Krause, Paul F., Army Topographic Engineering Center, USA; Flood, Kathleen L., Army Topographic Engineering Center, USA; Sep. 1997; 98p; In English
Report No.(s): AD-A346058; TEC-0099; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This report consists of world weather and climate extremes that have been extracted from various sources. The report contains discussions covering the measurement of various meteorological elements, measurement practices, and instrumentation. All extremes are presented in terms of their location and date and, where supportive information is available in the professional literature, detailed discussions of the extreme event are provided. The elements covered in this report include surface air temperature, precipitation (rainfall, snowfall and hail), wind, thunderstorms, air pressure, solar radiation, dew point temperature and fog. The report contains five maps. There is one each for the worldwide extremes of temperature, precipitation, and other elements. The

remaining two maps show U.S. state extremes for monthly temperature (absolute maximum and absolute minimum) and precipitation (maximum monthly and maximum 24-hour).
DTIC
Meteorological Parameters; Weather; Meteorology

19980209842 National Weather Service, Climate Prediction Center, Camp Springs, MD USA
Precipitation Climatology for Stations in the Tropical Pacific Basin: Effects of ENSO
He, Y., National Weather Service, USA; Barnston, A. G., National Weather Service, USA; Hilton, A. C., National Weather Service, USA; Feb. 1998; 290p; In English
Report No.(s): PB98-146178; NCEP/ATLAS-5; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

A precipitation climatology for 66 tropical Pacific basin stations over the period of 1955-96 has been developed. The main purpose of the climatology is to establish a background for defining thresholds of rainfall deficiency amount and duration associated with drought episodes on an individual island-to-island basis.
NTIS
Climatology; Tropical Regions; Pacific Ocean; El Nino; Precipitation (Meteorology); Climate; Southern Oscillation

19980210007 ENSCO, Inc., Applied Meteorology Unit, Cocoa Beach, FL USA
An Extended Objective Evaluation of the 29-km Eta Model for Weather Support to the USA Space Program
Nutter, Paul, ENSCO, Inc., USA; Manobianco, John, ENSCO, Inc., USA; Jul. 1997; 76p; In English
Contract(s)/Grant(s): NAS10-96018
Report No.(s): NASA/CR-1998-207910; NAS 1.26:207910; Rept-98-003; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report describes the Applied Meteorology Unit's objective verification of the National Centers for Environmental Prediction 29-km eta model during separate warm and cool season periods from May 1996 through January 1998. The verification of surface and upper-air point forecasts was performed at three selected stations important for 45th Weather Squadron, Spaceflight Meteorology Group, and National Weather Service, Melbourne operational weather concerns. The statistical evaluation identified model biases that may result from inadequate parameterization of physical processes. Since model biases are relatively small compared to the random error component, most of the total model error results from day-to-day variability in the forecasts and/or observations. To some extent, these nonsystematic errors reflect the variability in point observations that sample spatial and temporal scales of atmospheric phenomena that cannot be resolved by the model. On average, Meso-Eta point forecasts provide useful guidance for predicting the evolution of the larger scale environment. A more substantial challenge facing model users in real time is the discrimination of nonsystematic errors that tend to inflate the total forecast error. It is important that model users maintain awareness of ongoing model changes. Such changes are likely to modify the basic error characteristics, particularly near the surface.
Author
Mathematical Models; Meteorological Services; Evaluation; Statistical Analysis; Real Time Operation

19980210183 Oak Ridge National Lab., TN USA
Analysis of monthly mean cloud amount for China: 1951-1994
Kaiser, D. P., Oak Ridge National Lab., USA; [1998]; 4p; In English; 9th; Global Change Studies, 14-16 Jan. 1998, Phoenix, AZ, USA; Sponsored by American Meteorological Society, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-94973; CONF-980121; DE98-000899; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The distribution of clouds over the globe greatly influences the regimes of other important climatic variables, such as temperature and precipitation. While satellite records of cloudiness are extremely valuable in the study of the earth's climate (spanning now 2--3 decades), the longer records of surface-observed cloudiness for much of the earth's surface are preferred for integration with long-term records of other surface variables in attempting to understand these variables' relationships and trends. As databases of surface-based cloud observations have become available for research use over recent decades, there have been many studies concerned with examining trends in regional cloud cover. Kaiser and Vose (1997) performed a gridded analysis of variations and trends in cloud amount using 187 Chinese weather stations for the period 1954--1990. The main findings were significant decreases in annual mean cloud amount over much of northern China, coupled with corresponding increases in the frequency of occurrence of clear skies. The decreased trends in annual mean cloud amount over northern China were found to be driven by

decreasing cloud amount over most months of the year. The current study uses an expanded period of record of China cloud observations (1951--1994) to re-examine trends in cloud amount at individuals stations and over eight regions of China.
DOE
Atmospheric Temperature; Climatology; Clouds (Meteorology); Precipitation (Meteorology); Visual Observation; Weather Stations

19980210208 NASA Goddard Space Flight Center, Greenbelt, MD USA
Linkages Between Global Vegetation and Climate: An Analysis Based on NOAA Advanced Very High Resolution Radiometer Data
Los, Sietse Oene, Science Systems and Applications, Inc., USA; Apr. 1998; 204p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS5-31752
Report No.(s): NASA/CR-1998-206852; Rept-98B00021; NAS 1.26:206852; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

A monthly global 1 degree by 1 degree data set from 1982 until 1990 was derived from data collected by the Advanced Very High Resolution Radiometer on board the NOAA 7, 9, and 11 satellites. This data set was used to study the interactions between variations in climate and variations in the ”greenness” of vegetation. Studies with the Colorado State University atmospheric general circulation model coupled to the Simple Biosphere model showed a large sensitivity of the hydrological balance to changes in vegetation at low latitudes. The depletion of soil moisture as a result of increased vegetation density provided a negative feedback in an otherwise positive association between increased vegetation, increased evaporation, and increased precipitation proposed by Charney and coworkers. Analysis of climate data showed, at temperate to high latitudes, a positive association between variation in land surface temperature, sea surface temperature and vegetation greenness. At low latitudes the data indicated a positive association between variations in sea surface temperature, rainfall and vegetation greenness. The variations in mid- to high latitude temperatures affected the global average greenness and this could provide an explanation for the increased carbon uptake by the terrestrial surface over the past couple of decades.
Author
Atmospheric General Circulation Models; Biosphere; Vegetation; Climate Change; Atmospheric Models; Data Correlation; Data Processing; Image Analysis; Surface Properties; Satellite Imagery

19980210254 Los Alamos National Lab., NM USA
Application of tethered balloon and kite measurements using chilled mirror hygrometers during the ARM WVIOP in the fall of 1996 in Oklahoma
Porch, W., Los Alamos National Lab., USA; Balsley, B., Colorado Univ., USA; Jensen, M., Colorado Univ., USA; Cole, H., National Center for Atmospheric Research, USA; Lesht, B., Argonne National Lab., USA; Liljegren, J., Pacific Northwest National Lab., USA; Richardson, S., Oklahoma Univ., USA; Revercomb, H., Wisconsin Univ., USA; [1997]; 6p; In English; 10th; Meteorological Observations and Instrumentation, 11 - 16 Jan. 1998, Phoenix, AZ, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3556; CONF-980124; DE98-001478; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Water vapor is the most important greenhouse gas, and its measurement is currently so imprecise that long term trends are difficult to document. This problem was the focus of a Water Vapor Intensive Operations Period (WVIOP) at the Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) site near Billings, OK in September 1996. The part of this comparison involved tethered-balloon and kite profiling of meteorological parameters and dew-point measurements using a light-weight chilled-mirror system. The tethered balloon system was used when the winds were less than about 12 m/s. The kite system was used when winds were in the 12--15 m/s range. In this abstract, the authors will focus on comparisons on boundary-layer profiles using the tethered systems and conventional rawinsonde measurements at ARM SGP. The tethered systems were limited to profiles up to 1 km above ground level. of particular interest, is the representativity of the rapid-ascent measurements associated with rawinsonde launches and the longer-term profiling associated with the tethered system in the boundary layer. Comparisons show that profiles differed significantly in both temperature (1 to 2 C) and water vapor (5 to 10%). Both calibration and representativity contribute to these differences.
DOE
Water Vapor; Meteorology; Measuring Instruments; Data Acquisition; Radiation Measurement; Meteorological Parameters; Great Plains Corridor (North America); Balloon Sounding

19980210269 Sandia National Labs., Albuquerque, NM USA

Data and image fusion for geometrical cloud characterization

Thorne, L. R., Sandia National Labs., USA; Buch, K. A., Sandia National Labs., USA; Sun, Chen-Hui, Sandia National Labs., USA; Diegert, C., Sandia National Labs., USA; Apr. 1997; 58p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-8252; DE97-053780; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Clouds have a strong influence on the Earth's climate and therefore on climate change. An important step in improving the accuracy of models that predict global climate change, general circulation models, is improving the parameterization of clouds and cloud-radiation interactions. Improvements in the next generation models will likely include the effect of cloud geometry on the cloud-radiation parameterizations. We have developed and report here methods for characterizing the geometrical features and three-dimensional properties of clouds that could be of significant value in developing these new parameterizations. We developed and report here a means of generating and imaging synthetic clouds which we used to test our characterization algorithms; a method for using Taylor's hypotheses to infer spatial averages from temporal averages of cloud properties; a computer method for automatically classifying cloud types in an image; and a method for producing numerical three-dimensional renderings of cloud fields based on the fusion of ground-based and satellite images together with meteorological data.

DOE

Atmospheric General Circulation Models; Satellite Imagery; Climatology; Meteorological Parameters; Algorithms; Climate Change

19980210396 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Relationship Between NDVI Derived from NOAA-AVHRR and Precipitation in the Amazonia Region ***Relacao Entre Indice de Vegetacao Derivado do NOAA-AVHRR e Precipitacao na Regiao Amazonica***

deAlmeida, Eugenio Sper, Instituto Nacional de Pesquisas Espacias, Brazil; Aug. 1997; 108p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-6390-TDI/606; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

This study analyzed the relationship between precipitation and NDVI (Normalized Difference Vegetation Index) derived from NOAA- AVHRR (National Oceanic and Atmospheric Administration's - Advanced Very High Resolution Radiometer) in the Amazon Region. First, the literature about the AVHRR sensor, the NDVI, the NDVI image generated by the GIMMS ('Global Inventory Monitoring and Modeling Studies') group of NASA/GSFC (National Aeronautics and Space Administration - Goddard Space Flight Center), factors that alter the NDVI value (cloud contamination, atmospheric effects, view angle and illumination and sensor degradation) and the literature that analyses vegetation index applications and especially the relationship between vegetation index and precipitation was reviewed. Two methodologies to analyze the relationship (linear and logarithmic) between NDVI and precipitation, in the period from January 1982 to December 1990 were tested. The first methodology was based on a punctual analysis over the meteorological stations, using precipitation information from DNAEE and the mean monthly NDVI over 3 x 3 pixels. From the total of 486 DNAEE's terrestrial stations with precipitation information, only 137 had both more than 70% of precipitation data and more than 50% of original vegetation cover. After a sensor degradation correction, a table containing the stations names, coordinates, original vegetation cover, percentage of useful precipitation data, forest cover percentage and correlation coefficients (for time lag of 1, 2, sum of two months between the occurrence of precipitation and the vegetation NDVI value) was built. A second approach investigated the relationship between the NDVI images generated by the NASA/GSFC GIMMS group and the precipitation image by the University of Washington based on ground stations data from DNAEE. Both approaches revealed low correlation coefficients ($r < 0.1$)betweenNDVIandprecipiation for forested areas, for time lag of one, two and the sum of two past months between the occurrence of precipitation and the observed NDVI monthly maximum. Only in those stations located over "cerrado' areas, relatively high correlation coefficients ($r > 0.6$) were verified in the multitemporal analysis based on images of NDVI and precipitation. The results obtained using the punctual approach showed that both linear and logarithmic presented approximately the same results (low correlation coefficients). The correlation coefficients varied as a function of the time lag between the precipitation and NDVI; best results were found for the 2 months of the occurrence of precipitation prior the NDVI observation.

Author

Precipitation (Meteorology); NASA Programs; Atmospheric Effects; Contamination; Correlation Coefficients; Inventories; Management; Vegetation; Weather Stations

19980210481 Desert Research Inst., Reno, NV USA

Microphysics and Radiative Properties of Cirrus: Instrumentation and Analysis ***Final Report, 4 May 1995 - 3 May 1998***

Arnott, W. P., Desert Research Inst., USA; Hallett, John, Desert Research Inst., USA; 1998; 8p; In English

Contract(s)/Grant(s): NAG1-1707; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This section summarizes the scientific questions which originated with participation in FIRE II in Coffeyville KA, evolved through participation in several field projects related to FIRE and culminated in participation in FIRE III in the Arctic in March / May 1998. It is noted that many of the ideas generated in FIRE II 1992 - 1995 and published under the grant involving the role of CCN in cirrus formation have been followed through in this grant and have also been central in the ideas for work under the SUCCESS project and the laboratory work currently supported by NSF.

Derived from text

Success Project; Fires; Cirrus Clouds

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OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

19980206702 Naval Postgraduate School, Monterey, CA USA

Monitoring Temperature Variability Along the California Coast Using Acoustic Tomography

Morvillez, Thierry, Naval Postgraduate School, USA; Sep. 1997; 50p; In English

Report No.(s): AD-A341180; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The electronic emissions of a low frequency sound source placed by the Acoustic Thermometry of Ocean Climate (ATOC) project on Pioneer Seamount were monitored by a bottom lying receiver on Sur Ridge from April 1996 to February 1997. The processed signals show a stable arrival pattern that was repeated in all the transmissions during the 11 months. Using the processed data, a tomographic analysis to study the coastal ocean variability along this California transmission path was conducted. Systematically, the analysis involved forward acoustic modeling of the arrival structure using ray theory, associating the observed arrivals with the modeled arrivals, extracting the travel times of the arrivals, inverting the travel times for temporal and spatial temperature changes, and interpreting the observed temperature variations. In particular, the tomographic estimate was compared to the temperature and wind measurements from an in situ mooring deployed by the Monterey Bay Aquarium Research Institution (MBARI). The comparison show that the tomographic estimate is of high quality and that the observed temperature variations were linked to coastal upwelling and downwelling events. The data, methods and result, demonstrating fully the feasibility of using tomography to study coastal temperature variability in central California on a long term basis, are presented.

DTIC

Atmospheric Temperature; Tomography; Coasts; Temperature Measurement; Acoustic Velocity; Ocean Temperature; Acoustic Measurement

19980209704 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Modeling the Gulf Stream System: How Far from Reality?

Choa, Yi, Jet Propulsion Lab., California Inst. of Tech., USA; Gangopadhyay, Avijit, Jet Propulsion Lab., California Inst. of Tech., USA; Bryan, Frank O., National Center for Atmospheric Research, USA; Holland, William R., National Center for Atmospheric Research, USA; Geophysical Research Letters; 1996; ISSN 0094-8534; Volume 23, No. 22, pp. 3155-3158; In English; Original contains color illustrations

Report No.(s): NASA/TM-96-207741; NAS 1.15:207741; Paper-96GL03003; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Analyses of a primitive equation ocean model simulation of the Atlantic Ocean circulation at 1/6 deg horizontal resolution are presented with a focus on the Gulf Stream region. Among many successful features of this simulation, this letter describes the Gulf Stream separation from the coast of North America near Cape Hatteras, meandering of the Gulf Stream between Cape Hatteras and the Grand Banks, and the vertical structure of temperature and velocity associated with the Gulf Stream. These results demonstrate significant improvement in modeling the Gulf Stream system using basin- to global scale ocean general circulation models. Possible reasons responsible for the realistic Gulf Stream simulation are discussed, contrasting the major differences between the present model configuration and those of previous eddy resolving studies.

Author

Mathematical Models; Ocean Models; Primitive Equations; Scale Models; Gulf Stream

19980210621 Scripps Institution of Oceanography, San Diego, CA USA

Inversion Schemes to Retrieve Atmospheric and Oceanic Parameters from SeaWiFS Data ***Final Report, 1 Oct. 1996 - 30 Sep. 1997***

Frouin, Robert, Scripps Institution of Oceanography, USA; Deschamps, Pierre-Yves, Universite des Sciences et Techniques de Lille Flandres Artois, France; 1997; 94p; In English

Contract(s)/Grant(s): NAGw-5224

Report No.(s): NASA/CR-1997-208029; NAS 1.26:208029; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Firstly, we have analyzed atmospheric transmittance and sky radiance data connected at the Scripps Institution of Oceanography pier, La Jolla during the winters of 1993 and 1994. Aerosol optical thickness at 870 nm was generally low in La Jolla, with most values below 0.1 after correction for stratospheric aerosols. For such low optical thickness, variability in aerosol scattering properties cannot be determined, and a mean background model, specified regionally under stable stratospheric component, may be sufficient for ocean color remote sensing, from space. For optical thicknesses above 0. 1, two modes of variability characterized by Angstrom exponents of 1.2 and 0.5 and corresponding, to Tropospheric and Maritime models, respectively, were identified in the measurements. The aerosol models selected for ocean color remote sensing, allowed one to fit, within measurement inaccuracies, the derived values of Angstrom exponent and 'pseudo' phase function (the product of single scattering albedo and phase function), key atmospheric correction parameters. Importantly, the 'pseudo' phase function can be derived from measurements of the Angstrom exponent. Shipborne sun photometer measurements at the time of satellite overpass are usually sufficient to verify atmospheric correction for ocean color.

Author

Ocean Data Acquisitions Systems; Ocean Color Scanner; Aerosols; Atmospheric Correction; Atmospheric Models; Oceanography; Photometers; Scattering Functions; Troposphere

51
LIFE SCIENCES (GENERAL)

19980206467 NASA Marshall Space Flight Center, Huntsville, AL USA

Animal Enclosure Module (AEM)

Life and Microgravity Spacelab (LMS); Feb. 1998, pp. 337-360; In English; Also announced as 19980206462; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The primary objective of this research project is to test the hypothesis that corticosteroids contribute to the adverse skeletal effects of space flight. To achieve this objective, serum corticosteroids, which are known to increase during space flight, must be maintained at normal physiologic levels in flight rats by a combination of adrenalectomy and corticosteroid supplementation via implanted hormone pellets. Bone analyses in these animals will then be compared to those of intact flight rats that, based on past experience, will undergo corticosteroid excess and bone loss during space flight. The results will reveal whether maintaining serum corticosteroids at physiologic levels in flight rats affects the skeletal abnormalities that normally develop during space flight. A positive response to this question would indicate that the bone loss and decreased bone formation associated with space flight are mediated, at least in part, by corticosteroid excess.

Author

Bone Demineralization; Musculoskeletal System; Corticosteroids; Microgravity; Gravitational Effects; Spaceborne Experiments; Physiological Responses

19980206470 NASA Marshall Space Flight Center, Huntsville, AL USA

Space Tissue Loss Configuration B (STL-B)

Life and Microgravity Spacelab (LMS); Feb. 1998, pp. 607-619; In English; Also announced as 19980206462; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The goal of these experiments was to determine the effect of microgravity on the early development of the fish medaka. There were two objectives for this flight series. The primary objective was to assess the effects of microgravity on different stages of development and to ascertain whether the relevant developmental questions can be addressed at the gross morphological level or if the issues involve more subtle questions about regulation at the molecular and cellular levels. The secondary objective was the assessment of the utility of flight hardware with the capabilities to perform embryological studies. We have been able to take advantage of the flight testing phase of the STL-B hardware to also study the effects of microgravity on the early development of the fish, Medaka. Our initial studies involved monitoring the early Medaka development and raising flight embryos for breeding. Images of the developing embryos were collected either via video which was either taken by the astronauts or broadcast to

Earth. Sample video images were digitized and stored on a hard drive resident within the on-board STL-B unit. Embryos were fixed at specific intervals, returned to Earth and are being analyzed for the timing and location of molecular events associated with controlling the morphological pattern for the onset of adult structures.
Author
Microgravity; Gravitational Effects; Spaceborne Experiments; Fishes; Hardware; Space Flight; Embryos

19980206724 Harvard Univ., Cambridge, MA USA
Unraveling photosystems ***Final Report***
[1997]; 3p; In English
Contract(s)/Grant(s): DE-FG02-87ER-13743
Report No.(s): DOE/ER/13743-T1; DE97-009422; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report highlights four main points. (1) A residue substitution in phosphoribulokinase of Synechocystis PCC 6803 renders the mutant light-sensitive. The authors isolated a light-sensitive mutant (BRLS) of the photosynthetic cyanobacterium Synechocystis 6803 that does not survive exposure to bright light; 70% of BRLS cells die upon exposure to light of greater than 3000 lux for 2 hr. (2) Excitation energy transfer from phycocyanin to chlorophyll in an apcA-defective mutant of Synechocystis sp. PCC 6803. A greenish mutant of the normally bule-green cyanobacterium Synechocystis sp. PC 6803, designated UV6p, was isolated and characterized. UV6p possesses functional photosystems I and II but lacks normal light harvesting phycobilisomes because allophycocyanin is absent and core-specific linker proteins are almost entirely absent. (3) Deletion of the psbG1 gene of the cyanobacterium Synechocystis sp. PCC 6803 leads to the activation of the cryptic psbG2 gene. The genes psbG1 and psbG2 in cyanobacterium Synechocystis sp. PCC 6803 are homologous. The psbG1 gene is located on the chromosome and is part of the ndhC-psbG1-ORF157 operon, while psbG2 is located on a plasmid and is not flanked by equivalent ndhC or ORF157 genes. (4) Deletion of the structural gene for the NADH-dehydrogenase subunit 4 of Synechocystis 6803 alters respiratory properties. Chloroplasts and cyanobacteria contain genes encoding polypeptides homologous to some subunits of the mitochondrial respiratory NADH-ubiquinol oxidoreductase complex (NADH dehydrogenase). Nothing is known of the role of the NADH dehydrogenase complex in photosynthesis, respiration, or other functions in chloroplasts, and little is known about their specific roles in the perhaps 42 subunits of this complex in the mitochondrion.
DOE
Photosynthesis; Energy Transfer; Chromosomes; Chloroplasts; Mitochondria

19980209932 California Univ., San Diego, Dept. of Chemistry, La Jolla, CA USA
From the Primitive Soup to Cyanobacteria: It May have Taken Less Than 10 Million Years
Miller, Stanley L., California Univ., San Diego, USA; Lazcano, Antonio, Universidad Nacional Autonoma de Mexico, Mexico; Circumstellar Habitable Zones; 1996, pp. 393-404; In English
Contract(s)/Grant(s): NAGw-2881
Report No.(s): NASA/CR-1996-207632; NAS 1.26:207632; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Most scientific discussions on the likelihood of extraterrestrial life have been constrained by the characteristics of life on our planet and the environmental conditions under which it may have emerged. Although it has been generally assumed that this process must have been extremely slow, involving hundreds of millions or even billions of years, a number of recent discoveries have led to a considerable compression of the time believed necessary for life to appear. It is now recognized that during its early history the Earth and other bodies of the inner Solar System went through a stage of intense collisions. Some of these impacts by large asteroids or comets may have raised the terrestrial surface to sterilizing temperatures and may have evaporated the oceans and killed off life as late as 3.8 x 10(exp 9) years ago. However, there is also ample paleontological evidence derived from the 3.5 x 10(exp 9) year old Warrawoona sediments showing that only 300 million years after the period of intense impacts ended, our planet was populated by phototactic, stromatolite-forming microorganisms. Although these discoveries are now generally interpreted to imply that the origin and early evolution of life were rapid, no attempts have been made to estimate the actual time required for these processes to occur.
Derived from text
Biological Evolution; Comets; Collisions; Bacteria

19980210107 Oak Ridge National Lab., TN USA
An editing environment for DNA sequence analysis and annotation
Uberbacher, E. C., Oak Ridge National Lab., USA; Xu, Y., Oak Ridge National Lab., USA; Shah, M. B., Oak Ridge National Lab., USA; Olman, V., Oak Ridge National Lab., USA; Parang, M., Oak Ridge National Lab., USA; Mural, R., Oak Ridge National

Lab., USA; [1998]; 9p; In English; 3rd; Biocomputing, 5 Jan. 1998, Kapalua, HI, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-94756; CONF-980118; DE98-000574; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This paper presents a computer system for analyzing and annotating large-scale genomic sequences. The core of the system is a multiple-gene structure identification program, which predicts the most probable gene structures based on the given evidence, including pattern recognition, EST and protein homology information. A graphics-based user interface provides an environment which allows the user to interactively control the evidence to be used in the gene identification process. to overcome the computational bottleneck in the database similarity search used in the gene identification process, the authors have developed an effective way to partition a database into a set of sub-databases of related sequences, and reduced the search problem on a large database to a signature identification problem and a search problem on a much smaller sub-database. This reduces the number of sequences to be searched from N to O((radical)N) on average, and hence greatly reduces the search time, where N is the number of sequences in the original database. The system provides the user with the ability to facilitate and modify the analysis and modeling in real time.

DOE

Pattern Recognition; Deoxyribonucleic Acid; Proteins; Sequencing

19980210108 Oak Ridge National Lab., TN USA

Overview of PSB track on gene structure identification in large-scale genomic sequence

Uberbacher, E. C., Oak Ridge National Lab., USA; Xu, Y., Oak Ridge National Lab., USA; [1998]; 4p; In English; 3rd; Biocomputing, 5 Jan. 1998, Kapalua, HI, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-94807; CONF-980118; DE98-000576; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The recent funding of more than a dozen major genome centers to begin community-wide high-throughput sequencing of the human genome has created a significant new challenge for the computational analysis of DNA sequence and the prediction of gene structure and function. It has been estimated that on average from 1996 to 2003, approximately 2 million bases of newly finished DNA sequence will be produced every day and be made available on the Internet and in central databases. The finished (fully assembled) sequence generated each day will represent approximately 75 new genes (and their respective proteins), and many times this number will be represented in partially completed sequences. The information contained in these is of immeasurable value to medical research, biotechnology, the pharmaceutical industry and researchers in a host of fields ranging from microorganism metabolism, to structural biology, to bioremediation. Sequencing of microorganisms and other model organisms is also ramping up at a very rapid rate. The genomes for yeast and several microorganisms such as H. influenza have recently been fully sequenced, although the significance of many genes remains to be determined.

DOE

Biotechnology; Deoxyribonucleic Acid; Genes; Influenza; Microorganisms; Pharmacology; Proteins

19980210414 Los Alamos National Lab., NM USA

Applications of optical trapping to single molecule DNA

Sonek, G. J., California Univ., USA; Berns, M. W., California Univ., USA; Keller, R. A., Los Alamos National Lab., USA; [1997]; 6p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3253; DE98-001512; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The project focused on the methodologies required to integrate optical trapping with single molecule detection (SMD) so as to demonstrate high speed sequencing through optical micromanipulation of host substrates, nucleotide cleavage, and single molecule detection. As part of this effort, the new technology of optical tweezers was applied to the confinement and manipulation of microsphere handles containing attached DNA fragments. The authors demonstrated substrate optical trapping in rapid flow streams, the fluorescence excitation and detection of fluorescently labeled nucleotides in an optical trapping system, and the epifluorescent imaging of DNA fragments in flow streams. They successfully demonstrated optical trap-

ping in laminar flow streams and completely characterized the trapping process as functions of fluid flow velocity, chamber dimension, trapping depth, incident laser power, and fluorescence measurement geometry.
DOE
Molecular Biology; Deoxyribonucleic Acid; Microparticles; Nucleotides; Fluid Flow; Molecules; Laser Induced Fluorescence

19980210478 Medical Coll. of Wisconsin, Dept. of Cellular Biology and Anatomy, Milwaukee, WI USA
Development of a Deltoid Shoulder Muscle Model for Rhesus Monkey Spaceflight Studies ***Final Report***
Riley, Danny A., Medical Coll. of Wisconsin, USA; Macias, Melissa Y., Medical Coll. of Wisconsin, USA; Anders, Scott, Medical Coll. of Wisconsin, USA; Slocum, Glenn R., Medical Coll. of Wisconsin, USA; 1995; 9p; In English
Contract(s)/Grant(s): NAG2-633; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The acromiodeltoid shoulder muscle was demonstrated to be a suitable model for spaceflight studies. The muscle contains a mixture of fast and slow fibers, permitting analysis of muscle fiber type specific changes. Two biopsy sites per muscle were identified that provided samples not degraded by the biopsy procedure. Both sites contained sufficient numbers fibers for determining changes in fiber type percentages and size. There was adequate bilateral symmetry regarding fiber type composition in the left and right muscles such that a total of four times points can be compared. The ESOP cage did not cause atrophy of deltoid muscle fibers; this means that microgravity-induced atrophy should be detectable. As expected, muscle excision stimulated muscle IgM and IgG muscle autoantibody production. Nonrestrained control animals suppressed this response whereas restrained monkeys showed an abnormally pronounced response indicative a compromised immune system. The presence of ESOP cage-induced changes in the immune response may mask spaceflight-induced effects. The ESOP cage modified the dominant hand operation of the PTS. These results demonstrate the importance of high fidelity ground based controls.
Author
Physiological Responses; Monkeys; Shoulders; Space Flight; Microgravity

19980210561 Argonne National Lab., IL USA
Third order nonlinear optical properties of stacked bacteriochlorophylls in bacterial photosynthetic light-harvesting proteins
Chen, L. X., Argonne National Lab., USA; Laible, P. D., Argonne National Lab., USA; Spano, F. C., Temple Univ., USA; Manas, E. S., Temple Univ., USA; [1997]; 7p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/CHM/CP-94165; CONF-970706; DE97-054004; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Enhancement of the nonresonant second order molecular hyperpolarizabilities gamma were observed in stacked macrocyclic molecular systems, previously in a (micro)-oxo silicon phthalocyanine (SiPcO) monomer, dimer and trimer series, and now in bacteriochlorophyll a (BChla) arrays of light harvesting (LH) proteins. Compared to monomeric BChla in a tetrahydrofuran (THF) solution, the <gamma for each macrocycle was enhanced in naturally occurring stacked macrocyclic molecular systems in the bacterial photosynthetic LH proteins where BChla's are arranged in tilted face-to-face arrays. In addition, the gamma enhancement is more significant in B875 of LH1 than in B850 in LH2. Theoretical modeling of the nonresonant gamma enhancement using simplified molecular orbitals for model SiPcO indicated that the energy level of the two photon state is crucial to the gamma enhancement when a two photon process is involved, whereas the charge transfer between the monomers is largely responsible when one photon near resonant process is involved. The calculated results can be extended to gamma enhancement in B875 and B850 arrays, suggesting that BChla in B875 are more strongly coupled than in B850. In addition, a 50--160 fold increase in <gamma for the S(sub 1) excited state of relative to S(sub 0) of bacteriochlorophyll in vivo was observed which provides an alternative method for probing excited state dynamics and a potential application for molecular switching.
DOE
Bacteria; Optical Properties; Photosynthesis; Proteins; Chlorophylls

19980210568 Argonne National Lab., IL USA
Changes in gene expression following EMF exposure
Woloschak, G. E., Argonne National Lab., USA; Paunesku, T., Argonne National Lab., USA; Chang-Liu, C. M., Argonne National Lab., USA; Loberg, L., IIT Research Inst., USA; Gauger, J., IIT Research Inst., USA; McCormick, D., IIT Research Inst., USA; [1997]; 5p; In English; 2nd; Electricity and Magnetism In Biology and Medicine, 8-13 Jun. 1997, Bologna, Italy
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/CMB/CP-94239; CONF-9706201; DE97-054504; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Experiments were designed to examine the effects of electromagnetic field (EMF) exposure on specific gene expression, an effect that can be deleterious, beneficial, or neutral, depending on the long-term consequences; however, the proof of a reproducible, quantitative biological effect (such as change in gene expression) will lead to latter experiments aimed at determining the relative contribution of these changes to cellular consequences. Past work by ourselves and by others has shown that measures of gene expression are extremely sensitive indicators of the cellular and biological effects of ionizing radiation, with transcriptional changes being detected by exposure of cells to doses of gamma-rays as low as 0.01 cGy that have no pronounced cellular consequences. On the basis of this work, the authors hypothesized that measures of gene expression will be equally sensitive to EMF effects on cells.
DOE
Gene Expression; Biological Effects; Electromagnetic Fields; Ionizing Radiation; Radiation Effects

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

19980206468 NASA Marshall Space Flight Center, Huntsville, AL USA
JSC Human Life Sciences Project
Life and Microgravity Spacelab (LMS); Feb. 1998, pp. 361-588; In English; Also announced as 19980206462; No Copyright; Avail: CASI; A11, Hardcopy; A06, Microfiche

This section of the Life and Microgravity Spacelab (LMS) publication includes articles entitled: (1) E029 - Magnetic Resonance Imaging after Exposure to Microgravity; (2) E030 - Extended Studies of Pulmonary Function in Weightlessness; (3) E074 - Direct Measurement of the Initial Bone Response to Spaceflight in Humans; (4) E401 - The Effects of Microgravity on Skeletal Muscle Contractile Properties; (5) E407 - Effects of Microgravity on the Biochemical and Bioenergetic Characteristics of Human Skeletal Muscle; (6) E410 - Torso Rotation Experiment; (7) E920 - Effect of Weightlessness on Human Single Muscle Fiber Function; (8) E948 - Human Sleep, Circadian Rhythms and Performance in Space; (9) E963 - Microgravity Effects on Standardized Cognitive Performance Measures; and (10) E971 - Measurement of Energy Expenditures During Spaceflight Using the Doubly Labeled Water Method
CASI
Weightlessness; Microgravity; Gravitational Effects; Aerospace Environments; Physiological Responses; Human Performance; Spaceborne Experiments; Spacecraft Environments

19980209692 Lawrence Livermore National Lab., Livermore, CA USA
Modeling of bubble dynamics in relation to medical applications
Amendt, P. A., Lawrence Livermore National Lab., USA; London, R. A., Lawrence Livermore National Lab., USA; Strauss, M., California Univ., USA; Mar. 12, 1997; 16p; In English, 8 - 14 Feb. 1997, San Jose, CA, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-126961; CONF-970231-47; DE97-053416; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In various pulsed-laser medical applications, strong stress transients can be generated in advance of vapor bubble formation. to better understand the evolution of stress transients and subsequent formation of vapor bubbles, two-dimensional simulations are presented in channel or cylindrical geometry with the LATIS (LAser TISsue) computer code. Differences with one-dimensional modeling are explored, and simulated experimental conditions for vapor bubble generation are presented and compared with data.
DOE
Two Dimensional Models; Laser Applications; Pulsed Lasers; Bubbles

19980209737 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Test-Retest Reliability of the USA Air Forces Submaximal Bicycle Ergometry Aerobic Fitness Test
Glenn, Frank A., Air Force Inst. of Tech., USA; May 19, 1998; 75p; In English
Report No.(s): AD-A344913; AFIT-98-016; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The ability to perform endurance work is dependent on aerobic metabolism. Maximal oxygen consumption (VO2 max) defines aerobic capacity and quantifies an individual's capability for aerobic resynthesis of adenosine triphosphate. VO2 max is

the primary indicator of aerobic fitness, cardiovascular health, and endurance performance. When assessing aerobic capacity, a type of exercise must be chosen which involves a large group of muscles and be of sufficient intensity and duration to cause an adjustment in the cardio-respiratory system to the level of exercise. The typical exercise modes include treadmill running and walking, endurance runs and walks for time or distance, stationary cycling, arm cranking, bench stepping, and swimming. to determine aerobic capacity, a maximal test (direct measurement) or a submaximal test (estimation or prediction) is used to obtain a VO2 mx value.
DTIC
Physical Fitness; Cycles; Reliability; Armed Forces; Aerobes; Cardiovascular System; Physical Exercise

19980209818 Department of the Navy, Washington, DC USA
Automatic Medical Sign Monitor
Pugh, Jamie K., Inventor, Department of the Navy, USA; Sep. 30, 1997; 9p; In English
Patent Info.: Filed 3 Nov. 1995; US-Patent-Appl-SN-552818; US-Patent-5,671,734
Report No.(s): AD-D018818; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An automatic medical monitor of the present invention comprises medical sign sensors for collecting a time-ordered set of values representative of medical signs such as pulse respiration. and blood pressure. The medical sign sensors are coupled to a medical sign data processor that forms statistics from the medical sign data and forms a modified Fast initial Response (FIR) Shewhart cumulative sum and a variance cumulative sum to detect changes in health state. When a change in health state is detected the medical sign data processor displays the statistics on a display and logs them on a printer.
DTIC
Medical Equipment; Data Processing Equipment; Blood Pressure; Medical Services

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.

19980209724 Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada
A look at Behaviourism and Perceptual Control Theory in Interface Design
Chery, Sandra, Defence and Civil Inst. of Environmental Medicine, Canada; Farrell, Philip S. E., Defence and Civil Inst. of Environmental Medicine, Canada; Feb. 1998; 25p; In English
Report No.(s): AD-A345852; DCIEM-98-R-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Behaviourism and Perceptual Control Theory (PCT) were reviewed and their shortfalls, as well as their application to human machine interactions, were assessed. Behaviourism, which studies only observable behaviors and discards the purpose of actions, implies that given a stimulus, one can predict the response. The PCT framework introduces the requirement for a desired perceptual state which would then be compared to its perception. Behaviors would then result in an attempt to minimize the perceptual error when present. However, PCT's shortfall includes the inability to objectively measure internal variables. Behaviourism, on the other hand, can not account for variability in responses, instinctive drift, autoshaping, etc. Researchers have used behaviourism as a framework for human machine interactions concluding that compatibility between a stimulus and its response resulted in increased performance of the system. Other researchers have argued that the use of PCT in human machine interactions can explicitly show all the required feedback messages necessary for a stable and effective interaction between the human and the machine.
DTIC
Human Factors Engineering; Man Machine Systems; Performance Prediction; Perceptual Errors

19980209727 Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada
Water Entry Onto the MAC 200 Immersion Suit During Simulated Parachute Jump and Drag Trials
Ducharme, Michel B., Defence and Civil Inst. of Environmental Medicine, Canada; Thompson, John A., Defence and Civil Inst. of Environmental Medicine, Canada; Jan. 1998; 15p; In English
Report No.(s): AD-A345838; DCIEM-98-R-33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The MAC 200 immersion suit newly developed by Mustang Survival (Richmond, B.C.) has recently been considered a potential replacement suit for the constant wear dry immersion suit currently used by Canadian Forces aircrew. The objective of the present evaluation trial was to evaluate the effectiveness of the new neck seal concept by measuring water leakage into the MAC 200 suit during a simulated parachute jump into water followed by a 15 s drag. Four male aircrew members volunteered to partici-

pate in the study. On Day 1 they jumped from the back of a boat (about 30 cm above the water) moving at a speed of 5 km . h-1 and were dragged for 15 sec. On Day 2, the aircrew jumped from a platform 3 m above water to simulate the speed of parachute entry and were immediately attached to a line and dragged behind a boat for 15 sec at a speed of 5 km/h. Before and after the jump/drag procedure the aircrew were weighed to estimate the amount of water leakage into the suit. The results showed that when the neck and wrist seals of the suit were closed properly before the entry into the water, no leakage was observed following the jump/drag procedure on both testing days.
DTIC
Parachutes; Protective Clothing; Water Immersion; Wettability

19980209728 Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada
Efficacy of Liquid, Air, and Phase Change Material Torso Cooling During Light Exercise While Wearing NBC Clothing
McLellan, Tom M., Defence and Civil Inst. of Environmental Medicine, Canada; Frim, John, Defence and Civil Inst. of Environmental Medicine, Canada; Mar. 1998; 36p; In English
Report No.(s): AD-A345833; DCIEM-98-R-36; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study compared the thermoregulatory responses with liquid, air and phase change material (PCM) torso cooling during light exercise at 40 C while wearing NBC protective clothing. The liquid-(LC) and air-cooling (AC) systems were powered from external portable chiller units. The PCM cooling vests, which were supplied by Microclimate Systems Incorporated, were worn under the NBC overgarment and were tested with a vertical (CVV) and horizontal (CVH) design. Seven males (29 yrs, 75.6 kg, 1.78 m) performed a no cooling (NC) and 4 cooling trials while walking at 3.5 km.h-1 on a treadmill in the environmental chamber. During the NC condition, tolerance times were 100 min and final core temperature was 39.1 C. For the PCM trials (CVV and CVH), tolerance times were extended by 30 min but core temperature still rose to reach values close to 39.0 deg C indicating that the cooling vests could only delay the exhaustion from the heat exposure. However, with both the LC and AC trials, all subjects completed 180 min of exercise and they could of continued longer given that their core temperatures were still below 38.0 C. The results have shown that the PCM cooling vests are of benefit for work tasks that continue between 1 to 2 hours but these vests are not as effective in reducing the heat strain of wearing NBC clothing in hot environments as liquid- or air-cooling systems.
DTIC
Protective Clothing; Thermoregulation; Air Cooling; Physical Exercise; Physiological Responses

19980210008 NASA Johnson Space Center, Houston, TX USA
Understanding Skill in EVA Mass Handling, Volume 3, Empirical Developments and Conclusions
Riccio, Gary E., Nascent Technologies, USA; McDonald, P. Vernon, Nascent Technologies, USA; Jul. 1998; 46p; In English
Contract(s)/Grant(s): RTOP 199-16-11-48
Report No.(s): NASA/TP-1998-3684/Vol-3; NAS 1.60:3684/Vol-3; S-827; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Key attributes of skilled mass handling were identified through an examination of lessons learned by the extravehicular activity operational community. These qualities were translated into measurable quantities. The operational validity of the ground-based investigation was improved by building a device that increased the degrees of freedom of extravehicular mobility unit motion on the Precision Air-Bearing Floor. The results revealed subtle patterns of interaction between motions of an orbital replacement unit mockup and mass handler that should be important for effective performance on orbit. The investigation also demonstrated that such patterns can be measured with a variety of common instruments and under imperfect conditions of observation.
Author
Extravehicular Activity; Extravehicular Mobility Units; Mass; Human Behavior

19980210109 Oak Ridge National Lab., TN USA
Beta reduction factors for protective clothing at the Oak Ridge National Laboratory
Franklin, G. L., Oak Ridge National Lab., USA; Gonzalez, P. L., Oak Ridge National Lab., USA; [1998]; 9p; In English, 8-11 Feb. 1998, Mobile, AL, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95027; CONF-980203; DE98-000896; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Beta reduction factors (f(sub (beta))) for protective clothing (PC) at the Oak Ridge National Laboratory (ORNL) have been determined for a variety of protective clothing combinations. Data was collected to determine the experimental f(sub (beta)) for several combinations of PCs under laboratory conditions. Radiation dose rates were measured with an open window Bicron(reg

sign) RSO-5 ion chamber for two distinct beta energy groups (E(sub max) = 1.218 (times) 10(sup (minus)13) J(0.860 MeV) and 3.653 (times) 10(sup (minus)13) J (2.280 MeV)). Data points determined, as the ratio of unattenuated (no PCs) to attenuated (PCs), were used to derive a set of equations using the Microsoft(reg sign) Excel Linet function. Field comparison tests were then conducted to determine the validity of these beta reduction factors. The f(sub (beta)) from the field tests were significantly less than the experimental f(sub (beta)), indicating that these factors will yield conservative results.
DOE
Ionization Chambers; Protective Clothing

19980210354 IPROZ, Zagreb, Croatia
Work and Safety, March 1997 (Rad i Sigurnost) Chemical Abstracts, Health and Safety Science Abstracts
Dec. 1997; 134p; In English; In Croatian
Report No.(s): PB98-141633; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); Abstracts, Microfiche

The paper presents the results of a sample survey of comprehensibility and recognizability of safety signs. Two groups of examinees were randomly chosen for the examinations. There were secondary school students aged 15-18 in the first group, and in the second group persons at the age of 40-50, with a greater life and work experience. The research has shown that the examinees recognized the majority of signs and their messages. In the group of warning signs a considerable number of messages made according to ISO standards and EEC guidelines were not recognized.
NTIS
Safety; Health; Surveys

19980210638 Nanomaterials Research Corp., Tucson, AZ USA
Intermediate-temperature electrolysis cells for oxygen production from carbon dioxide
Hu, H., Nanomaterials Research Corp., USA; Yadav, T., Nanomaterials Research Corp., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 15; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this project, Nanomaterials Research Corporation has sought to develop intermediate-temperature electrolysis cells based on YSZ electrolyte. The work has been focused on nano-engineering of the electrolyte-electrode interfaces in order to minimize interfacial overpotentials and total cell resistance at intermediate temperatures. A series of mixed ionic-electronic conducting (MIEC) metal-ceramic nano-composites have been studied as electrode materials for YSZ-based electrolysis cells. Impedance spectroscopy and dc measurement have been used for identifying highly catalytically active MIEC nano-composite electrode materials under oxygen pump conditions.
Derived from text
Electrolytic Cells; Liquid-Solid Interfaces; Interface Stability; Oxygen Production; Cermets; Nanostructures (Devices); Electrode Materials

19980210641 Ceramphysics, Inc., Westerville, OH USA
Oxygen extraction using a ceramic honeycomb technology
Lawless, W. N., Ceramphysics, Inc., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 23; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The results of a NASA-supported study are reported to examine if a ceramic-honeycomb technology can contribute to producing oxygen from the Martian atmosphere. The honeycomb technology is based on a stabilized Bi2O3 ceramic composition and has been developed for extracting oxygen from air in the 500-600 C range.
Derived from text
Ceramic Honeycombs; Honeycomb Structures; Extraction; Oxygen Production; Mars Atmosphere; Extraterrestrial Resources

19980210642 NASA Kennedy Space Center, Cocoa Beach, FL USA
Oxygen liquefaction and zero-loss storage system
Lin, F. N., NASA Kennedy Space Center, USA; Bollo, T. R., NASA Kennedy Space Center, USA; Peterson, D. M., NASA Kennedy Space Center, USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 25-26; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper presents an alternative concept that employs existing technologies and off-the-shelf components to liquefy gaseous oxygen from an in-situ propellant production (ISPP) unit and to store the liquid oxygen without boil-off loss. A primary goal is to minimize active components with a secondary goal of designing the active component in a protected or failure-free environ-

ment. The resulting design requires only one active component, a compressor operating in a closed and consequently more protected system. The design avoids pumps as active components by employing cryopumping for gaseous oxygen (GOX) and gravity transfer for liquid oxygen (LOX).
Derived from text
Oxygen; Liquid Oxygen; Oxygen Production; Liquefaction; Propellant Storage; Liquid Rocket Propellants

19980210646 Old Dominion Univ., Norfolk, VA USA
Oxygen production and separation from Martian atmosphere by the radio-frequency discharge
Vuskovic, L., Old Dominion Univ., USA; Ash, R. L., Old Dominion Univ., USA; Popovic, S., Old Dominion Univ., USA; Dinh, T., Old Dominion Univ., USA; VanOrden, A., Old Dominion Univ., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 33; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Included are the new results from the experiments on the radio-frequency discharge of Martian atmospheric gas and separation of oxygen from the gas mixture using a silver membrane. The discharge was generated at simulated conditions of the Martian surface atmosphere. Background gas pressure was 6 to 7 Torr. Gas mixture contained 95.7% CO2, 2.7% N2, and 1.6% Ar.
Derived from text
Radio Frequency Discharge; Oxygen Production; Mars Atmosphere; Silver

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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.

19980206519 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Towards Asynchronous A-D Conversion
Kinniment, D. J., Newcastle-upon-Tyne Univ., UK; Gao, B., Newcastle-upon-Tyne Univ., UK; Yakovlev, A. V., Newcastle-upon-Tyne Univ., UK; Xia, F., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 28p; In English
Report No.(s): PB98-147812; TRS-615; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Analogue to digital (A-D) converters with a fixed conversion time are subject to errors due to metastability. The authors estimate the frequency of these errors in a successive approximation converter, and compare the results with asynchronous designs using both a fully speed-independent, and a bundled data approach. It is shown that an asynchronous converter is more reliable than its synchronous counterpart, and that the bundled data design is also faster, on average, than the synchronous design. The authors also demonstrate tradeoffs involved in asynchronous converter designs, such as speed, robustness to delay variations, circuit size and design scalability.
NTIS
Analog to Digital Converters; Metastable State; Stability; Reliability Analysis; Synchronism; Analogs; Bundles

19980206741 Sandia Labs., Livermore, CA USA
A survey of IP over ATM architectures
Chen, H., Sandia Labs., USA; Tsang, R., Sandia Labs., USA; Brandt, J., Sandia Labs., USA; Hutchins, J., Sandia Labs., USA; Jul. 1997; 29p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-8273; DE97-053786; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Over the past decade, the Internet has burgeoned into a worldwide information highway consisting of approximately 5 million hosts on over 45,000 interconnected networks. This unprecedented growth, together with the introduction of multimedia workstations, has spurred the development of innovative applications that require high speed, low latency, and real-time transport. Today's Internet can neither scale in its bandwidth nor guarantee the Quality of Services (QoS) necessary to meet these performance requirements. Many network researchers propose to use the Asynchronous Transfer Mode (ATM) technology as the underlying infrastructure for the next generation of workgroup, campus, and enterprise IP networks. Since ATM is significantly different from

today's legacy network technologies, efficient implementation of IP over ATM is especially challenging. This tutorial paper covers several existing proposals that integrate IP over ATM.
DOE
Real Time Operation; Asynchronous Transfer Mode; Bandwidth; Internets

19980209825 Department of the Navy, Washington, DC USA
Real-Time Data Sorter
Cho, Kichul, Inventor, Department of the Navy, USA; Dec. 30, 1997; 6p; In English
Patent Info.: Filed 1 Oct. 1992; US-Patent-5,704,057; US-Patent-Appl-SN-955388
Report No.(s): AD-D018835; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An apparatus is provided to sort an incoming stream of data points in terms of data point value and time of occurrence thereof. A first and second memory each have an input for receiving the incoming data stream and an output. Each data point accesses an address of the first memory based upon a corresponding data point value. The value of the accessed address is incremented by one by an incrementing means. The output of the incrementing means is coupled to the first memory to store the incremented value at the accessed address. Each data point value is also indicative of a predetermined offset address stored in the second memory. An address latch is coupled to the first and second memories to generate a concatenated address based on the value of the accessed address (i.e., before it is incremented) and the offset address. Each successive time of occurrence is stored in a storage means at the concatenated address.
DTIC
Data Flow Analysis; Data Storage; Data Systems; Random Access Memory

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COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

19980206492 Sandia National Labs., Albuquerque, NM USA
Experiments in micromanipulation and CAD-driven microassembly
Feddema, J. T., Sandia National Labs., USA; Keller, C. G., California Univ., USA; Howe, R. T., California Univ., USA; 1997; 11p; In English; Microrobotics and Microsystem Fabrication, 14 - 17 Oct. 1997, Pittsburgh, PA, USA; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2530C; CONF-971086; DE98-000386; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper discusses recent experiments in the manipulation and assembly of parts with 100 micron outside dimensions and submicron tolerances. The objective of this work is to develop a micromanipulation workcell which can automatically assemble LIGA (Lithography Galvonoforming Abforming) parts using an assembly plan and a CAD drawing of each of the components. The workcell consists of an Adeptone robot, precision stages, long distance microscope, and a high aspect ratio modeled polysilicon tweezers for picking up the parts. Fourier optics methods are used to generate synthetic microscope images from CAD drawings. These synthetic images are used off-line to test image processing routines under varying magnifications an depths of field. They also provide reference image features which are used to visually servo the true part to the desired position.
DOE
Computer Aided Design; Assembling; Image Processing

19980206520 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Exception Handling in Object-Oriented Real-Time Distributed Systems
Romanovsky, A., Newcastle-upon-Tyne Univ., UK; Xu, J., Newcastle-upon-Tyne Univ., UK; Randell, B., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 34p; In English
Report No.(s): PB98-147804; TRS-618; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper, we develop a general structuring framework based on the coordinated atomic (CA) action concept for handling exceptions in an object-oriented distributed systems, in which exceptions in both the value and the time domain are taken into account.
NTIS
Concurrent Processing; Distributed Processing; Object-Oriented Programming; Real Time Operation; Time Measurement

19980206575 Los Alamos National Lab., NM USA

Algorithms using inter-band cross-correlation for pixel registration and jitter reconstruction in multi-channel push-broom imagers

Theiler, J., Los Alamos National Lab., USA; Henderson, B. G., Los Alamos National Lab., USA; Smith, B. W., Los Alamos National Lab., USA; 1997; 13p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2605; CONF-970706; DE98-000597; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We present two algorithms for determining sensor motion of a multi-spectral push-broom imager for use in subsequent image registration. The first algorithm, termed the (open quotes)pairwise(close quotes) method, performs cross-correlations between individual pairs of channels. The offsets of maximum correlation are formulated into a system of linear equations whose solution gives an estimate of the jitter function. The second algorithm performs cross-correlations between channels and a reference image called the (open quotes)baseline(close quotes) which is constructed by averaging together all the channels in the image cube. An estimated jitter time series is computed for each channel, all of which are overlapped and averaged to obtain a best estimate of the jitter function. The pairwise method is more general in that it can handle a wider range of jitter scenarios. The baseline method, although more restricted, is very simple to implement, and its accuracy can be improved substantially through iteration. In this paper, we describe both methods in detail and present results of simulations performed on thermal-infrared data cubes.

DOE

Pixels; Image Processing; Pattern Registration; Algorithms; Vibration

19980206577 Sandia National Labs., Albuquerque, NM USA

Context sensitivity and ambiguity in component-based systems design

Bespalko, S. J., Sandia National Labs., USA; Sindt, A., Sandia National Labs., USA; 1997; 9p; In English; Foundations of Software Engineering International Convention, 21 - 25 Sep. 1997, Zurich, Switzerland; Sponsored by American Chemical Society, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2304C; CONF-9709104; DE98-000231; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Designers of components-based, real-time systems need to guarantee to correctness of software and its output. Complexity of a system, and thus the propensity for error, is best characterized by the number of states a component can encounter. In many cases, large numbers of states arise where the processing is highly dependent on context. In these cases, states are often missed, leading to errors. The following are proposals for compactly specifying system states which allow the factoring of complex components into a control module and a semantic processing module. Further, the need for methods that allow for the explicit representation of ambiguity and uncertainty in the design of components is discussed. Presented herein are examples of real-world problems which are highly context-sensitive or are inherently ambiguous.

DOE

Systems Engineering; Real Time Operation; Errors

19980206636 Naval Postgraduate School, Monterey, CA USA

A Naval Reserve Database Application and Future Network Solutions

Patrou, Bruce M., Naval Postgraduate School, USA; Jun. 1998; 248p; In English

Report No.(s): AD-A345911; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This thesis develops a Naval Reserve squadron database management system prototype and provides recommendations on future network solutions. The development centers on a Strike Fighter Squadron 203 (VFA-203), located in Atlanta, Georgia. This project focuses on an application which will support those current critical administrative systems which are not electronically automated or do not reside in a distributed computing environment. Emphasis is on utilizing current hardware and software while minimizing costs, training and organizational change associated with new information systems. Database scaleability using Access 97 and IT 21 compliance are important features of this system. A small local area network (LAN) option in a Peer to Peer configuration is discussed as a means increase system efficiency by providing distributed access to this application. A future client/server network architecture capable of far greater scalability, network sharing and security will be recommended for further increases in system effectiveness.

DTIC

Data Bases; Network Analysis; Data Base Management Systems; Prototypes; Information Systems

19980206638 Prediction Systems, Inc., Spring Lake, NJ USA

System Architecture Tool Design ***Final Report***

Ucles, Jose L., Prediction Systems, Inc., USA; Dworkin, Larry, Prediction Systems, Inc., USA; May 29, 1998; 55p; In English

Contract(s)/Grant(s): DAAB07-98-C-B601

Report No.(s): AD-A345969; PSI-97001; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In order to achieve a well-conceived system architecture several steps are involved. Initially, system requirements need to be defined, functional procedures need to be established. an operational architecture needs to be developed, and a System Architecture needs to be realized. The PSI/MU Team proposes to develop a specification and a concept of operation for the Automated Tool Suite (ATS) which will take the various requirements of the Army's Operational Architecture and automate the synthesis of the system architecture. What makes this Automated Tool Suite (ATS) unique is its focus on offering the system architect designer a series of steps that guide the user through the complex process of developing the architecture. They include: (1) a user-friendly interface that includes an expert system which allows various architectural tradeoffs. (2) a series of supporting databases that help in rapidly defining system requirements in support of the operational requirements, (3) an expert system that interacts with high eve parametric models that are used to provide the System Architect feedback about expected performance of proposed architectures, and (4) an analyst's back end that permits the viewing of the architecture from several views (e.g., hardware, communication and network, etc.) useful to an architect.

DTIC

Architecture (Computers); Functional Design Specifications; Expert Systems; Communication Networks

19980206707 Los Alamos National Lab., NM USA

Computing n-dimensional volumes of complexes: Application to constructive entropy bounds

Beiu, V., Los Alamos National Lab., USA; Makaruk, H. E., Los Alamos National Lab., USA; [1997]; 5p; In English; Nolta '97: International Symposium on Nonlinear Theory and Its Applications, 29 Nov. - 3 Dec. 1997, Honolulu, HI, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2873; CONF-971167; DE98-000623; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The constructive bounds on the needed number-of-bits (entropy) for solving a dichotomy (i.e., classification of a given dataset into two distinct classes) can be represented by the quotient of two multidimensional solid volumes. Exact methods for the calculation of the volume of the solids lead to a tighter lower bound on the needed number-of-bits- than the ones previously known. Establishing such bounds is very important for engineering applications, as they can improve certain constructive neural learning algorithms, while also reducing the area of future VLSI implementations of neural networks. The paper will present an effective method for the exact calculation of the volume of any n-dimensional complex. The method uses a divide-and-conquer approach by: (1) partitioning (i.e., slicing) a complex into simplices; and (2) computing the volumes of these simplices. The slicing of any complex into a sum of simplices always exists, but it is not unique. This non-uniqueness gives us the freedom to choose that specific partitioning which is convenient for a particular case. It will be shown that this optimal choice is related to the symmetries of the complex, and can significantly reduce the computations involved.

DOE

Entropy; Dichotomies

19980206708 Los Alamos National Lab., NM USA

X3D moving grid methods for semiconductor applications

Kuprat, A., Los Alamos National Lab., USA; Cartwright, D., Los Alamos National Lab., USA; Gammel, J. T., Los Alamos National Lab., USA; George, D., Los Alamos National Lab., USA; Kendrick, B., Los Alamos National Lab., USA; Kilcrease, D., Los Alamos National Lab., USA; Trease, H., Los Alamos National Lab., USA; Walker, R., Los Alamos National Lab., USA; [1997]; 15p; In English; 5th; Computational Electronics, 2 - 4 Nov. 1997, Notre Dame, IN, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2891; CONF-971166; DE98-000624; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Los Alamos 3D grid toolbox handles grid maintenance chores and provides access to a sophisticated set of optimization algorithms for unstructured grids. The application of these tools to semiconductor problems is illustrated in three examples: grain growth, topographic deposition and electrostatics. These examples demonstrate adaptive smoothing, front tracking, and automatic, adaptive refinement/derefinement.

DOE

Unstructured Grids (Mathematics); Semiconductors (Materials); Three Dimensional Models

19980206740 Los Alamos National Lab., NM USA

Unstructured 3D grid toolbox for modeling and simulation

George, D., Los Alamos National Lab., USA; 1997; 7p; In English; NASA Workshop, 7 - 8 Aug. 1997, Moffett Field, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3052; CONF-9708113; DE98-001084; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Computable 3D grids that accurately represent complex multimaterial geometries are essential for both static and time-dependent modeling and simulation. LaGriT, the grid toolbox developed at Los Alamos provides a sophisticated set of initial grid generation, grid maintenance and grid optimization tools. We present example grids that demonstrate the flexibility of the grid generator. Additionally, we present the results of an electrostatic calculation and a grain growth problem that illustrate the grid optimization features and the utility of the grid server architecture.
DOE
Computational Grids; Computerized Simulation; Mathematical Models; Grid Generation (Mathematics)

19980206782 Sandia National Labs., Albuquerque, NM USA

Introduction to NuMAD: A numerical manufacturing and design tool

Laird, D. L., Sandia National Labs., USA; Ashwill, T. D., Sandia National Labs., USA; 1997; 8p; In English; 16th; Wind Energy, 6 - 9 Jan. 1997, Reno, NV, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2746C; AIAA Paper 98-0060; CONF-970135-; DE98-001042; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Given the complex geometry of most wind turbine blades, structural modeling using the finite element method is generally performed using a unique model for each particular blade analysis. Development time (often considerable) spent creating a model for one blade may not aid in the development of a model for a different blade. In an effort to reduce model development time and increase the usability of advanced finite element analysis capabilities, a new software tool, NuMAD, is being developed.
DOE
Turbine Blades; Models; Finite Element Method; Computer Aided Design; Computer Aided Manufacturing; Applications Programs (Computers); Airfoils

19980206790 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK

Using Responsibility Modelling to Match Organizational Change to Changes in the Systems Development Process

Strens, M. R., Newcastle-upon-Tyne Univ., UK; Chudge, J., Loughborough Univ. of Technology, UK; Dec. 1997; 14p; In English
Report No.(s): PB98-147945; TRS-605; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The authors describe the use of responsibility modeling as an aid to identifying the organizational changes needed if changes to the software systems development process are to be implemented successfully within the organizational context.
NTIS
Software Engineering; Systems Engineering; Organizations

19980209655 National Inst. of Standards and Technology, Software Diagnostics and Conformance Testing Div., Gaithersburg, MD USA

EFFective Manager Tool for Software Developers

Wallace, D. R., National Inst. of Standards and Technology, USA; Zimmerman, M. L., National Inst. of Standards and Technology, USA; Apr. 1998; 42p; In English
Report No.(s): PB98-144512; NISTIR-6137; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The collection and analysis of software error, fault, and failure data from many high integrity systems may yield reference data for matching development and assurance methods to characteristics of a specific system. Profiles derived from the data may help researchers to identify areas where new methods of error prevention and detection are most needed. The National Institute of Standards and Technology has initiated a program on error, fault, and failure data collection and analysis to address these two topics. An initial data collection and analysis tool has been developed for this project.
NTIS
Software Engineering; Quality Control; Error Analysis; Failure Analysis; Computer Programs; Software Development Tools

19980209719 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

Verification of Floating-Point Adders

Chen, Yirng-An, Carnegie-Mellon Univ., USA; Bryant, Randal E., Carnegie-Mellon Univ., USA; Apr. 1997; 22p; In English

Contract(s)/Grant(s): DABT63-96-C-0071

Report No.(s): AD-A346061; CMU-CS-98-121; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The floating-point division bug in Intel's Pentium processor and the overflow flag erratum of the FIST instruction in Intel's Pentium Pro and Pentium II processor have demonstrated the importance and the difficulty of verifying floating-point arithmetic circuits. In this paper, we present a "black box" version of verification of FP adders. In our approach, FP adders are verified by an extended word-level SMV using reusable specifications without knowing the circuit implementation. Word-level SMV is improved by using Multiplicative Power HDDs (*PHDDs), and by incorporating conditional symbolic simulation as well as a short-circuiting technique. Based on a case analysis, the adder specification is divided into several hundred implementation-independent sub-specifications. We applied our system and these specifications to verify the IEEE double precision FP adder in the Aurora III Chip from the University of Michigan. Our system found several design errors in this FP adder. Each specification can be checked in less than 5 minutes. A variant of the corrected FP adder was created to illustrate the ability of our system to handle different EP adder designs. For each adder, the verification task finished in 2 CPU hours on a Sun UltraSPARC-II server.

DTIC

Floating Point Arithmetic; Computers; Program Verification (Computers); Computer Systems Programs

19980209722 Naval Postgraduate School, Monterey, CA USA

Costs and Benefits of Software Process Improvement

Prenger, Karen D., Naval Postgraduate School, USA; Dec. 1997; 110p; In English

Report No.(s): AD-A346053; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

There are numerous problems in DoD software development projects. The ad hoc practices used in the military services and in industry have resulted in unpredictable costs and schedules and low-quality products. This thesis proposes that one solution to these problems is to integrate Software Process Improvement (SPI) activities based on a proven model into software development projects. Both a formal and an informal approach to SPI will be discussed. The thesis will also describe not only the problems encountered in most software development projects, but also the activities defined in these SPI approaches that are designed to solve these problems. A case study of a military project that has spent several years implementing SPI activities based on Software Engineering Institute's (SEI) Capability Maturity Model (CMM) is presented. The SPI activities were implemented in an effort to deliver a high quality product with high reliability while maintaining a high level of control of costs and schedule. This project has succeeded in its goals and the costs and benefits of the project's efforts will be presented.

DTIC

Computer Programs; Costs; Software Engineering

19980209736 Florida Agricultural and Mechanical Univ., Tallahassee, FL USA

Computational Methods for the Simulation of Nonconvex Variational Problems with Applications to Smart Materials ***Final Report, 15 Mar. 1996 - 14 Mar 1998***

Turner, James C., Jr., Florida Agricultural and Mechanical Univ., USA; Apr. 11, 1998; 49p; In English

Contract(s)/Grant(s): F49620-96-1-0090

Report No.(s): AD-A345631; AFRL-SR-BL-TR-98-0459; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An interdisciplinary research group in modeling, analysis and simulation was established at Florida A&M University (FAMU). This group set as its scientific goal the development of robust computational algorithms that are well suited for nonconvex variational principles, and other nonlinear problems that arise in the study of highly nonlinear materials. The equally important second goal of the group was to enhance the participation of under-represented minorities in applied disciplines connected to emerging technologies that are important to the Air Force Office of Scientific Research. Mechanisms used for meeting these goals include the strengthening of the infrastructure for research at FAMU, strengthening of the existing relationship between AFOSR and FAMU, and enhancing the existing relationship between FAMU, Carnegie Mellon University, University of Minnesota, and North Carolina University. This report describes the background and overall research goals of this project, and delineates the accomplishments made thus far.

DTIC

Smart Materials; Finite Element Method; Computer Aided Manufacturing; Computerized Simulation; Variational Principles

19980209744 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Efficient Encoding and Rendering of Time-Varying Volume Data

Ma, Kwan-Liu, Institute for Computer Applications in Science and Engineering, USA; Smith, Diann, Institute for Computer Applications in Science and Engineering, USA; Shih,Ming-Yun, Institute for Computer Applications in Science and Engineering, USA; Shen, Han-Wei, MRJ Technology Solutions, USA; Jun. 1998; 20p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-1998-208424; NAS 1:26:208424; ICASE-98-22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Visualization of time-varying volumetric data sets, which may be obtained from numerical simulations or sensing instruments, provides scientists insights into the detailed dynamics of the phenomenon under study. This paper describes a coherent solution based on quantization, coupled with octree and difference encoding for visualizing time-varying volumetric data. Quantization is used to attain voxel-level compression and may have a significant influence on the performance of the subsequent encoding and visualization steps. Octree encoding is used for spatial domain compression, and difference encoding for temporal domain compression. In essence, neighboring voxels may be fused into macro voxels if they have similar values, and subtrees at consecutive time steps may be merged if they are identical. The software rendering process is tailored according to the tree structure and the volume visualization process. With the tree representation, selective rendering may be performed very efficiently. Additionally, the I/O costs are reduced. With these combined savings, a higher level of user interactivity is achieved. We have studied a variety of time-varying volume datasets, performed encoding based on data statistics, and optimized the rendering calculations wherever possible. Preliminary tests on workstations have shown in many cases tremendous reduction by as high as 90 percent in both storage space and inter-frame delay.

Author

Efficiency; Coding; Data Bases; Time Dependence

19980209824 Department of the Navy, Washington, DC USA

VXI Test Executive

McKeon, Brian T., Inventor, Department of the Navy, USA; Larson, Mark C., Inventor, Department of the Navy, USA; Sherman, Douglas H., Inventor, Department of the Navy, USA; Sep. 16, 1997; 23p; In English

Patent Info.: Filed 16 Sep. 1997; US-Patent-Appl-SN-969530

Report No.(s): AD-D018831; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A system is provided for developing program test sets with test hardware conforming to well known test industry standards, such as VXI, VME and GPIB standards. The system has a computer with a display console. After initialization and password checks, the console displays a front panel from which a user chooses the instruments, switches, connections, inputs, outputs, etc. which make up the program test set. As each choice is made, the system generates test script corresponding to the choice. The system then uses the test script, or macro, to generate the graphical representation of the component and its connections on the display. The graphical displays are standardized for each functional component or operation of a program test set, as well as being standardized between program test sets. The macros further allow a program test set to be more efficiently developed by coding macros rather than by developing graphical displays. The combined macros for the entire test set provide written documentation for the program test set, allowing for easy configuration management of the program test set.

DTIC

Software Engineering; Configuration Management; Computer Information Security; Computer Programs; Program Verification (Computers)

19980209836 Sandia Labs., Livermore, CA USA

Jess: The Java expert system shell

Friedman-Hill, E. J., Sandia Labs., USA; Nov. 1997; 44p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-98-8206; DE98-051308; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report describes Jess, a clone of the popular CLIPS expert system shell written entirely in Java. Jess supports the development of rule-based expert systems which can be tightly coupled to code written in the powerful, portable Java language. The syntax of the Jess language is discussed, and a comprehensive list of supported functions is presented. A guide to extending Jess by writing Java code is also included.

DOE

Applications Programs (Computers); Expert Systems

19980209996 Los Alamos National Lab., NM USA

MC++ and a transport physics framework

Lee, S. R., Los Alamos National Lab., USA; Cummings, J. C., Los Alamos National Lab., USA; Nolen, S. D., Texas A&M Univ., USA; Keen, N. D., New Mexico Univ., USA; 1997; 4p; In English; International Conference on Computational Physics, 15-19 Dec. 1997, Marina del Rey, CA, USA

Contract(s)/Grant(s): W-7405-eng-36

Report No.(s): LA-UR-97-2399; CONF-971218; DE97-008621; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Department of Energy has launched the Accelerated Strategic Computing Initiative (ASCI) to address a pressing need for more comprehensive computer simulation capabilities in the area of nuclear weapons safety and reliability. In light of the decision by the US Government to abandon underground nuclear testing, the Science-Based Stockpile Stewardship (SBSS) program is focused on using computer modeling to assure the continued safety and effectiveness of the nuclear stockpile. The authors believe that the utilization of object-oriented design and programming techniques can help in this regard. Object-oriented programming (OOP) has become a popular model in the general software community for several reasons. MC++ is a specific ASCI-relevant application project which demonstrates the effectiveness of the object-oriented approach. It is a Monte Carlo neutron transport code written in C++. It is designed to be simple yet flexible, with the ability to quickly introduce new numerical algorithms or representations of the physics into the code. MC++ is easily ported to various types of UNIX workstations and parallel computers such as the three new ASCI platforms, largely because it makes extensive use of classes from the Parallel Object-Oriented Methods and Applications (POOMA) C++ class library. The MC++ code has been successfully benchmarked using some simple physics test problems, has been shown to provide comparable serial performance and a parallel efficiency superior to that of a well-known Monte Carlo neutronics package written in FORTRAN, and was the first ASCI-relevant application to run in parallel on all three ASCI computing platforms.

DOE

C++ (Programming Language); Parallel Computers; Object-Oriented Programming; Nuclear Weapons; Computerized Simulation; Algorithms; Neutron Distribution

19980210009 National Inst. of Standards and Technology, Manufacturing Systems Integration Div., Gaithersburg, MD USA

Production Systems Engineering: Requirements Analysis for Discrete-Event Simulation

Bartolotta, A., National Inst. of Standards and Technology, USA; McLean, C., National Inst. of Standards and Technology, USA; Lee, Y. T., National Inst. of Standards and Technology, USA; Jones, A., National Inst. of Standards and Technology, USA; Apr. 1998; 54p; In English

Report No.(s): PB98-144561; NISTIR-6154; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document describes the results of the requirement analysis phase for a neutral interface specification to discrete event simulation software. The interface specification should provide a neutral mechanism capable of describing input data to a discrete-event simulation system for manufacturing systems, independent from any particular commercial software system. This document defines the context, scope and information requirements for discrete-event simulation models of manufacturing systems, according to the guidelines established for National Institute of Standards and Technology Initial Manufacturing Exchange Specification (IMES).

NTIS

Production Engineering; Systems Engineering; Requirements; Simulation; User Requirements

19980210100 Sandia National Labs., Livermore, CA USA

The IDES framework: A case study in development of a parallel discrete-event simulation system

Nicol, D. M., Dartmouth Coll., USA; Johnson, M. M., Sandia National Labs., USA; Yoshimura, A. S., Sandia National Labs., USA; [1997]; 8p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-8650C; DE97-054448; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This tutorial describes considerations in the design and development of the IDES parallel simulation system. IDES is a Java-based parallel/distributed simulation system designed to support the study of complex large-scale enterprise systems. Using the

IDES system as an example, the authors discuss how anticipated model and system constraints molded the design decisions with respect to modeling, synchronization, and communication strategies.
DOE
Complex Systems; Applications Programs (Computers); Systems Simulation; Computerized Simulation; Distributed Processing; Parallel Processing (Computers); Systems Engineering

19980210167 National Inst. of Standards and Technology, High Performance Systems and Services Div., Gaithersburg, MD USA
User Guide to CADMUS, a Simplified Parallel Routine for Laplacian-Fractal Growth
Fowler, H. A., National Inst. of Standards and Technology, USA; Devaney, J. E., National Inst. of Standards and Technology, USA; Hagedorn, J. G., National Inst. of Standards and Technology, USA; Jun. 1998; 22p; In English
Report No.(s): PB98-146277; NISTIR-6180; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High-voltage breakdown in liquid dielectric is simulated as growth of a stochastic Laplacian fractal. The model is contained in a software package that is written in FORTRAN 90 with data parallel extensions for distributed execution. These extensions encapsulate an underlying, invisible message-passing environment (MPI), thus enabling the solution of memory intensive problems on a group of limited-memory processors. Block-partitioning creates processes of reasonable size, which operate in parallel like small copies of the original code. The user needs only to express his model in transparent array-directed commands; parallel interfacing between blocks is handled invisibly. Breakdown is performed in parallel, in each of the local blocks.
NTIS
Applications Programs (Computers); Dielectrics; Encapsulating; Stochastic Processes; Transparence

19980210234 ESDU International Ltd., London UK
OSMEC. Computer-Aided Mechanism Design: Installation
Dec. 1997; 10p; In English; Included in the Mechanisms Sub-series
Report No.(s): ESDU-97023; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97023 describes the installation details, hardware requirements and configuration details for OSMEC, a general-purpose mechanism design program. The configuration details of associated printers and plotters are also provided. The program is provided compiled on disc for use on PC compatibles running DOS. ESDU 97026 is a user manual for the program, and describes its capabilities and use fully.
Author
User Manuals (Computer Programs); Computer Aided Design; Hardware; Requirements

19980210236 ESDU International Ltd., London UK
OSMEC. Computer-Aided Mechanism Design: User Manual
Dec. 1997; 79p; In English; Included in the Mechanisms Sub-series
Report No.(s): ESDU-97026; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU)97026 is a user manual for OSMEC, a design program that can model plane mechanisms composed of links with pivoted or sliding joints, gears, and springs driven by cranks, pistons, trunnion mounted rams, or cams (in which case it can interface with the cam design program, OSCAM). The mechanisms may be high-speed and carry large loads. The program is menu driven with extensive help facilities, displays static or animated sketches of the mechanism, and outputs tables and graphs of positions of points, velocities, accelerations, driving and bearing forces, and drive torque. The dimensions, masses, moments of inertia, and loads can be altered easily and the effects of the changes are immediately analysed and displayed. External loads can be applied to any link as forces or torques or by linear or torsion springs. An extensive library of mechanism models representing the majority of planar linkages found in practice is included. Any display can be sent to a printer or plotter or can be converted to other formats such as HPGL for use in other applications. A DXF file can be exported to CAD software. ESDU 97023 describes the installation and the requirements for the hardware including configuration details of associated printers and plotters.
Author
Computer Aided Design; User Manuals (Computer Programs); Display Devices; Design Analysis; Mechanical Devices

19980210278 Sandia National Labs., Albuquerque, NM USA
Solid model design simplification
Ames, A. L., Sandia National Labs., USA; Rivera, J. J., Sandia National Labs., USA; Webb, A. J., Sandia National Labs., USA;

Hensinger, D. M., Sandia National Labs., USA; Dec. 1997; 39p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3141; DE98-002693; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper documents an investigation of approaches to improving the quality of Pro/Engineer-created solid model data for use by downstream applications. The investigation identified a number of sources of problems caused by deficiencies in Pro/Engineer's geometric engine, and developed prototype software capable of detecting many of these problems and guiding users towards simplified, useable models. The prototype software was tested using Sandia production solid models, and provided significant leverage in attacking the simplification problem.

DOE

Simplification; Engineers; Prototypes

19980210279 Argonne National Lab., IL USA

Using ADIFOR and ADIC to provide Jacobians for the SNES component of PETSc

Wu, Po-Ting, Argonne National Lab., USA; Bischof, C. H., Argonne National Lab., USA; Hovland, P. D., Argonne National Lab., USA; Nov. 1997; 41p; In English
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/MCS-TM-233; DE98-002695; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The solution of large-scale nonlinear problems is important to many areas of computational science. The SNES component of PETSc provides a robust and flexible suite of numerical routines for the solving such problems. These routines generally utilize the Jacobian matrix. We present a strategy for using ADIFOR or ADIC to assist in the development of a subroutine for computing this matrix. We illustrate this strategy using one of the PETSc example programs and four different approaches to computing the Jacobian via automatic differentiation.

DOE

Subroutines; Computer Programs; Jacobi Matrix Method

19980210317 Fermi National Accelerator Lab., Batavia, IL USA

Open inventor and virtual reality at Fermilab

Boehnlein, A., Fermi National Accelerator Lab., USA; Kallenbach, J., Fermi National Accelerator Lab., USA; Lebrun, P., Fermi National Accelerator Lab., USA; Apr. 1997; 7p; In English; Computing In High Energy Physics, 7-12 Apr. 1997, Berlin, Germany
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/081; CONF-970410; DE97-052741; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We discuss our experiences with Open Inventor and with basic tools and techniques of Virtual Reality, including some preliminary results from an immersive system.

DOE

Virtual Reality; Conferences; Computerized Simulation

19980210386 Physics and Electronics Lab. TNO, The Hague, Netherlands

Software Specifications BIAS

Bennis, H. G. M., Physics and Electronics Lab. TNO, Netherlands; Onderwater, A. P. T. M., Physics and Electronics Lab. TNO, Netherlands; Sep. 1997; 76p; In English
Contract(s)/Grant(s): A97KL790
Report No.(s): TNO-FEL-97-A253; TD97-0154; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., PO Box 96864, 2509 JG The Hague, The Netherlands); US Sales Only, Hardcopy, Microfiche

This document describes the Software Requirement Specifications(SRS) and the Recommendations Software Specifications(RSS) for a BIt Analysis System(BIAS) for the Royal Dutch Army. This BIAS is a system to analyse intercepted long, haul digital communications links. The SRS is developed according to MIL-STD-498. The resulting SRS shall be used to define and implement a BIAS or redefine an existing, analysis program.

Author

Communication Networks; Specifications; Recommendations

19980210393 Instituto Nacional de Tecnica Aeroespacial, Div. de Aerodinamica, Torrejon de Ardoz, Spain

General Files Format. Vortice: General Development, Version 1.2 ***Formatos de ficheros generales. Vortice: Desarrollo general, Version 1.2***

Scanchez-Martinez, Francisco J., Instituto Nacional de Tecnica Aeroespacial, Spain; Oct. 31, 1997; 19p; In Spanish

Report No.(s): AT/TNO/4510/013/INTA/97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In this document are presented the present versions of the general formats of input and output files, used in Vortice project. It is made a description of each of formats used by the UNSEULD2D code.

Author

Document Storage; Product Development

19980210459 Energia Nucleare e Delle Energie Alternative, Funzione Centrale Studi, Rome, Italy

A software system for the analysis of the 'giornate' sequences in frescoes

Bordoni, L., Energia Nucleare e Delle Energie Alternative, Italy; Seccaroni, C., Energia Nucleare e Delle Energie Alternative, Italy; Bertorello, C., Rome Univ., Italy; Martellotti, G., Rome Univ., Italy; Martellotti, G., Rome Univ., Italy; Colagrossi, A., Consiglio Nazionale delle Ricerche, Italy; Jul. 1997; ISSN 0393-6317; 13p; In English

Report No.(s): ENEA-RT-STUDI-97-03; DE98-728530; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

This paper reports on a software system for the analysis of the 'giornate' sequences in frescoes, based on mathematical modelling. This model takes into account whole 'giornate' and the relations defined on them by the temporal precedence in their realization. A sample application is provided on frescoes by Luca Signorelli in the Cappella di San Brizio in the Orvieto Cathedral.

DOE

Sequencing; Culture Techniques; Time Measurement; Software Development Tools

19980210490 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

Report on the Second International Workshop on Development and Evolution of Software Architectures for Product Families

Clements, Paul C., Carnegie-Mellon Univ., USA; Weiderman, Nelson, Carnegie-Mellon Univ., USA; May 1998; 29p; In English; 2nd; Development and Evolution of Software Architectures for Product Families, 1998, Unknown

Report No.(s): AD-A346343; CMU/SEI-98-SR-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In February 1998, the European Architectural Reasoning for Embedded Software (ARES) project sponsored the Second International Workshop on Development and Evolution of Software Architectures for Product Families. The workshop brought together practitioners and academics from Europe and the United States who are working in the area of software product families; that is, the production of related software systems from a common set of core assets. Chief among those assets is a shared software and/or system architecture. This workshop explored problems of architecture creation, description, evaluation, recovery, and architecture-based process in the context of building a product family. This report summarizes the discussions and outcomes of the workshop.

DTIC

Architecture (Computers); Software Engineering; Conferences

19980210533 Lawrence Livermore National Lab., Livermore, CA USA

Development of a common software interface

Davis, B., Lawrence Livermore National Lab., USA; Parrett, J., Lawrence Livermore National Lab., USA; Jun. 16, 1997; 24p; In English

Contract(s)/Grant(s): W-7405-ENG-48; W-7405-Eng-48

Report No.(s): UCRL-ID-127777; DE98-050903; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The variety of applications, databases, and information technologies makes it difficult to locate and retrieve information or applications that are otherwise openly available. The promise of the World Wide Web was that it was a paradigm for organizing and distributing information. Under this project, we looked at how we could more tightly couple the Web with the UNIX operating system for exchanging information, connecting programs and data, and facilitating collaboration between people in a more natural way. Ease of secure access and the ability to have electronic dialogues on specific questions will become increasingly important

as the pressure Increases for scientists and analysts to rapidly access diverse information to make informed judgments and initiate new lines of Investigation.
DOE
Computer Programming; Computer Networks; Display Devices; Interfaces

19980210541 Lawrence Livermore National Lab., Livermore, CA USA
Secure software distribution system
Bartoletti, T., Lawrence Livermore National Lab., USA; Dobbs, L. A., Lawrence Livermore National Lab., USA; Kelley, M., Lawrence Livermore National Lab., USA; Feb. 01, 1997; 15p; In English; National Information Systems Security Conference, 7 Oct. 1997, Baltimore, MD, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-123354; CONF-971034; DE98-050913; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Authenticating and upgrading system software plays a critical role in information security, yet practical tools for assessing and installing software are lacking in today's marketplace. The Secure Software Distribution System (SSDS) will provide automated analysis, notification, distribution, and installation of security patches and related software to network-based computer systems in a vendor-independent fashion. SSDS will assist with the authentication of software by comparing the system's objects with the patch's objects. SSDS will monitor vendor's patch sites to determine when new patches are released and will upgrade system software on target systems automatically. This paper describes the design of SSDS. Motivations behind the project, the advantages of SSDS over existing tools as well as the current status of the project are also discussed.
DOE
Computer Information Security; Computer Networks; Computer Programs; Computer Systems Programs

19980210543 Lawrence Livermore National Lab., Livermore, CA USA
PCS a code system for generating production cross section libraries
Cox, L. J., Lawrence Livermore National Lab., USA; Apr. 01, 1997; 37p; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-ID-127184; DE98-051043; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This document outlines the use of the PCS Code System. It summarizes the execution process for generating FORMAT 2000 production cross section files from FORMAT 2000 reaction cross section files. It also describes the process of assembling the ASCII versions of the high energy production files made from ENDL and Mark Chadwick's calculations. Descriptions of the function of each code along with its input and output and use are given.
DOE
Libraries; Data Management

19980210558 California Univ., Electronics Research Lab., Berkeley, CA USA
Autonomous Image Processing Algorithms Locate Region-of-Interests: The Mars Rover Application ***Final Report***
Privitera, Claudio, California Univ., USA; Azzariti, Michela, California Univ., USA; Stark, Lawrence W., California Univ., USA; Mar. 10, 1998; 22p; In English
Contract(s)/Grant(s): NCC2-998
Report No.(s): NASA/CR-1998-208289; NAS 1.26:208289; UCB/ERL-M98/8; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

In this report, we demonstrate that bottom-up IPA's, image-processing algorithms, can perform a new visual task to select and locate Regions-Of-Interests (ROIs). This task has been defined on the basis of a theory of top-down human vision, the scanpath theory. Further, using measures, Sp and Ss, the similarity of location and ordering, respectively, developed over the years in studying human perception and the active looking role of eye movements, we could quantify the efficient and efficacious manner that IPAs can imitate human vision in located ROIS. The means to quantitatively evaluate IPA performance has been an important part of our study. In fact, these measures were essential in choosing from the initial wide variety of IPAS, that particular one that best serves for a type of picture and for a required task. It should be emphasized that the selection of efficient IPAs has depended upon their correlation with actual human chosen ROIs for the same type of picture and for the same required task accomplishment.
Author
Image Processing; Algorithms; Autonomy

19980210711 Los Alamos National Lab., NM USA

Second biennial tri-laboratory engineering conference on modeling and simulation

[1997]; 100p; In English; 2nd; Biennial Tri-laboratory Engineering Conference on Modeling and Simulation, 12 4 Nov. 1997, Santa Fe, NM, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): CONF-971187-Absts.; DE98-002946; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This conference was divided into eight sessions. Session one covered the following topics: material behavior and characterization; computation heat transfer; computational fluid dynamics; and hydrodynamics. Topics covered in session two were: structural dynamics; manufacturing process modeling; solid and structural mechanics; and electromagnetics. Session three topics were: materials behavior and characterization; computational heat transfer; computational fluid dynamics; neutron generators and gas transfer systems applications. Topics for session four were: mesh generation and visualization; validation and verification; and pit manufacturing. Session five covered the following: ALE techniques and applications; solid and structural mechanical; and system applications. The three topics of session six were: optimization methods; manufacturing process modeling; and weapon response in hostile environments. Session covered: material behavior and characterization; computational heat transfer; solid and structural mechanics; and mesh generation and visualization. And finally, the topics of session 8 were: manufacturing and process modeling; solid and structural mechanics; uncertainty analysis; and structural dynamics. Paper covered a range of applications, many of which were weapons and weapon systems.

DOE

Conferences; Mathematical Models; Computerized Simulation

19980210774 Florida International Univ., School of Computer Science, Miami, FL USA

A Theoretical Framework for Specification Refinement Via Transformations ***Final Report, Jul. 1996 - Aug. 1997***

Attie, Paul, Florida International Univ., USA; May 1998; 32p; In English

Contract(s)/Grant(s): F30602-96-1-0249; AF Proj. 2304

Report No.(s): AD-A348660; AFRL-IF-RS-TR-1998-70; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The idea of successively refining an abstract specification until it contains enough detail to suggest an implementation has been investigated by numerous researchers. The emphasis to date has been on techniques that, unfortunately, lead to a large amount of manual labor for each refinement step. With such techniques, both the cost and the possibility of errors arising in the formal manipulation are high. Using a theorem prover can reduce the number of manipulation errors, but the amount of labor involved is daunting. This research explores an alternative solution to the refinement problem, namely the use of syntactic transformations to realize each refinement step. We reduce formal labor by employing automatic transformations that guarantee the preservation of desirable properties such as deadlock freedom, safety, and liveness of process-algebraic specifications. This report presents three syntactic transformations that can be used to replace an atomic action in a concurrent program by a program fragment. We include applicability conditions for these transformations, and show that deadlock freedom and certain liveness properties are preserved when the transformations are applied in a context where the applicability conditions are satisfied.

DTIC

Refining; Concurrent Engineering; Computer Programs

62
COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19980206521 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK

The Web

Randell, B., Editor, Newcastle-upon-Tyne Univ., UK; Sep. 1997; 234p; In English; Joint International Computers Limited/University of Newcastle Seminar, 1-5 Sep. 1997, Newcastle, UK

Report No.(s): PB98-147796; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche

Contents include the following: On the Limits of Steganography; Security in Clinical Information System; The Virtual University; Strategic and Tactical Uses of the Web: The Stanford University Libraries Program; Highwire Press, the Internet Imprint of Stanford University; The Future of Telecommunications and Networking - an Attempt to Predict the Unpredictable; URL's Considered Harmful: Large Scale Information Management for the Web; Global Web Search; Document Formats for the Web;

Tools for Intercreativity on the Web; Constructing Dependable Web Services; What are Rights and Why and How Should They be Managed; Distributed Middleware Tools for Trusted Electronic Inter-Actions; and Discussions.
NTIS
World Wide Web; Telecommunication; Conferences

19980206602 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Morphisms for Inhibitor Nets and Related Transition Systems
Pietkiewicz-Koutny, M., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 38p; In English
Report No.(s): PB98-147838; TRS-613; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The authors consider Elementary Net Systems (ENI-systems) with inhibitor arcs executed according to the a-priori semantics, and transition systems generated by them (TSENI). The relationship between nets and their transition systems is established via the notion of a region. The authors introduce morphisms both for the ENI-systems, and for the TSENI transition systems. The authors then define the category of ENI-systems CAT(sub ENI), and the category of TSENI transition systems CAT(sub TSENI), as well as functors between them. Finally, the authors prove that the functors between categories CAT(Sub ENI) and CAT(sub TSENI) form an adjunction.
NTIS
Petri Nets; Regions; Nets; Inhibitors; Categories

19980206603 Newcastle-upon-Tyne Univ., Dept. of Computing Scinece, Newcastle, UK
Identifying State Coding Conflicts in Asynchronous System Specifications Using Petri Net Unfoldings
Kondratyev, A., Newcastle-upon-Tyne Univ., UK; Cortadella, J., Newcastle-upon-Tyne Univ., UK; Kishinevsky, M., Newcastle-upon-Tyne Univ., UK; Lavagno, L., Newcastle-upon-Tyne Univ., UK; Taubin, A., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 38p; In English
Report No.(s): PB98-147820; TRS-614; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

State coding conflict detection is a fundamental part of synthesis of asynchronous concurrent systems from their specifications as Signal Transit Graphs (STGs), which are a special kind of labelled Petri nets. The paper develops a method for identifying state coding conflicts in STGs that is intended to work within a new synthesis framework based on Petri net unfolding. The latter offers potential advantages due to a partial order representation of highly concurrent behavior as opposed to the more traditional construction of a stage graph, known to suffer from combinatorial explosion. The authors develop a necessary condition for coding conflicts to exist, by using an approximate state covering approach. A technique for refining the latter, with extra computational cost, is provided.
NTIS
Petri Nets; Logic Design; Systems Analysis; Coding; Identifying

19980206738 Sandia National Labs., Albuquerque, NM USA
The development and performance of a message-passing version of the PAGOSA shock-wave physics code
Gardner, D. R., Sandia National Labs., USA; Vaughan, C. T., Sandia National Labs., USA; Oct. 1997; 115p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2551; DE98-001271; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A message-passing version of the PAGOSA shock-wave physics code has been developed at Sandia National Laboratories for multiple-instruction, multiple-data stream (MIMD) computers. PAGOSA is an explicit, Eulerian code for modeling the three-dimensional, high-speed hydrodynamic flow of fluids and the dynamic deformation of solids under high rates of strain. It was originally developed at Los Alamos National Laboratory for the single-instruction, multiple-data (SIMD) Connection Machine parallel computers. The performance of Sandia's message-passing version of PAGOSA has been measured on two MIMD machines, the nCUBE 2 and the Intel Paragon XP/S. No special efforts were made to optimize the code for either machine. The measured scaled speedup (computational time for a single computational node divided by the computational time per node for fixed computational load) and grind time (computational time per cell per time step) show that the MIMD PAGOSA code scales linearly with the number of computational nodes used on a variety of problems, including the simulation of shaped-charge jets perforating an oil well casing. Scaled parallel efficiencies for MIMD PAGOSA are greater than 0.70 when the available memory per node is filled (or nearly filled) on hundreds to a thousand or more computational nodes on these two machines, indicating that

the code scales very well. Thus good parallel performance can be achieved for complex and realistic applications when they are first implemented on MIMD parallel computers.
DOE
Applications Programs (Computers); Message Processing; Three Dimensional Flow; Hydrodynamics; MIMD (Computers)

19980209950 Sandia National Labs., Albuquerque, NM USA
PNNI routing support for ad hoc mobile networking: A flat architecture
Martinez, L., Sandia National Labs., USA; Sholander, P., Sandia National Labs., USA; Tolendino, L., Sandia National Labs., USA; [1997]; 6p; In English, 10 Apr. 1995, Denver, CO, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2898C; CONF-9504139; DE98-001383; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This contribution extends the Outside Nodal Hierarchy List (ONHL) procedures described in ATM Form Contribution 97-0766. These extensions allow multiple mobile networks to form either an ad hoc network or an extension of a fixed PNNI infrastructure. This contribution covers the simplest case where the top-most Logical Group Nodes (LGNs), in those mobile networks, all reside at the same level in a PNNI hierarchy. Future contributions will cover the general case where those top-most LGNs reside at different hierarchy levels. This contribution considers a flat ad hoc network architecture--in the sense that each mobile network always participates in the PNNI hierarchy at the preconfigured level of its top-most LGN.
DOE
Architecture (Computers); Computer Networks; Data Transfer (Computers)

19980209969 Sandia National Labs., Albuquerque, NM USA
Network congestion can be controlled: Routing algorithms in optical networks and Ethernets
Goldberg, L. A., Sandia National Labs., USA; MacKenzie, P. D., Sandia National Labs., USA; Greenberg, D. S., Sandia National Labs., USA; Dec. 1997; 42p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-95-0974; DE98-001780; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Congestion and contention can greatly reduce the effective performance of an interconnection network. This report gathers together research done under a Laboratory Research and Development Program (LDRD) project at Sandia National Laboratories. The goal of the project was to explore the contention properties of novel optical interconnects. In the process of exploring optical interconnects the project also gained new insights into the use of backoff protocols in the current dominant interconnect technology, Ethernet.
DOE
Optical Interconnects; Protocol (Computers); Computer Networks

19980209994 Los Alamos National Lab., NM USA
Deeper sparsely nets are size-optimal
Beiu, V., Los Alamos National Lab., USA; Makaruk, H. E., Los Alamos National Lab., USA; 1997; 7p; In English; Neural Information Processing Systems, 1-6 Dec. 1997, Denver, CO, USA
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-UR-97-1916; CONF-971217; DE97-008149; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The starting points of this paper are two size-optimal solutions: (1) one for implementing arbitrary Boolean functions; and (2) another one for implementing certain sub-classes of Boolean functions. Because VLSI implementations do not cope well with highly interconnected nets-the area of a chip grows with the cube of the fan-in-this paper will analyze the influence of limited fan-in on the size optimality for the two solutions mentioned. First, the authors will extend a result from Horne and Hush valid for fan-in (Delta) = 2 to arbitrary fan-in. Second, they will prove that size-optimal solutions are obtained for small constant fan-in for both constructions, while relative minimum size solutions can be obtained for fan-ins strictly lower than linear. These results are in agreement with similar ones proving that for small constant fan-ins ((Delta) = 6...9) there exist VLSI-optimal (i.e. minimizing AT(sup 2)) solutions, while there are similar small constants relating to the capacity of processing information.
DOE
Boolean Functions; Optimization; Neural Nets; Integrated Circuits; Chips; Distribution Functions

19980210019 Sandia National Labs., Albuquerque, NM USA

Experiences implementing the MPI standard on Sandia's lightweight kernels

Brightwell, R., Sandia National Labs., USA; Greenberg, D, S., Sandia National Labs., USA; Oct. 1997; 21p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2519; DE98-001586; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

This technical report describes some lessons learned from implementing the Message Passing Interface (MPI) standard, and some proposed extensions to MPI, at Sandia. The implementations were developed using Sandia-developed lightweight kernels running on the Intel Paragon and Intel TeraFLOPS platforms. The motivations for this research are discussed, and a detailed analysis of several implementation issues is presented.

DOE

Messages; Massively Parallel Processors; Supercomputers

19980210415 Los Alamos National Lab., NM USA

Transactional memories: A new abstraction for parallel processing

Fasel, J. H., Los Alamos National Lab., USA; Lubeck, O. M., Los Alamos National Lab., USA; Agrawal, D., California Univ., USA; Bruno, J. L., California Univ., USA; El Abbadi, A., California Univ., USA; [1997]; 6p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3254; DE98-001513; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). Current distributed memory multiprocessor computer systems make the development of parallel programs difficult. From a programmer's perspective, it would be most desirable if the underlying hardware and software could provide the programming abstraction commonly referred to as sequential consistency--a single address space and multiple threads; but enforcement of sequential consistency limits opportunities for architectural and operating system performance optimizations, leading to poor performance. Recently, Herlihy and Moss have introduced a new abstraction called transactional memories for parallel programming. The programming model is shared memory with multiple threads. However, data consistency is obtained through the use of transactions rather than mutual exclusion based on locking. The transaction approach permits the underlying system to exploit the potential parallelism in transaction processing. The authors explore the feasibility of designing parallel programs using the transaction paradigm for data consistency and a barrier type of thread synchronization.

DOE

Parallel Processing (Computers); Memory (Computers); Architecture (Computers); Multiprocessing (Computers)

19980210571 Los Alamos National Lab., NM USA

Performance of the BLAS-1 and other mathematical kernels on the SGI/Cray Origin 2000 processor

Dearholt, W., Los Alamos National Lab., USA; Joubert, W., Los Alamos National Lab., USA; Aug. 1997; 16p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3891; DE98-001570; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The purpose of this paper is to explore issues related to the computation and communication performance of the Basic Linear Algebra Subroutines (BLAS-1) and related kernels on the SGI/Cray Origin 2000 parallel computer. Experiments are performed both on vendor-supplied mathematical library routines as well as hand-coded loops and array syntax. The goal of this study is to get a better understanding of performance issues pertaining to the Origin 2000 architecture.

DOE

Cray Computers; Parallel Processing (Computers); Algebra

19980210572 Los Alamos National Lab., NM USA

Compressed fields in the POOMA framework: Design, implementation, and performance

Bassetti, F., Los Alamos National Lab., USA; Karmesin, S., Los Alamos National Lab., USA; Williams, T., Los Alamos National Lab., USA; Reynders, J., Los Alamos National Lab., USA; [1998]; 8p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3890; DE98-001571; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The POOMA framework is a C++ class library for doing large scale parallel computations. POOMA's Field class implements a multidimensional data parallel array annotated with mesh coordinate information. The Field class breaks up the whole domain into sub-blocks and transparently compresses constant blocks down to a single value to improve the memory and computational efficiency. This allows the user to simply and efficiently simulate phenomena that are taking place in a small fraction of the domain. We examine the cache and computational benefits associated with this capability. The algorithm implementation is based on the fact that if we have a large constant region in the field we only need to store one value for that region. In this paper we will describe the design of compressed fields, their implementation in the POOMA framework, and the performance of this technique on an Silicon Graphics Inc. Origin 2000.
DOE
Algorithms; Parallel Processing (Computers); Computation

19980210788 Lawrence Livermore National Lab., Livermore, CA USA
Go ahead, visit those web sites, you can't get hurt, can you?
Rothfuss, J. S., Lawrence Livermore National Lab., USA; Parrett, J. W., Lawrence Livermore National Lab., USA; Feb. 01, 1997; 18p; In English; National Information Systems Security Conference, 7 Oct. 1997, Baltimore, MD, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-128433; CONF-971034; DE98-050768; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Browsing (surfing) the World Wide Web (the web) has exploded onto the Internet with an unprecedented popularity. Fueled by massive acceptance, the web client/server technology is leaping forward with a speed that competes with no other software technology. The primary force behind this phenomenon is the simplicity of the web browsing experience. People who have never touched a computer before can now perform sophisticated network tasks with a simple point-and-click. Unfortunately, this simplicity gives many, if not most, web wanderers the impression that the web browser is risk free, nothing more than a high powered television. This misconception is dangerous by creating the myth that a user visiting a web site is immune from subversive or malicious intent. While many want you to believe that surfing the web is as simple as using any other household appliance, it is not like surfing television channels, it is bi-directional. You can learn a lot of useful information from web sites. But, either directly or indirectly, others can also learn quite a bit about you. Of even more concern is a web sites' potential ability to exert control over the local computer. This paper tries to consolidate some of the current concerns that you should consider as you jump into the surf.
DOE
World Wide Web; Software Engineering

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CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also 54 Man/System Technology and Life Support.

19980206510 Notre Dame Univ., Dept. of Electrical Engineering, IN USA
Fast Algorithms for Hybrid Control System Design ***Final Report, Aug. 1995 - Aug 1997***
Lemmon, Michael D., Notre Dame Univ., USA; Antsaklis, Panos J., Notre Dame Univ., USA; Jan. 05, 1998; 229p; In English
Contract(s)/Grant(s): DAAH04-95-1-0600
Report No.(s): AD-A344941; ISIS-98-001; ARO-34586.20-MA; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Hybrid dynamical systems are systems generating a mixture of continuous valued and discrete event signals. Such systems provide a convenient modeling framework for a variety of complex engineering systems; manufacturing systems, power distribution networks, air traffic control networks, and battlefield management systems. Such systems arise frequently in the supervision of complex dynamical processes. This project examined three aspects of hybrid system analysis and design: (1) multiple model identification, (2) supervisor synthesis, and (3) hybrid system interface design. The objective of this project was to produce computationally efficient algorithms for solving these problems. The project was successful in meetings these goals.
DTIC
Algorithms; Systems Engineering; Systems Analysis; Management Systems; Control Systems Design; Adaptive Control

19980206704 Naval Postgraduate School, Monterey, CA USA
Virtual Environments and Wayfinding in the Natural Environment
Banker, William P., Naval Postgraduate School, USA; Sep. 1997; 165p; In English

Report No.(s): AD-A341166; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The purpose of this study was to determine if a Virtual Environment (VE) model of a natural environment could provide familiarity training transfer. The methods used included aspects from sport orienteering. 15 male participants comprising three ability groups participated within three treatment groups. The treatment groups were comprised of a map study, map and VE study, and an actual environment study. The results indicated that navigational ability had a more pronounced effect on performance then did treatment group. However, among the treatment groups, the intermediate ability group seemed to benefit the most from the VE. Within the VE treatment, the beginner ability group seemed to suffer from excess workload, while the advanced group found the VE treatment only useful for pinpointing the location of the marker. The results indicate that a properly designed VE can, through training, impart a familiarity with a selected natural environment area, better than map study for all except the most sophisticated land navigators. Further study is needed to examine aspects of the VE, how they need to be represented, and what other refinements or features could be included in such a VE in order to maximize training transfer.

DTIC

Virtual Reality; Transfer of Training; Environment Models; Geographic Information Systems

19980206737 Lawrence Livermore National Lab., Livermore, CA USA

Optical control, diagnostic, and power supply system for a solid state induction modulator

Saethre, R., Bechtel Nevada Corp., USA; Kirbie, H., Lawrence Livermore National Lab., USA; Hickman, B., Lawrence Livermore National Lab., USA; Lee, B., Lawrence Livermore National Lab., USA; Ollis, C., Lawrence Livermore National Lab., USA; Jun. 1997; 9p; In English; 11th; Pulsed Power, 29 Jun. - 2 Jul. 1997, Baltimore, MD, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-127142; DOE/NV/11718-132; CONF-9706113; DE98-050258; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A new high speed optical control, diagnostic, and power supply system has been developed for a solid state induction modulator. The modulator consists of a large array of field effect transistors (FETs) that switch a high-voltage pulse across a tape-wound magnetic core. The FETs within the modulator are mounted on numerous circuit boards that are stacked in series for high-voltage operation. The new optical system overcomes the issue of voltage isolation by supplying each circuit board with optically coupled control power and high bandwidth signal information. An optical fiber is used to transmit laser light to a custom photovoltaic cell that provides dc power to the on-board control circuits. Optical fiber technology is again used to convey a pulse that contains detailed analog features to the FET gate controls. Diagnostic data and status information are also obtained from each board by similar optical methods.

DOE

Field Effect Transistors; Fiber Optics; Modulators; Optical Control; Electric Power Supplies

19980206781 Sandia National Labs., Albuquerque, NM USA

Neural networks for damage identification

Paez, T. L., Sandia National Labs., USA; Klenke, S. E., Sandia National Labs., USA; 1997; 10p; In English; Intelligent NDW Sciences for Aging and Futuristic Aircraft, 30 Sep. - 2 Oct. 1997, El Paso, TX, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-2724C; CONF-9709128; DE98-001040; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Efforts to optimize the design of mechanical systems for preestablished use environments and to extend the durations of use cycles establish a need for in-service health monitoring. Numerous studies have proposed measures of structural response for the identification of structural damage, but few have suggested systematic techniques to guide the decision as to whether or not damage has occurred based on real data. Such techniques are necessary because in field applications the environments in which systems operate and the measurements that characterize system behavior are random. This paper investigates the use of artificial neural networks (ANNs) to identify damage in mechanical systems. Two probabilistic neural networks (PNNs) are developed and used to judge whether or not damage has occurred in a specific mechanical system, based on experimental measurements. The first PNN is a classical type that casts Bayesian decision analysis into an ANN framework; it uses exemplars measured from the undamaged and damaged system to establish whether system response measurements of unknown origin come from the former class (undamaged) or the latter class (damaged). The second PNN establishes the character of the undamaged system in terms of a kernel density estimator of measures of system response; when presented with system response measures of unknown origin, it makes a probabilistic judgment whether or not the data come from the undamaged population. The physical system used to carry out the experiments is an aerospace system component, and the environment used to excite the system is a stationary random vibra-

tion. The results of damage identification experiments are presented along with conclusions rating the effectiveness of the approaches.
DOE
Neural Nets; Damage; Bayes Theorem; Statistical Analysis; Structural Members; Decision Theory

19980209875 Sandia National Labs., Albuquerque, NM USA
Dynamical system modeling via signal reduction and neural network simulation
Paez, T. L., Sandia National Labs., USA; Hunter, N. F., Los Alamos National Lab., USA; 1997; 11p; In English; 68th; Shock and Vibration Symposium, 3 Nov. 1997, Baltimore, MD, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2685C; CONF-971164-; DE98-000814; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Many dynamical systems tested in the field and the laboratory display significant nonlinear behavior. Accurate characterization of such systems requires modeling in a nonlinear framework. One construct forming a basis for nonlinear modeling is that of the artificial neural network (ANN). However, when system behavior is complex, the amount of data required to perform training can become unreasonable. The authors reduce the complexity of information present in system response measurements using decomposition via canonical variate analysis. They describe a method for decomposing system responses, then modeling the components with ANNs. A numerical example is presented, along with conclusions and recommendations.
DOE
Dynamical Systems; Neural Nets; Simulation; Nonlinear Systems

19980209877 Department of the Navy, Washington, DC USA
System for Assessing Stochastic Properties of Signals Representing Three Items of Mutually Orthogonal Measurement Information
OBrien, Francis J., Jr., Inventor, Department of the Navy, USA; Nguyen, Chung T., Inventor, Department of the Navy, USA; Hammel, Sherry E., Inventor, Department of the Navy, USA; Dec. 30, 1997; 10p; In English; Supersedes AD-D018020
Patent Info.: Filed 17 Jan. 1996; US-Patent-Appl-SN-605292; US-Patent-5,703,906
Report No.(s): AD-D018801; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A signal processing system provides and processes a digital signal generated in response to an analog signal, which includes a noise component and possibly also an information component representing three mutually orthogonal items of measurement information representable as a sample point in a symbolic Cartesian three-dimensional spatial reference system. A noise likelihood determination sub-system receives the digital signal and generates a random noise assessment of whether or not the digital signal comprises solely random noise, and if not, generates an assessment of degree-of-randomness. The noise likelihood determination system controls the operation of an information processing sub-system for extracting the information component in response to the random noise assessment or a combination of the random noise assessment and the degree-of-randomness assessment. The information processing system is illustrated as combat control equipment for submarine warfare. which utilizes a sonar signal produced by a towed linear transducer array. and whose mode operation employs three orthogonally related dimensions of data, namely: (1) clock time associated with the interval of time over which the sample point measurements are taken. (2) conical angle representing bearing of a passive sonar contact derived from the signal produced by the towed array. and (3) a frequency characteristic of the sonar signal.
DTIC
Stochastic Processes; Sonar; Information Systems; Sound Transducers

19980210017 NASA Ames Research Center, Moffett Field, CA USA
Comparison of Five System Identification Algorithms for Rotorcraft Higher Harmonic Control
Jacklin, Stephen A., NASA Ames Research Center, USA; May 1998; 152p; In English
Report No.(s): NASA/TP-1998-207687; A-977183; NAS 1.60:207687; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report presents an analysis and performance comparison of five system identification algorithms. The methods are presented in the context of identifying a frequency-domain transfer matrix for the higher harmonic control (HHC) of helicopter vibration. The five system identification algorithms include three previously proposed methods: (1) the weighted-least- squares-error approach (in moving-block format), (2) the Kalman filter method, and (3) the least-mean-squares (LMS) filter method. In addition there are two new ones: (4) a generalized Kalman filter method and (5) a generalized LMS filter method. The generalized Kalman filter method and the generalized LMS filter method were derived as extensions of the classic methods to permit identification

by using more than one measurement per identification cycle. Simulation results are presented for conditions ranging from the ideal case of a stationary transfer matrix and no measurement noise to the more complex cases involving both measurement noise and transfer-matrix variation. Both open-loop identification and closed- loop identification were simulated. Closed-loop mode identification was more challenging than open-loop identification because of the decreasing signal-to-noise ratio as the vibration became reduced. The closed-loop simulation considered both local-model identification, with measured vibration feedback and global-model identification with feedback of the identified uncontrolled vibration. The algorithms were evaluated in terms of their accuracy, stability, convergence properties, computation speeds, and relative ease of implementation.
Author
Algorithms; Feedback Control; Harmonic Control; Helicopters; Kalman Filters; Matrices (Mathematics); Rotary Wing Aircraft

19980210408 Los Alamos National Lab., NM USA
A human supervisory approach to rapid world modeling through the use of geometric primitives
Luck, J., Los Alamos National Lab., USA; Roberts, R., Los Alamos National Lab., USA; Aug. 11, 1997; 15p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3344; DE98-001497; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A three-dimensional world model is crucial for many robot-oriented tasks. The most efficient mapping configuration use geometric primitives to model environments, and are easy to store and process. In the past, modeling techniques have been either fully manual or autonomous. Manual methods are extremely time consuming but also highly accurate and flexible. On the other hand autonomous techniques are fast but inflexible and often inaccurate. The method presented in this paper combines the two thereby yielding a highly efficient, flexible, and accurate tool. Our methods enable a human supervisor to quickly construct a fully defined world model from unfiltered and unsegmented real-world range data.
DOE
Three Dimensional Models; Robots; Mapping

19980210418 Argonne National Lab., IL USA
Experiments with the hot list strategy
Wos, L., Argonne National Lab., USA; Oct. 1997; 75p; In English
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/MCS-TM-232; DE98-002717; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Experimentation strongly suggests that, for attacking deep questions and hard problems with the assistance of an automated reasoning program, the more effective paradigms rely on the retention of deduced information. A significant obstacle ordinarily presented by such a paradigm is the deduction and retention of one or more needed conclusions whose complexity sharply delays their consideration. to mitigate the severity of the cited obstacle, the author formulates and features in this report the hot list strategy. The hot list strategy asks the researcher to choose, usually from among the input statements, one or more clauses that are conjectured to play a key role for assignment completion. The chosen clauses - conjectured to merit revisiting, again and again - are placed in an input list of clauses, called the hot list. When an automated reasoning program has decided to retain a new conclusion C - before any other clause is chosen to initiate conclusion drawing - the presence of a nonempty hot list (with an appropriate assignment of the input parameter known as heat) causes each inference rule in use to be applied to C together with the appropriate number of members of the hot list. Members of the hot list are used to complete applications of inference rules and not to initiate applications. The use of the hot list strategy thus enables an automated reasoning program to briefly consider a newly retained conclusion whose complexity would otherwise prevent its use for perhaps many CPU-hours. to give evidence of the value of the strategy, the author focuses on four contexts: (1) dramatically reducing the CPU time required to reach a desired goal; (2) finding a proof of a theorem that had previously resisted all but the more inventive automated attempts; (3) discovering a proof that is more elegant than previously known; and (4) answering a question that had steadfastly eluded researchers relying on an automated reasoning program.
DOE
Artificial Intelligence; Automation; Proving; Neural Nets

19980210426 Allied-Signal Aerospace Co., Kansas City Div., Kansas City, MO USA
Development of a cost-effective PC-based motion control system
Hollar, D. L., Allied-Signal Aerospace Co., USA; Jan. 1998; 12p; In English
Contract(s)/Grant(s): DE-AC04-76DP-00613

Report No.(s): KCP-613-6037; DE98-051591; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A cost-effective PC-based motion control system was developed and evaluated for use on a laser welding system. The motion system is capable of X-Y simultaneous contouring and provides a rotary axis of motion also. The system motion paths can be specified in either Relative or Absolute motion. The PC controls all of the laser power supply and shutter I/O operations. All of the motion programming and operator interfacing is via the Windows(R)-95 operating system.

DOE

Laser Welding; Numerical Control; Computer Techniques; Control Equipment

19980210777 Department of the Navy, Washington, DC USA

System for Eliminating or Reducing Exemplar Noise Effects (Serene)

Palmadesso, Peter J., Inventor, Department of the Navy, USA; Antoniades, John A., Inventor, Department of the Navy, USA; Baumback, Mark M., Inventor, Department of the Navy, USA; Bowles, Jeffrey H., Inventor, Department of the Navy, USA; Grossman, John M., Inventor, Department of the Navy, USA; Mar. 12, 1998; 36p; In English

Patent Info.: Filed 12 Mar. 1998; US-Patent-Appl-SN-038925

Report No.(s): AD-D018900; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The Intelligent Hypersensor Processing System (IHPS) is a system for the rapid detection of small, weak, or hidden objects, substances, or patterns embedded in complex backgrounds, providing fast adaptive processing for demixing and recognizing patterns or signatures in data provided by certain types of 'hypersensors'. SERENE introduces an improved noise reduction algorithm useful on systems which use hypersensors such as IHPS, or other systems which use sensors which are hyper or multi spectral. The SERENE technique may be employed through out the Learning Module Processor pipelining and further processes the data stream to filter intrinsic and extrinsic noise, and minimize exemplar noise effects in the exemplar set. This system represents an alternative to prior systems for hidden object detection by solving the problems encountered when attempting to detect hidden objects/targets in dynamic scenarios at real-time.

DTIC

Noise Reduction; Detection; Real Time Operation; Signal Processing; Computer Programs

64
NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19980206788 Rutherford Appleton Lab., Computing and Information Systems Dept., Chilton, UK

Ordering Symmetric Sparse Matrices for Small Profile and Wavefront

Reid, J. K., Rutherford Appleton Lab., UK; Scott, J. A., Rutherford Appleton Lab., UK; Feb. 1998; ISSN 1362-0223; 48p; In English

Report No.(s): PB98-142763; RAL-TR-98-016; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The ordering of large sparse symmetric matrices for small profile and wavefront or for small bandwidth is important for the efficiency of frontal and variable-band solvers. In this report, the authors look at the computation of pseudoperipheral nodes and compare the effectiveness of using an algorithm based on level-set structures with using the spectral method as the basis of the Reverse Cuthill-McKee algorithm for bandwidth reduction. The authors also consider a number of ways of improving the performance and efficiency of Sloan's algorithm for profile and wavefront reduction, including the use of different weights, the use of supervariables, and implementing the priority queue as a binary heap. The authors also examine the use of the spectral ordering in combination with Sloan's algorithm. The design of software to implement the reverse Cuthill-McKee algorithm and a modified Sloan's algorithm is discussed. Extensive numerical experiments that justify the authors' choice of algorithm are reported on.

NTIS

Matrices (Mathematics); Wave Fronts

19980209854 Sandia National Labs., Albuquerque, NM USA

Correcting numerical integration errors caused by small aliasing errors

Smallwood, D. O., Sandia National Labs., USA; [1997]; 11p; In English; 68thShock and Vibration Symposium, 3 Nov. 1997, Baltimore, MD, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-1479C; CONF-971164-; DE98-000971; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Small sampling errors can have a large effect on numerically integrated waveforms. An example is the integration of acceleration to compute velocity and displacement waveforms. These large integration errors complicate checking the suitability of the acceleration waveform for reproduction on shakers. For waveforms typically used for shaker reproduction, the errors become significant when the frequency content of the waveform spans a large frequency range. It is shown that these errors are essentially independent of the numerical integration method used, and are caused by small aliasing errors from the frequency components near the Nyquist frequency. A method to repair the integrated waveforms is presented. The method involves using a model of the acceleration error, and fitting this model to the acceleration, velocity, and displacement waveforms to force the waveforms to fit the assumed initial and final values. The correction is then subtracted from the acceleration before integration. The method is effective where the errors are isolated to a small section of the time history. It is shown that the common method to repair these errors using a high pass filter is sometimes ineffective for this class of problem.

DOE

Correction; Numerical Integration; Errors

19980210015 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Three-Dimensional High-Lift Analysis Using a Parallel Unstructured Multigrid Solver ***Final Report***

Mavriplis, Dimitri J., Institute for Computer Applications in Science and Engineering, USA; May 1998; 22p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-1998-207682; NAS 1.26:207682; ICASE-98-20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A directional implicit unstructured agglomeration multigrid solver is ported to shared and distributed memory massively parallel machines using the explicit domain-decomposition and message-passing approach. Because the algorithm operates on local implicit lines in the unstructured mesh, special care is required in partitioning the problem for parallel computing. A weighted partitioning strategy is described which avoids breaking the implicit lines across processor boundaries, while incurring minimal additional communication overhead. Good scalability is demonstrated on a 128 processor SGI Origin 2000 machine and on a 512 processor CRAY T3E machine for reasonably fine grids. The feasibility of performing large-scale unstructured grid calculations with the parallel multigrid algorithm is demonstrated by computing the flow over a partial-span flap wing high-lift geometry on a highly resolved grid of 13.5 million points in approximately 4 hours of wall clock time on the CRAY T3E.

Author

Three Dimensional Models; Algorithms; Computational Fluid Dynamics; Massively Parallel Processors

19980210206 Rutherford Appleton Lab., Atlas Centre, Chilton, UK

Subspace-by-Subspace Preconditioners for Structured Linear Systems

Dayde, M. J., Centre National de la Recherche Scientifique, France; Decamps, J. P., Centre National de la Recherche Scientifique, France; Gould, N. I. M., Rutherford Appleton Lab., UK; Jan. 20, 1998; ISSN 1358-6254; 32p; In English

Report No.(s): PB98-142938; RAL-TR-98-005; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The authors consider the iterative solution of symmetric positive-definite linear systems whose coefficient matrix may be expressed as the outer-product of low-rank terms. The authors derive suitable preconditioners for such systems, and demonstrate their effectiveness on a number of test examples. The authors also consider combining these methods with existing techniques to cope with the commonly-occuring case where the coefficient matrix is the linear sum of elements, some of which are of very low rank.

NTIS

Linear Systems; Iterative Solution

19980210407 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

Evaluating the State Probabilities of M out of N Sliding Window Detectors

Williams, Peter, Defence Science and Technology Organisation, Australia; Feb. 1998; 22p; In English

Report No.(s): DSTO-TN-0132; DODA-AR-010-448; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria, Australia 3001); US Sales Only, Hardcopy, Microfiche

The term M out of N sliding window detectors refers to processes that determine whether there have been M successes in a sequence of N binary trials, where the window (of N trials under examination) slides along a possibly infinite sequence stopping when the criterion (of M successes in N successive trials) is met. They are frequently used to model the operators of naval surveillance systems such as radar and sonar. When an M out of N sliding window detector is examining a sequence of trials, it may be

in one of several states. The state of most interest is the accepting state into which it enters (and remains) when it encounters a sequence of N trials containing M successes. This paper describes a generalised method for estimating the probability that an M out of N sliding window detector is in its accepting state given a sequence of probabilities representing the likelihood of success on each of a sequence of binary trials.
Derived from text
Evaluation; Probability Theory; Criteria; Estimating

19980210523 Energia Nucleare e Delle Energie Alternative, Dipt. Energia, Rome, Italy
Analytical functions in non-canonical two dimensional algebras ***Funzioni analitiche nelle algebre a due componenti***
Catoni, Francesco, Energia Nucleare e Delle Energie Alternative, Italy; Zampetti, Paolo, Energia Nucleare e Delle Energie Alternative, Italy; Cannata, Roberto, Energia Nucleare e Delle Energie Alternative, Italy; Nichelatti, Enrico, Energia Nucleare e Delle Energie Alternative, Italy; Oct. 1997; ISSN 0393-6317; 26p; In Italian
Report No.(s): ENEA-RT-ERG-97-09; DE98-728620; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

Systems of two-dimensional hypercomplex numbers are usually studied in their canonical form, i.e. according to the multiplicative rule for the 'imaginary' versor i(sup 2) = +/- 1, 0. In this report those systems for which i(sup 2) = alpha + (beta)i are studied and expressions are derived for functions given by series expansion as well as for some elementary functions. The results obtained for systems which can be decomposed are then extended to all systems.
DOE
Algebra; Functions (Mathematics)

19980210819 NASA Lewis Research Center, Cleveland, OH USA
Institute for Computational Mechanics in Propulsion (ICOMP) ***Annual Report No. 12***
Keith, Theo G., Jr., Editor, Ohio Aerospace Inst., USA; Balog, Karen, Editor, Ohio Aerospace Inst., USA; Povinelli, Louis A., Editor, Ohio Aerospace Inst., USA; Jun. 1998; 42p; In English
Contract(s)/Grant(s): RTOP 523-36-13
Report No.(s): NASA/TM-1998-208397; NAS 1.15:208397; E-11224; ICOMP-98-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Institute for Computational Mechanics in Propulsion (ICOMP) was formed to develop techniques to improve problem-solving capabilities in all aspects of computational mechanics related to propulsion. ICOMP is operated by the Ohio Aerospace Institute (OAI) and funded via numerous cooperative agreements by the NASA Lewis Research Center in Cleveland, Ohio. This report describes the activities at ICOMP during 1997, the Institute's twelfth year of operation.
Author
Propulsion; High Impulse; Missiles; Propulsive Efficiency; Post Boost Propulsion System; Space Flight

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing: Monte Carlo method; and stochastic processes.

19980206731 Argonne National Lab., IL USA
Treatment of irradiation effects in structural design criteria for fusion reactors
Majumdar, S., Argonne National Lab., USA; Smith, P., International Thermonuclear Experimental Reactor Joint Central Team, USA; Mar. 1997; 16p; In English; 4th; Fusion Nuclear Technology, 6 - 11 Apr. 1997, Tokyo, Japan
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/ET/CP-93432; CONF-970404-12; DE97-053561; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The irradiation environment experienced by the in-vessel components of fusion reactors such as the International Thermonuclear Experimental Reactor (ITER) presents structural design challenges not envisioned in the development of existing structural design criteria such as the ASME Code or RCC-MR. From the standpoint of structural design criteria, the most significant issues stem from the irradiation-induced changes in material properties, specifically the reduction of ductility, strain hardening capability, and fracture toughness with neutron irradiation. These effects call into question the basis of the design rules in existing structural design criteria which assume that only code-approved materials with high toughness, ductility and strain hardening capability

will be used. The present paper reviews the basis of new rules that address these issues in Draft 5 of the interim ITER structural design criteria (ISDC) which was released recently for trial use by the ITER designers.
DOE
Fusion Reactors; Fracture Strength; Thermonuclear Reactions; Structural Design Criteria; Strain Hardening

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19980206635 Kansas Univ., Center for Research, Inc., Lawrence, KS USA
Theoretical Study of Controlling Chaos with Applications to Nonlinear Optical Systems, *1 Mar. 1996 - 28 Feb. 1998*
Lai, Ying-Cheng, Kansas Univ., USA; Apr. 28, 1998; 11p; In English
Contract(s)/Grant(s): F49620-96-1-0066
Report No.(s): AD-A345873; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The main goal of the proposed research was to study forefront problems in nonlinear dynamics and chaos, particularly in the direction of controlling chaos, and to explore applications to lasers in which the Air Force researchers are greatly interested. During the funding period, all specific objectives in the original plan were accomplished (see report). These achievements have advanced our understanding of how a chaotic system can be manipulated by utilizing small perturbations to achieve desirable system performance. Researchers at the Air Force Laboratories are investigating applying small perturbations to chaotic lasers to encode messages for nonlinear digital communication. Our results are closely related to this line of investigation. During the funding period, the PI also provided a large amount of scientific consultation to the Nonlinear Optics Center at the Phillips Laboratory, Kirtland AFB, NM. Frequent contacts (including two visits to the Phillips Lab) were made with the Kirtland group. At present, the PI is collaborating with Air Force Researchers on laser chaos, communication, and chaos in electronic circuits.
DTIC
Chaos; Nonlinear Optics; Nonlinear Systems; Optical Communication; Nonlinearity

19980209878 Department of the Navy, Washington, DC USA
System and Computer-Implemented Method for Fractal-Dimension Measurement for Target-Motion Analysis Noise Discrimination
OBrien, Francis J., Jr., Inventor, Department of the Navy, USA; Nguyen, Chung T., Inventor, Department of the Navy, USA; Hammel, Sherry E., Inventor, Department of the Navy, USA; Bates, Bruce J., Inventor, Department of the Navy, USA; Nardone, Steven C., Inventor, Department of the Navy, USA; Dec. 09, 1997; 11p; In English; Supersedes AD-D017684
Patent Info.: Filed 26 Jun. 1995; US-Patent-Appl-SN-494674; US-Patent-5,696,700
Report No.(s): AD-D018802; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A signal processing system and computer-implemented method for processing a digital data sequence representing all Input signal to generate a fractal dimension value. The system includes a correlation integral value generation module correlation plot generation module a segmentation module correlation dimension generation module and a control module. The correlation Integral value generation module generates a series of correlation integral values for points Wn(k) In 'N'-dimensional space corresponding to vectors of said digital data sequence and in particular generates inter-point distance values within each of a plurality of volume elements of said 'N'-dimensional space. The correlation plot generation module generates a correlation Integral plot comprising a plot of the correlation integral values as a function of said 'N'-dimensional space volume elements. The segmentation module generates from the plot a series of correlation integral plot segments.
DTIC
Digital Data; Segments; Signal Processing; Computer Programs; Dimensional Measurement

19980210012 NASA Johnson Space Center, Houston, TX USA
Field Guide for Designing Human Interaction with Intelligent Systems
Malin, Jane T., NASA Johnson Space Center, USA; Thronesbery, Carroll G., Metrica, Inc., USA; Jul. 1998; 44p; In English
Report No.(s): NASA/TM-1998-208470; S-841; NAS 1.15:208470; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The characteristics of this Field Guide approach address the problems of designing innovative software to support user tasks. The requirements for novel software are difficult to specify a priori, because there is not sufficient understanding of how the users' tasks should be supported, and there are not obvious pre-existing design solutions. When the design team is in unfamiliar territory,

care must be taken to avoid rushing into detailed design, requirements specification, or implementation of the wrong product. The challenge is to get the right design and requirements in an efficient, cost-effective manner. This document's purpose is to describe the methods we are using to design human interactions with intelligent systems which support Space Shuttle flight controllers in the Mission Control Center at NASA/Johnson Space Center. Although these software systems usually have some intelligent features, the design challenges arise primarily from the innovation needed in the software design. While these methods are tailored to our specific context, they should be extensible, and helpful to designers of human interaction with other types of automated systems. We review the unique features of this context so that you can determine how to apply these methods to your project Throughout this Field Guide, goals of the design methods are discussed. This should help designers understand how a specific method might need to be adapted to the project at hand.
Author
Software Engineering; Computer Programs; Automatic Control; Human-Computer Interface

19980210682 North Atlantic Treaty Organization, Consultation, Command and Control Agency, The Hague, Netherlands
NATO Alliance Ground Surveillance Interoperability
Lenk, Peter J., North Atlantic Treaty Organization, Netherlands; Retzer, Gert, North Atlantic Treaty Organization, Netherlands; Apr. 1998; 8p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Through the NATO Alliance Ground Surveillance (AGS) Project, NATO is proposing to procure an airborne ground surveillance system based on a NATO-owned and operated core capability which would be supplemented by interoperable national assets, as required. The NATO Consultation, Command and Control (C3) Agency (NC3A), together with support from six nations, France, Germany, Italy, Norway, The UK and The USA, has established a testbed capability which includes simulations of the candidate sensor systems and various exploitation capabilities. This testbed, coupled with various other command and control testbeds resident at NC3A, allows the study of many aspects of command and control associated with the AGS problem. Essential to the selected ownership option is the concept of the interoperability of the NATO-owned assets with each other and with the nationally-owned assets. In order to address this problem, the NC3A, in conjunction with the six nations has developed an architecture and a standard format for the sensor data, so that any ground station could be made to receive and process data from any of the candidate platforms. Important to the solution is the ability to simultaneously receive and process data from different sensors and sensor platforms allowing for the fusion of data and potentially leading to improved surveillance coverage, tracking performance and accuracy. This approach has been prototyped and tested in the laboratory utilizing the AGS testbed. Recently, a large experiment was conducted during which several real AGS platforms and ground stations were utilized in order to prove the interoperability concepts that have been developed at NC3A in a more practical environment. In order to set the stage, the paper begins with a brief overview of the NATO AGS project followed by a definition of the interoperability problem. Next, the hardware and data architecture developed at NC3A for achieving interoperability is described. Finally, the paper concludes with a description of a recent AGS interoperability experiment used to prove the concepts is presented.
Author
Aerial Reconnaissance; Command and Control; Data Processing

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THEORETICAL MATHEMATICS

Includes topology and number theory.

19980206713 Los Alamos National Lab., NM USA
pi kinks in the parametrically driven sine-Gordon equation and applications
Zharnitsky, V., Los Alamos National Lab., USA; Mitkov, I., Los Alamos National Lab., USA; Jul. 08, 1997; 15p; In English; 17th; Nonlinear Waves and Solitons In Physical Systems, 12 - 16 May 1997, Los Alamos, NM, USA; Sponsored by Los Alamos National Lab., USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2726; CONF-9705192-; DE98-000812; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Parametrically driven sine-Gordon equation with a mean-zero forcing is considered. It is shown that the system is well approximated by the double sine-Gordon equation using the normal form technique. The reduced equation possesses pi-kink solutions, which are also observed numerically in the original system. This result is applied to domain walls dynamics in one-dimen-

sional easy-plane ferromagnets. For such system the existence of pi-kinks implies the true domain structure in the presence of high-frequency magnetic field.
DOE
Electromagnetic Fields; Conferences; Numerical Analysis

19980210463 Energia Nucleare e Delle Energie Alternative, Dipt. Energia, Rome, Italy
Geodesics in hypercomplex number systems. Application to commutative quaternions
Catoni, Francesco, Energia Nucleare e Delle Energie Alternative, Italy; Zampetti, Paolo, Energia Nucleare e Delle Energie Alternative, Italy; Cannata, Roberto, Energia Nucleare e Delle Energie Alternative, Italy; Bordoni, Luciana, Energia Nucleare e Delle Energie Alternative, Italy; Oct. 1997; ISSN 0393-0317; 19p; In English
Report No.(s): ENEA-RT-ERG-97-11; DE98-728615; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

The functions of hypercomplex variable can be related to the physical fields. Following the Einstein's ideas, by which the Theory of General Relativity was developed, they want to verify if a generalisation is possible, in order to described the motion of a body in a gravitational field, by the geodesics in spaces ''deformed'' by functional transformations of hypercomplex variables. These number systems introduce new space symmetries. This paper is just a first step in the more extended study. As a first application they consider the ''commutative quaternions'' system that may be considered as a composition of complex and hyperbolic numbers. by using in this system the same functional transformations valid for the two dimensional case, elliptical geodesics are obtained, with the eccentricity related to the angle between the orbit plane and a reference plane. These geodesics do not describe the Kepler orbits, but they show a space anisotropy that might be related to planet orbits of the solar system.
DOE
Relativity; Functional Analysis; Differential Geometry; Gravitational Fields; Complex Numbers

19980210466 Energia Nucleare e Delle Energie Alternative, Dipt. Energia, Rome, Italy
Matrix representation of hypercomplex numbers and of analytical functions of hypercomplex variable ***Rappresentazione matriciale dei numeri ipercomplessi e delle funzioni analitiche di variabile ipercomplessa***
Catoni, Francesco, Energia Nucleare e Delle Energie Alternative, Italy; Cannata, Roberto, Energia Nucleare e Delle Energie Alternative, Italy; Nichelatti, Enrico, Energia Nucleare e Delle Energie Alternative, Italy; Oct. 1997; ISSN 0393-6317; 29p; In Italian
Report No.(s): ENEA-RT-ERG-97-10; DE98-728619; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

Systems of hypercomplex numbers, which had been studied and developed at the end of the last century, are nowadays quite unknown to the scientific community. It is believed that study of their applications ended just before one of the fundamental discoveries of our century, Einstein's equivalence between space and time. Owing to this equivalence, not-defined quadratic forms - which are in a quite strong relationship with hypercomplex numbers possessing divisors of the zero - have got concrete physical meaning. The aim of this work is to study these systems of numbers and to describe them in terms of a familiar mathematical tool, i.e. matrix algebra. Moreover, they will show how hypercomplex numbers possessing divisors of the zero candidate themselves to be the most proper mathematical language for treatment of propagative phenomena.
DOE
Matrices (Mathematics); Functions (Mathematics); Analysis (Mathematics)

70
PHYSICS (GENERAL)

For precision time and time interval (PTTI) see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

19980206466 NASA Lewis Research Center, Cleveland, OH USA
Space Acceleration Measurement System (SAMS)/Orbital Acceleration Research Experiment (OARE)
Hakimzadeh, Roshanak, NASA Lewis Research Center, USA; Life and Microgravity Spacelab (LMS); Feb. 1998, pp. 319-335; In English; Also announced as 19980206462; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The Life and Microgravity Spacelab (LMS) payload flew on the Orbiter Columbia on mission STS-78 from June 20th to July 7th, 1996. The LMS payload on STS-78 was dedicated to life sciences and microgravity experiments. Two accelerometer systems managed by the NASA Lewis Research Center (LERC) flew to support these experiments, namely the Orbital Acceleration Research Experiment (OARE) and the Space Acceleration Measurements System (SAMS). In addition, the Microgravity Mea-

surement Assembly (NOAA), managed by the European Space Research and Technology Center (ESA/ESTEC), and sponsored by NASA, collected acceleration data in support of the experiments on-board the LMS mission. OARE downlinked real-time quasi-steady acceleration data, which was provided to the investigators. The SAMS recorded higher frequency data on-board for post-mission analysis. The MMA downlinked real-time quasi-steady as well as higher frequency acceleration data, which was provided to the investigators. The Principal Investigator Microgravity Services (PIMS) project at NASA LERC supports principal investigators of microgravity experiments as they evaluate the effects of varying acceleration levels on their experiments. A summary report was prepared by PIMS to furnish interested experiment investigators with a guide to evaluate the acceleration environment during STS-78, and as a means of identifying areas which require further study. The summary report provides an overview of the STS-78 mission, describes the accelerometer systems flown on this mission, discusses some specific analyses of the accelerometer data in relation to the various activities which occurred during the mission, and presents plots resulting from these analyses as a snapshot of the environment during the mission. Numerous activities occurred during the STS-78 mission that are of interest to the low-gravity community. Specific activities of interest during this mission were crew exercise, radiator deployment, Vernier Reaction Control System (VRCS) reboost, venting operations, Flight Control System (FCS) checkout, rack excitation, operation of the Life Sciences Laboratory Equipment Refrigerator/Freezer (LSLE R/F), operation of the JSC Projects Centrifuge, crew sleep, and attitude changes. The low-gravity environment related to these activities is discussed in the summary report.
Author
Microgravity; Gravitational Effects; Acceleration Measurement; Flight Control; Accelerometers; Aerospace Environments; Spacecrews; Acceleration Tolerance; Spaceborne Experiments; Deployment

19980206652 Los Alamos National Lab., NM USA
Caballero: A high current flux compressor system for 100 MJ solid liner experiments
Reinovsky, R. E., Los Alamos National Lab., USA; Lindemuth, I. R., Los Alamos National Lab., USA; Lopez, E. A., Los Alamos National Lab., USA; Goforth, J. H., Los Alamos National Lab., USA; Marsh, S. P., Los Alamos National Lab., USA; 1997; 8p; In English; 11th; Pulsed Power Conference, 29 Jun. - 2 Jul. 1997, Baltimore, MD, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2722; CONF-9706113; DE98-000595; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Pulse power systems delivering in excess of 100 MJ represent one of the next major challenges to the pulse power community. While a laboratory pulse power system in this energy range if feasible, it represents a very substantial investment of both time and resources. Prudence requires that fundamental proof-of-principle for the contemplated application is established before such massive resources are committed. Explosive pulse power systems using magnetic flux compression provide a direct path to such demonstrations. Furthermore, as energy requirements grow, single use explosive systems may represent the only affordable source of ultra-high energy environments.
DOE
Compressors; Magnetic Flux; High Current; Pulse Generators; Magnetic Compression

19980209683 Department of the Navy, Washington, DC USA
Method for Determining the Approximate Resonance Frequency of a Structure Surrounded by a Compressible Fluid
McCollum, Michele D., Inventor, Department of the Navy, USA; Siders, Clementina M., Inventor, Department of the Navy, USA; Nov. 11, 1997; 16p; In English; Supersedes US-Patent-Appl-SN-641019, AD-D018052.
Patent Info.: Filed 15 Apr. 1996; US-Patent-5,686,667; US-Patent-Appl-SN-641,019
Report No.(s): AD-D018849; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method for determining the approximate resonance frequency of a structure surrounded by a compressible fluid includes the steps of: (1) performing analysis to determine in-vacuo frequencies and mode shapes of the structure; (2) selecting an in-vacuo mode of interest; (3) computing an influence matrix at the eigenfrequency of the selected mode of interest; (4) combining the computed influence matrix with structural stiffness and mass matrices from a finite element program, and using the modified matrices computing eigenvalues of the structure, including eigenvectors; (5) selecting from the computed eigenvectors a computed mode having substantially the same displaced shape as the in-vacuo mode of interest; (6) determining the eigenfrequency of the selected computed mode; and (7) determining any difference between the computed eigenfrequency of the selected computed mode and the in-vacuo eigenfrequency of the selected in-vacuo mode of interest. The process iteratively returns to step (3) until the eigenvalues of the selected computed mode of step (5) and the in-vacuo eigenvalue substantially converge.
DTIC
Resonant Frequencies; Eigenvectors; Finite Element Method; Compressible Fluids; Eigenvalues

19980209867 Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Frascati, Frascati, Italy

Frequency dependence of susceptibility higher harmonics in YBCO samples by numerical solutions of the non linear magnetic flux diffusion equation

DiGioacchino, D., Istituto Nazionale di Fisica Nucleare, Italy; Celani, F., Istituto Nazionale di Fisica Nucleare, Italy; Tripodi, P., Istituto Nazionale di Fisica Nucleare, Italy; Testa, A. M., Consiglio Nazionale delle Ricerche, Italy; Pace, S., Salerno Univ., Italy; Mar. 1997; 4p; In English

Report No.(s): INFN-R-LNF-97-013; DE98-712215; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

They present a numerical analysis of the diffusion equation of the magnetic flux in YBCO in presence of ac magnetic fields taking into account flux creep and flux flow. Despite critical state models, the results how the dependence of harmonic susceptibilities on the field frequency in agreement with the experimental behaviour.

DOE

Diffusion; Frequencies; Harmonics; Magnetic Flux; Nonlinearity; YBCO Superconductors

19980209870 Istituto Nazionale di Fisica Nucleare, Lab. Nazionale di Frascati, Frascati, Italy

The gravitational wave detector NAUTILUS operating at T = 0.1 K

Astone, P., La Sapienza Univ., Italy; Bassan, M., Rome Univ., Italy; Bonifazi, P., Consiglio Nazionale delle Ricerche, Italy; Feb. 1997; 19p; In English

Report No.(s): INFN-P-LNF-97-005; DE98-712204; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

They report on the ultralow-temperature resonant-mass gravitational-wave detector NAUTILUS operating at the Frascati INFN Laboratories. The present aim of this detector is to achieve a sensitivity sufficient to detect bursts of gravitational radiation from sources located in our Galaxy and in the local group. Progress in transducer technology is likely to lead to sensitivities that will enable them to observe events from sources as far away as the Virgo cluster of galaxies. They describe the cryogenic apparatus, readout system cosmic-ray veto system, and give first results obtained during one year of continuous operation at T = 0.1 K. In particular the Brownian noise of the detector at T = 0.1 K was measured. The measured strain sensitivity was h-tilde approx. 6 10(exp -22) Hz(exp -1/2) at the frequencies of the two modes, 908 Hz and 924 Hz, with bandwidths of about 1 Hz.

DOE

Gravitational Waves; Cryogenic Temperature; Sensitivity; Cosmic Rays; Virgo Galactic Cluster; Radiation Detectors

19980209876 Department of the Navy, Washington, DC USA

A Monitor Particularly Suited for Naval Tactical Data System (NTDS) Interfaces Types A and B

Paterno, Robert M., Inventor, Department of the Navy, USA; Mar. 25, 1998; 21p; In English

Patent Info.: US-Patent-Appl-SN-047335

Report No.(s): AD-D018800; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A monitor is disclosed that presents a negligible load to a hardwired interface, provides electrical isolation between all of the interconnected equipment, adds no significant delay to the interface data, provides for maximum reliability of interface operation, provides for remote operation of the monitoring function, provides for noise immune reception of interface data, maintains interface controlled impedance, provides for ease of installation, and does not perturb system operation in any significant way.

DTIC

Interfaces; Electrical Insulation; Data Systems; Monitors

19980210484 Naval Postgraduate School, Monterey, CA USA

Performance Analysis of Noncoherent Differential Phase Shift Keying Using Post-Detection Selection Combining Over a Rayleigh Fading Channel

Conka, Tahir, Naval Postgraduate School, USA; Jun. 1998; 90p; In English

Report No.(s): AD-A346398; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In this thesis, the performance analysis of a non-coherent Differential Phase Shift Keying (DPSK) receiver using Post-Detection Selection Combining techniques over a Rayleigh fading channel is investigated. Post-Detection Selection Combining (PDSC) is evaluated and compared to Equal Gain Combining (EGC) and Selection Combining (SC), the two common diversity techniques discussed in the literature. Numerical results obtained for Post-Detection Selection Combining are compared to Selection Combining and Equal Gain Combining. The Post-Detection Selection Combining method is shown to be superior to the

Selection Combining method but inferior to Equal Gain Combining method for a non-coherent DPSK receiver operating over a Rayleigh fading channel.
DTIC
Phase Shift Keying; Fading; Electromagnetic Radiation; Signal Processing; Probability Density Functions; Radio Receivers

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ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see 45 Environmental Pollution.

19980206758 Naval Research Lab., Acoustics Systems Branch, Washington, DC USA
High-Angle Formulation for the Nonlinear Progressive-wave Equation (NPE) Model, *Oct. 1996 - Jun. 1997*
McDonald, B. E., Naval Research Lab., USA; Orris, Gregory J., Naval Research Lab., USA; May 29, 1998; 7p; In English
Contract(s)/Grant(s): DE-A101-95IS-200011
Report No.(s): AD-A346006; NRL/FR/7140-98-9859; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Nonlinear Progressive-wave Equation (NPE) model has been reformulated for wider propagation angle accuracy. The wide-angle NPE results from range-integrating the second-order time domain nonlinear wave equation rather than reducing it to a one-way equation as in the original NPE. The numerical implementation of the second-order NPE retains two time levels rather than one. The resulting model is referred to as NPE2. Benchmark tests reveal that root mean square (rms) errors in the model are reduced by a factor of 10 for moderately high propagation angles as compared to similar tests of the first-order NPE.
DTIC
Wave Equations; Nonlinear Equations; Mathematical Models; Underwater Acoustics; Wave Propagation

19980206764 Sandia National Labs., Albuquerque, NM USA
Closing remarks on Faraday Discussion 107: Interactions of acoustic waves with thin films and interfaces
Martin, S. J., Sandia National Labs., USA; 1997; 37p; In English; Faraday Society Discussion 107, 1 Nov. 1997, Leicester, UK
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2730C; CONF-971175; DE98-001043; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The papers in this Faraday Discussion represent the state-of-the-art in using acoustic devices to measure the properties of thin films and interfaces. Sauerbrey first showed that the mass sensitivity of a quartz crystal could be used to measure the thickness of vacuum-deposited metals. Since then, significant progress has been made in understanding other interaction mechanisms between acoustic devices and contacting media. Bruckenstein and Shay and Kanazawa and Gordon showed that quartz resonators could be operated in a fluid to measure surface mass accumulation and fluid properties. The increased understanding of interactions between acoustic devices and contacting media has allowed new information to be obtained about thin films and interfaces. These closing remarks will summarize the current state of using acoustic techniques to probe thin films and interfaces, describe the progress reported in this Faraday Discussion, and outline some remaining problems. Progress includes new measurement techniques, novel devices, new applications, and improved modeling and data analysis.
DOE
Vacuum Deposition; Film Thickness; Quartz Crystals; Thin Films; Sound Waves; Measuring Instruments

19980209666 Research Inst. of National Defence, Avdelningen foer Sensorteknik, Linkoeping, Sweden
Fiber Optic Hydrophones Tested at a Tank Measurement Facility *Fiberoptiska Hydrofoner Testade i Maettank*
Kullander, F., Research Inst. of National Defence, Sweden; Gruffman, S., Research Inst. of National Defence, Sweden; Jan. 1998; 30p; In Swedish
Report No.(s): PB98-147614; FOA-R-98-00680-409-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report describes measurements with fiber optic hydrophones at the hydroacoustic tank facility in Ursvik, summer 1996. Three different sensor heads were frequency characterized with regard to sensitivity. The measurements show that fiberoptic hydrophones that were comparetively easy to construct have equal or higher sensitivity than conventional hydrophones in a low frequency band (limited by the hydrophone dimensions).
NTIS
Fiber Optics; Hydrophones; Sensitivity; Measuring Instruments

19980209681 Department of the Navy, Washington, DC USA

Method for Data Gap Compensation

O'Brien, Francis J., Jr., Inventor, Department of the Navy, USA; Nguyen, Chung T., Inventor, Department of the Navy, USA; Hammel, Sherry E., Inventor, Department of the Navy, USA; Bates, Bruce J., Department of the Navy, USA; Nardone, Steven C., Department of the Navy, USA; Oct. 07, 1997; 12p; In English

Patent Info.: Filed 28 Jun. 1996; US-Patent-5,675,553; US-Patent-Appl-SN-682,895

Report No.(s): AD-D018851; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The present invention comprises a method for filling in missing data intervals in a quantized time-dependent data signal that is generated by, e.g., an underwater acoustic sensing device. In accordance with one embodiment of the invention, this quantized time-dependent data signal is analyzed to determine the number and location of any intervals of missing data, i.e., gaps in the time series data signal caused by noise in the sensing equipment or the local environment. The quantized time-dependent data signal is also modified by a low pass filter to remove any undesirable high frequency noise components within the signal. A plurality of mathematical models are then individually tested to derive an optimum regression curve for that model, relative to a selected portion of the signal data immediately preceding each previously identified data gap. The aforesaid selected portion is empirically determined on the basis of a data base of signal values compiled from actual undersea propagated signals received in cases of known target motion scenarios. An optimum regression curve is that regression curve, linear or nonlinear, for which a mathematical convergence of the model is achieved. Convergence of the model is determined by application of a smallest root-mean-square analysis to each of the plurality of models tested. Once a model possessing the smallest root-mean-square value is derived from among the plurality of models tested, that optimum model is then selected, recorded, and stored for use in filling the data gap. This process is then repeated for each subsequent data gap until all of the identified data gaps are filled.

DTIC

Underwater Acoustics; Data Bases; Time Series Analysis; Time Dependence; Low Pass Filters

19980209715 Lawrence Livermore National Lab., Livermore, CA USA

Mid-wave infrared DIAL noise phenomenology

Magnotta, F., Lawrence Livermore National Lab., USA; Morris, J. R., Lawrence Livermore National Lab., USA; Neuman, W. A., Lawrence Livermore National Lab., USA; Scharlemann, E. T., Lawrence Livermore National Lab., USA; Jul. 23, 1997; 10p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-128151; CONF-970706; DE98-050914; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

LLNL has utilized optical parametric oscillator technology to develop and field a rapidly-tunable mid-wave infrared (MWIR) DIAL system. The system can be tuned at up to 1 KHz over the 3.3-3.8 micron spectral region, where hydrogen-bond stretching modes provide spectroscopic signatures for a wide variety of chemicals. We have fielded the DIAL system on the LLNL site with targets at horizontal ranges of up to 2 km. We have collected data on noise levels and correlations and their dependences on range, turbulence, and receiver aperture size. In this paper we describe some of the implications of this data for MWIR DIAL phenomenology. In particular, the interplay of turbulence and speckle to produce the observed noise fluctuations at short ranges (less than 500 m) is presented.

DOE

Parametric Amplifiers; Infrared Radiation; Infrared Instruments; Optical Radar; Remote Sensing

19980209819 Department of the Navy, Washington, DC USA

Acoustic Communication System

Sutton, Paul W., Inventor, Department of the Navy, USA; Aug. 26, 1997; 12p; In English

Patent Info.: Filed 13 Feb. 1996; US-Patent-Appl-SN-605250; US-Patent-5,661,669

Report No.(s): AD-D018819; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An acoustic communication system comprises: a voice processing circuit which generates a first signal representing a voice message; a noise sensor channel which generates a second signal in response to detecting background noise in an environment; a microcomputer which receives the first and second signals and provides a third signal to a selected one of first and second output ports of the microcomputer where the amplitude of the third signal is functionaliy related to the value of the second signal; an ultrasonic output channel coupled to the first output port and which generates an ultrasonic output signal representing the voice message in response to receiving the third signal; a pubic address channel coupled to the second output port which generates an

audible signal representing the voice message in response to receiving the third signal; and an ultrasonic receiving system which generates an audible output representing the voice message in response to receiving the ultrasonic output signal.
DTIC
Acoustics; Sound Transmission; Voice Communication; Telecommunication

19980210187 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Proceedings of the Adaptive Sensor Array Processing (ASAP) Workshop, Volume 1
ODonovan, Gina M., Massachusetts Inst. of Tech., USA; May 15, 1998; 483p; In English; Adaptive Sensor Array Processing, 11-12 Mar. 1998, USA
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A346408; ASAP-6-VOL-1; ESC-TR-97-115-Vol-1; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

In 1997 the workshop, focused on the synergy between the sonar and the radar communities and their approaches to adaptive signal processing problems. This year we will continue expanding this interaction by providing a forum in which important new developments may be presented and discussed within the context of national defense. The theme for this year's workshop will be adaptive sensor fusion, which extends the concept of an array to a "system of systems." This theme is strengthened by the Inclusion of adaptive techniques for model-based image processing and SAR to complement sonar and radar.
DTIC
Conferences; Sonar; Multisensor Fusion; Synthetic Aperture Radar; Fuzzy Systems

19980210775 Department of the Navy, Washington, DC USA
Tapered Cylinder Electro-Acoustic Transducer with Reversed Tapered Driver
Janus, Robert S., Inventor, Department of the Navy, USA; Sep. 16, 1997; 13p; In English
Patent Info.: Filed 16 Sep. 1997; US-Patent-Appl-SN-933611
Report No.(s): AD-D018898; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A slotted cylinder transducer is provided having a cylindrical metal or composite material shell. A cylindrical piezoelectric driver is bonded to the inside of the shell with an opening corresponding to the slot. The shell thickness is tapered radially about the longitudinal axis such that the thickness is a maximum 1800 away from the slot and decreases progressively to a minimum adjacent each side of the slot. The piezoelectric driver is reverse tapered from the shell taper in that the thickness of the driver is a minimum 1800 away from the slot and increases progressively to a maximum adjacent each side of the slot. This taper places a larger volume of the driver material in the slot region of the shell where the maximum radial displacements occur, thus providing higher acoustic energy levels. When used as a hydrophone to detect acoustic signals in the surrounding medium, the larger volume of material at the point of maximum displacement provides increased signal detection capability.
DTIC
Tapering; Cylindrical Bodies; Slots; Composite Materials; Metal Shells; Piezoelectric Transducers; Hydrophones

19980210776 Department of the Navy, Washington, DC USA
Multi-Tuned Acoustic Projector
Obara, Robert J., Inventor, Department of the Navy, USA; Mar. 04, 1998; 18p; In English
Patent Info.: Filed 4 Mar. 1998; US-Patent-Appl-SN-038483
Report No.(s): AD-D018899; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A system and method for operating an acoustic projector is provided which allows efficient operation of the projector over a wide bandwidth. The system and method use multiple power amplifiers each tuned to operate over separate and narrow bandwidths, the number of separate bandwidths corresponding to the number of amplifiers such that the total bandwidth is covered. Each tuning network assembly includes the power amplifier, a transformer and a tuning inductor, with the tuning inductor selected for proper tuning over the frequency bands the amplifier is to operate at. The narrower bandwidths for each power amplifier result in a substantial reduction in the reactive power dissipated in the amplifiers and also the total power consumption of the acoustic projector.
DTIC
Tuning; Projectors; Bandwidth

19980210789 Technical Univ. of Denmark, Afd. for Fluid Mekanik, Lyngby, Denmark
Aero-acoustic noise of wind turbines: Noise prediction models
Maribo Pedersen, B., Editor, Technical Univ. of Denmark, Denmark; 1997; 126p; In English; 29th; Experts on Aero-Acoustic

Noise of Wind Turbines, 17-18 Mar. 1997, Milano, Italy
Report No.(s): NEI-DK-3024; CONF-9703137; DE98-718941; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Semi-empirical and CAA (Computational AeroAcoustics) noise prediction techniques are the subject of this expert meeting. The meeting presents and discusses models and methods. The meeting may provide answers to the following questions: What Noise sources are the most important? How are the sources best modeled? What needs to be done to do better predictions? Does it boil down to correct prediction of the unsteady aerodynamics around the rotor? Or is the difficult part to convert the aerodynamics into acoustics?
DOE
Aeroacoustics; Aerodynamic Noise; Mathematical Models; Noise Prediction; Wind Turbines; Rotors

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19980206534 Texas Univ., Austin, TX USA
Higgs-photon associated production at hadron colliders
Abbasabadi, A., Ferris State Univ., USA; Bowser-Chao, D., Illinois Univ., USA; Dicus, D. A., Texas Univ., USA; Repko, W. W., Michigan State Univ., USA; [1997]; 7p; In English
Contract(s)/Grant(s): DE-FG03-93ER-40757; NSF PHY-93-07980
Report No.(s): DOE/ER/40757-099; UTEXAS-HEP-97-11; MSUHEP-70610; DE98-001196; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors present cross sections for the reactions p(anti p) (yields) H(gamma) and pp (yields) H(gamma) arising from the subprocess q(anti q) (yields) H(gamma). The calculation includes the complete one-loop contribution from all light quarks and is the main source of Higgs-photon associated production in hadron colliders. At Tevatron energies, the cross section is typically 0.1 fb or less, while at LHC energies it can exceed 1.0fb.
DOE
Computation; Hadrons; Annihilation Reactions; Ionization Cross Sections

19980206542 Los Alamos National Lab., NM USA
Constant Q measurements of collective modes in Mg70Zn30 glass
Benmore, C. J., Guelph Univ., Canada; Sweeney, S., Guelph Univ., Canada; Robinson, R. A., Los Alamos National Lab., USA; Egelstaff, P. A., Guelph Univ., Canada; Suck, J. B., Technische Univ. Chemnitz-Zwickau, Germany; [1997]; 7p; In English; Neutron Scattering, 17 - 21 Aug. 1997, Toronto, Canada
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2952; CONF-970814-; DE98-001170; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In this study the Neutron Brillouin Scattering technique has been used to measure longitudinal excitations in a magnesium-zinc glass at momentum transfers within the first pseudo-Brillouin zone. The measurements were performed at room temperature and constant momentum transfer, which enables the data to be readily and reliably compared with theory. The experimental results taken down to Q = 6.2/ nm and E = 27 meV show a 5 meV downward shift in the dispersion energy of the longitudinal optic mode of the glass when compared to theoretical predictions.
DOE
Brillouin Zones; Neutron Scattering; Excitation; Longitudinal Stability; Magnesium Alloys; Zinc Alloys

19980206543 Los Alamos National Lab., NM USA
Vibrational dynamics of crystalline L-alanine
Bordallo, H. N., Los Alamos National Lab., USA; Eckert, J., Los Alamos National Lab., USA; Barthes, M., Montpellier-2 Univ., France; [1997]; 11p; In English; Neutron Scattering, 17 - 21 Aug. 1997, Toronto, Canada
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3051; CONF-970814-; DE98-001169; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors report a new, complete vibrational analysis of L-alanine and L-alanine-d(sub 4) which utilizes IINS intensities in addition to frequency information. The use of both isotopomers resulted in a self-consistent force field for and assignment of the molecular vibrations in L-alanine. Some details of the calculation as well as a comparison of calculated and observed IINS spectra are presented. The study clarifies a number of important issues on the vibrational dynamics of this molecule and presents a self-consistent force field for the molecular vibrations in crystalline L-alanine.
DOE
Vibration; Dynamic Models; Crystallinity; Alanine

19980206608 Los Alamos National Lab., NM USA
More many-body perturbation theory for an electron-ion system
Baker, G. A., Jr., Los Alamos National Lab., USA; Johnson, J. D., Los Alamos National Lab., USA; 1997; 14p; In English; Condensed Matter Theories, 22 - 27 Sep. 1997, Luso, Portugal
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3442; CONF-970994; DE98-000263; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

From previous finite-temperature, quantum, many-body perturbation theory results for the grand partition function of an electron-ion fluid through order epsilon(4), we compute the electron and ion fugacities in terms of the volume per ion and the temperature to that same order in perturbation theory. From these results we also give the pressure, again to the same order in perturbation theory about the values for the non-interacting fluid.
DOE
Many Body Problem; Perturbation Theory; Quantum Theory; Electrons; Ions

19980206649 Fermi National Accelerator Lab., Batavia, IL USA
CDF evidence for the top quark and B physics at Fermilab
Yao, Wei-Ming, Fermi National Accelerator Lab., USA; Feb. 1997; 26p; In English; 22nd; Particle Physics, Astrophysics and Cosmology, 8-19 Aug. 1994, Stanford, CA, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/033-E; CONF-9408100-5; DE97-052861; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present the first direct evidence for the top quark with the Collider Detector at Fermilab (CDF) in a sample of (bar-p)p collisions at radical-s = 1.8 TeV with an integrated luminosity of 19.3 pb(sup -1). The recent B physics results at Fermilab from both collider and fixed target experiments are reviewed.
DOE
Quarks; Elementary Particle Interactions; Particle Decay; Particle Production

19980206711 Los Alamos National Lab., NM USA
A local dynamic correlation function from inelastic neutron scattering
McQueeney, R. J., Los Alamos National Lab., USA; Jul. 13, 1997; 11p; In English; Neutron Scattering, 17 - 21 Aug. 1997, Toronto, Canada
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2880; CONF-970814; DE98-000804; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Information about local and dynamic atomic correlations can be obtained from inelastic neutron scattering measurements by Fourier transform of the Q-dependent intensity oscillations at a particular frequency. A local dynamic structure function, S(r, (omega)), is defined from the dynamic scattering function, S(Q, omega), such that the elastic and frequency-integrated limits correspond to the average and instantaneous pair-distribution functions, respectively. As an example, S(r, (omega)) is calculated for polycrystalline aluminum in a model where atomic motions are entirely due to harmonic phonons.
DOE
Correlation; Inelastic Scattering; Neutron Scattering; Atoms; Conferences

19980206712 Los Alamos National Lab., NM USA
S = -1 and S = -2 few-body hypernuclei
Gibson, B. F., Los Alamos National Lab., USA; [1997]; 6p; In English; 6th; Intersections of Particle and Nuclear Physics, 27 May - 2 Jun. 1997, Big Sky, MT, USA

Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2759; CONF-970564-; DE98-000808; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The S = -1 and S = -2 few-body bound states are the focus of this discussion. Implications for the understanding of the baryon-baryon interaction are examined. Octet-octet coupling effects not found in conventional, non-strange nuclei are highlighted. TJNAF wave function tests for the S = -1 sector are noted. The need to identify S = -2 hypernuclei to explore the S = -2 strong interaction and to test model predictions is emphasized.
DOE
Hypernuclei; Baryons; Conferences

19980206714 Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Frascati, Frascati, Italy
Top mesons
Fabiano, N., Perugia Univ., Italy; Mar. 1997; 17p; In English
Report No.(s): INFN-P-LNF-97-014; DE98-712220; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

The possibility of formation for a bound state of a t quark and a lighter one is investigated using potential model predictions and heavy quark effective theory approach. Resulting estimates for the 1S-2S splitting of the energy levels are compared to the total top decay width (Gamma)(sub t). As for the case of toponium, their conclusions show that the probability of formation for T-mesons is negligibly small due to the high top mass value.
DOE
Boundary Conditions; Mesons; Quarks; Particle Decay

19980206715 Istituto Nazionale di Fisica Nucleare, Lab. Nazionale di Frascati, Frascati, Italy
D production from e(sup +) e(sup -) to ep collisions in NLO QCD
Cacciari, M., Deutsches Elektronen-Synchrotron, Germany; Greco, M., Rome III Univ., Italy; Feb. 1997; 19p; In English
Report No.(s): INFN-P-LNF-97-007; DE98-712223; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

Fragmentation functions for D mesons, based on the convolution of a perturbative part, related to the heavy quark perturbative showering, and a non-perturbative model for its hadronization into the meson, are used to describe D production in e(sup +) e(sup -) and ep collisions. The non-perturbative part is determined by fitting the e(sup +) e(sup -) data taken by ARGUS and OPAL at 10.6 and 91.2 GeV respectively. When fitting with a non perturbative Peterson fragmentation function and using next-to-leading evolution for the perturbative part, they find an e parameter significantly different from the one commonly used, which is instead found with a leading order fit. The use of this new value is shown to increase considerably the cross section for D production at HERA, suggesting a possible reconciliation between the next-to-leading order theoretical prediction and the experimental data.
DOE
Fragmentation; Mesons; Perturbation Theory; Nuclear Models

19980206719 Oak Ridge National Lab., Grand Junction, CO USA
Introduction to naturally occurring radioactive material
Egidi, P., Oak Ridge National Lab., USA; [1997]; 54p; In English; Health Physics Annual Meeting, 1 Jul. 1997, San Antonio, TX, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-970795-1; DE97-008455; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Naturally occurring radioactive material (NORM) is everywhere; we are exposed to it every day. It is found in our bodies, the food we eat, the places where we live and work, and in products we use. We are also bathed in a sea of natural radiation coming from the sun and deep space. Living systems have adapted to these levels of radiation and radioactivity. But some industrial practices involving natural resources concentrate these radionuclides to a degree that they may pose risk to humans and the environment if they are not controlled. Other activities, such as flying at high altitudes, expose us to elevated levels of NORM. This session will concentrate on diffuse sources of technologically-enhanced (TE) NORM, which are generally large-volume, low-activity waste streams produced by industries such as mineral mining, ore benefication, production of phosphate Fertilizers, water treatment and purification, and oil and gas production. The majority of radionuclides in TENORM are found in the uranium and thorium decay chains. Radium and its subsequent decay products (radon) are the principal radionuclides used in characterizing the redistribution of TENORM in the environment by human activity. We will briefly review other radionuclides occurring in nature

(potassium and rubidium) that contribute primarily to background doses. TENORM is found in many waste streams; for example, scrap metal, sludges, slags, fluids, and is being discovered in industries traditionally not thought of as affected by radionuclide contamination. Not only the forms and volumes, but the levels of radioactivity in TENORM vary. Current discussions about the validity of the linear no dose threshold theory are central to the TENORM issue. TENORM is not regulated by the Atomic Energy Act or other Federal regulations. Control and regulation of TENORM is not consistent from industry to industry nor from state to state. Proposed regulations are moving from concentration-based standards to dose-based standards. So when is TENORM a problem? Where is it a problem? That depends on when, where, and whom you talk to! We will start by reviewing background radioactivity, then we will proceed to the geology, mobility, and variability of these radionuclides. We will then review some of the industrial sectors affected by TENORM, followed by a brief discussion on regulatory aspects of the issue.
DOE
Nuclear Electric Power Generation; Radioactive Materials; Activity (Biology); Contamination; Earth Resources; Nuclides; Potassium; Radioactive Isotopes

19980206726 Argonne National Lab., IL USA
Top quark physics: Future measurements
Frey, R., Oregon Univ., USA; Vejcik, S., Michigan Univ., USA; Berger, E. L., Argonne National Lab., USA; Apr. 04, 1997; 20p; In English; 1996 DPF/DPB Workshop on New Directions for High Energy Physics, 25 Jun. - 12 Jul. 1996, Snowmass, CO, USA; Sponsored by American Physical Society, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL-HEP-CP-97-18; CONF-9606243-70; DE97-053544; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors discuss the study of the top quark at future experiments and machines. Top's large mass makes it a unique probe of physics at the natural electroweak scale. They emphasize measurements of the top quark's mass, width, and couplings, as well as searches for rare or nonstandard decays, and discuss the complementary roles played by hadron and lepton colliders.
DOE
Electroweak Interactions (Field Theory); Quarks; Hadrons

19980206727 Argonne National Lab., IL USA
Search for flavor changing neutral current decays of the top quark in p(bar p) collisions at (radical)s = 1.8 TeV
LeCompte, T. J., Argonne National Lab., USA; 1997; 7p; In English; 1st; Flavor-changing Neutral Currents: Present and Future Studies, 19 - 21 Feb. 1997, Santa Monica, CA, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL-HEP-CP-97-17; CONF-970266-4; DE97-053545; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors search for the Flavor-Changing Neutral Current decays of the top quark t (yields) q(gamma) and t (yields) qZ (here q represents the c and u quarks) in p(bar p) collisions at (radical)s = 1.8 TeV from a dataset with an integrated luminosity of approximately 110 pb(sup (minus)1) collected during the 1992-1995 run of the Collider Detector at Fermilab. They set limits on the branching fractions BF (t (yields) q(gamma)) less than 2.9% (at 95% CL) and BF (t (yields) qZ) less than 44% (at 90% CL), consistent with the Standard Model.
DOE
Collisions; Neutral Currents; Quarks

19980206730 Argonne National Lab., IL USA
Variational nodal perturbation theory with anisotropic scattering
Laurin-Kovitz, K. F., Argonne National Lab., USA; Palmiotti, G., Argonne National Lab., USA; Lewis, E. E., Argonne National Lab., USA; 1997; 14p; In English; Mathematical Methods and Supercomputing In Nuclear Applications, 6 - 10 Oct. 1997, Saratoga Springs, NY, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/RA/CP-93581; CONF-971005-21; DE97-053560; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The variational nodal perturbation method previously developed in two- and three-dimensional Cartesian and hexagonal geometries using the diffusion and full or simplified spherical harmonics transport approximations, is extended to treat problems with anisotropic scattering. The requisite solution to the adjoint transport equation with anisotropic scattering in formulated and incorporated into the VARIANT (VARIational Anisotropic Nodal Transport) option of the Argonne National Laboratory DIF3D

production code. The method, which calculates changes in the critical eigenvalue due to perturbations arising from changes in the material cross sections, is demonstrated by applying perturbations to an anisotropic hexagonal benchmark. Exact and first order perturbation theory are used to calculate changes in the critical eigenvalue and compared to the change obtained by direct calculation in VARIANT. The time savings obtained by using perturbation theory is substantial; times for base forward and adjoint calculations are much greater than the times for perturbation calculations.
DOE
Perturbation; Eigenvalues; Perturbation Theory; Diffusion; Anisotropy

19980206735 Fermi National Accelerator Lab., Batavia, IL USA
Trilinear gauge couplings at the Fermilab Tevatron
Landsberg, G., Fermi National Accelerator Lab., USA; Oct. 1997; 6p; In English; 16th; Weak Interactions and Neutrinos, 22 - 28 Jun. 1997, Capri, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/340-E; CONF-9706187; DE98-050461; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Recent trilinear gauge boson couplings measurements by the CDF and D0 Collaborations at the Fermilab Tevatron are presented. The measurements were done by analyzing diboson production in multiple decay channels and final states. No deviations from the Standard Model description of the WWZ, WW(gamma), ZZ(gamma) and Z(gamma)(gamma) vertices were found. Limits on anomalous gauge couplings set by these analyses are the tightest available to date.
DOE
Bosons; Particle Production; Nuclear Reactions

19980206736 Fermi National Accelerator Lab., Batavia, IL USA
Top quark mass and production from CDF
Leone, S., Istituto Nazionale di Fisica Nucleare, Italy; Sep. 1997; 7p; In English; High Energy Physics: QCD 1997, 25th Anniversary of QCD, 3 - 9 Jul. 1997, Montpellier, France
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/319-E; CONF-9707114; DE98-050380; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We present the latest results about the top quark obtained by the CDF experiment using a data sample of about 110 pb(sup -1) collected at the Fermilab Tevatron collider. We briefly describe the production cross section determination and the top mass measurement. Finally we review the search for the top quark in rare decay channels and the first direct calculation of the CKM matrix element V(sub tb).
DOE
Particle Production; Particle Mass; Quarks; High Energy Interactions

19980206746 National Inst. of Standards and Technology, Gaithersburg, MD USA
Molecular Dynamics Simulation of Tethered Chains
Mountain, R. D., National Inst. of Standards and Technology, USA; Hubbard, J., National Inst. of Standards and Technology, USA; Apr. 1998; 50p; In English
Report No.(s): PB98-144389; NISTIR-6150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A description is provided for a molecular dynamics code that simulates the dynamics of chain molecules tethered to a smooth surface. The operation of the code is discussed from the point of view of the user. The structure of the input files is described and a discussion on how to change the state of the system (temperature and density/molecule) is provided. The steps needed to change the model are listed. Properties derived from some simulations are provided. A listing of the source code is included in an appendix.
NTIS
Molecular Dynamics; Molecules; Simulation; Tethering; Chains

19980206766 Fermi National Accelerator Lab., Batavia, IL USA
Search for new phenomena with the CDF detector
Azzi, P., Istituto Nazionale di Fisica Nucleare, Italy; May 1997; 11p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22 - 29 Mar. 1997, Les Arcs, France
Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/148-E; CONF-970393; DE97-053987; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We present the results of the searches for new phenomena in pp collisions at (radical)s=1.8 TeV with the CDF detector using the full data sample of 110 pb(sup -1) collected between 1992 and 1995. We have searched for new physics in events with two photons, testing some of the hypotheses proposed to explain the appearance of the CDF ee(gamma)(gamma) E(sub T) event. New results on the search for a heavy neutral scalar object, charged Higgs bosons (H(sup (+/-))) and the scalar top quark are presented. Finally we summarize the CDF results on the search for third generation leptoquarks.

DOE

Quarks; Particle Collisions; Higgs Bosons; Scalars

19980206767 Fermi National Accelerator Lab., Batavia, IL USA

W(+) jets production at the Fermilab Tevatron

Dittmann, J. R., Duke Univ., USA; May 1997; 8p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22 - 29 Mar. 1997, Les Arcs, France

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/152-E; CONF-970393; DE97-053997; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The production properties of jets in W events have been measured using radical-s = 1.8 TeV pp collisions at the Fermilab Tevatron Collider. Experimental results from several CDF and D0 analyses are compared to leading-order and next-to-leading-order QCD predictions.

DOE

Quantum Chromodynamics; Particle Production; Bosons; Proton-Proton Reactions

19980206768 Fermi National Accelerator Lab., Batavia, IL USA

Rare B decays to leptons

Ukegawa, F., Pennsylvania Univ., USA; Jul. 1997; 14p; In English; B Physics and CP Violation, 24 - 27 Mar. 1997, Honolulu, HI, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/173-E; CONF-970352; DE97-053998; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We review results from CLEO, LEP, and the Tevatron experiments on rare decays of B hadrons to final states including charged leptons.

DOE

Hadrons; Leptons; Particle Decay

19980206769 Fermi National Accelerator Lab., Batavia, IL USA

B physics at the Tevatron Collider

DeTroconiz, J. F., Harvard Univ., USA; May 1997; 11p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22 - 29 Mar. 1997, Les Arcs, France

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/165-E; CONF-970393; DE97-053999; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Precision B-physics results from the CDF and D0 Collaborations based on data collected during the Tevatron 1992-96 run are presented. In particular we discuss the measurement of B hadron lifetimes, and B(0) - (anti B)(0) mixing results obtained using time- evolution analyses. Perspectives for the next Tevatron run, starting in 1999, are also reported.

DOE

Elementary Particle Interactions; Mesons; Hadrons

19980206770 Fermi National Accelerator Lab., Batavia, IL USA

Probing color-singlet exchange at D0

Abbott, B., New York Univ., USA; Abolins, M., Michigan State Univ., USA; Acharya, B. S., Delhi Univ., India; Jul. 1997; 11p; In English; 18th; Lepton Photon Interactions, 28 Jul. - 1 Aug. 1997, Hamburg, Germany

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/250-E; CONF-970787; DE97-054021; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We present latest preliminary results on hard color-singlet exchange in proton-antiproton collisions. The fraction of dijet events produced via color-singlet exchange is measured as a function of jet transverse energy, dijet pseudorapidity separation, and proton-antiproton center-of-mass energy. These results are qualitatively consistent with a color-singlet fraction that increases with increasing quark-initiated processes.

DOE

Elementary Particle Interactions; Particle Production; Quarks

19980206771 Fermi National Accelerator Lab., Batavia, IL USA

Rapidity gaps in jet events at D0

Abbott, B., New York Univ., USA; Abolins, M., Michigan State Univ., USA; Acharya, B. S., Delhi Univ., India; Jul. 1997; 11p; In English; 18th; Lepton Photon Interactions, 28 Jul. - 1 Aug. 1997, Hamburg, Germany

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/251-E; CONF-970787; DE97-054022; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Preliminary results from the D0 experiment on jet production with rapidity gaps in p(anti-p) collisions are presented. A class of dijet events with a forward rapidity gap is observed at center-of-mass energies radical-s = 1800 GeV and 630 GeV. The number of events with rapidity gaps at both center-of-mass energies is significantly greater than the expectation from multiplicity fluctuations and is consistent with a hard diffractive process. A class of events with two forward gaps and central dijets is also observed at 1800 GeV. This topology is consistent with hard double pomeron exchange.

DOE

Particle Collisions; High Energy Interactions

19980206772 Fermi National Accelerator Lab., Batavia, IL USA

Recent results from the search for new phenomena at D0

Wightman, J. A., Iowa State Univ. of Science and Technology, USA; Jun. 1997; 17p; In English; 11th; Les Rencontres De Physique De La Vallee D'aoste: Results and Perspectives In Particle Physics, 2 - 8 Mar. 1997, LaThuile, Italy

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/178-E; CONF-9703116; DE97-054055; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We present results from several new searches for physics beyond the Standard Model. We describe a search based on the scalar sum of the transverse energy of the event, a global quantity nearly independent of the event topology. We summarize our searches for first generation leptoquarks into all three decay channels, eq(ovr eq), eq(ovr (nu)q), and (nu)q(ovr (nu)q) and note that this is the first time that the triumvirate of decay channels has been searched. We do not find any evidence for production of first generation leptoquarks and set a lower limit on the mass of the leptoquark of 175 GeV/c(sup 2) , assuming the decay is exclusively into eq(ovr eq). We also present results from the first search for a third generation leptoquark with charge +/- 1/3. Again, we find no evidence for its existence for a mass less than 80 GeV/sq c. Finally, we discuss one of our searches for supersymmetry, specifically the pair-production of (tilde e), (tilde (nu)), and (tilde (chi))(sup 0)(sub 2) where the decay yields final states with two photons plus missing transverse energy (E(sub T)). We set limits on the production cross section ranging from 1 pb to 400 fb, depending on the mass. This analysis also sets a model-independent limit of sigma.B(pp - (gamma)(gamma) (bar-E(sub T) bar-X) <185fbatthe95%CLforE(subT)sup (gamma)) > 12 GeV and (bar-eta) <1.1TandE(sul 25 GeV.

DOE

Pair Production; Photons; High Energy Interactions

19980206773 Fermi National Accelerator Lab., Batavia, IL USA

Recent results from Fermilab E687 on charm spectroscopy

Lebrun, P., Fermi National Accelerator Lab., USA; Jul. 1997; 8p; In English; 6th; Intersections of Particle and Nuclear Physics, 27 May - 2 Jun. 1997, Big Sky, MT, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/254-E; CONF-970564-2; DE97-054083; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Recent analyses of charm spectroscopy from Fermilab fixed target experiment 687 are summarized. Emphasis is placed on the phenomenology of Cabibbo suppression in the meson sector. Such transitions have been observed in the semileptonic modes

and hadronic modes. While the former transitions give us an opportunity to observe the weak current and the CKM matrix, a systematic comparison of the latter transitions allow us to study strong interaction effects, and possibly, light quark spectroscopy.
DOE
Spectroscopy; Mesons; Strong Interactions (Field Theory); Charm (Particle Physics)

19980206774 Fermi National Accelerator Lab., Batavia, IL USA
Diffractive phenomena at Tevatron
Santoro, A., Fermi National Accelerator Lab., USA; Jul. 1997; 7p; In English; 6th; Intersections of Particle and Nuclear Physics, 27 May - 2 Jun. 1997, Big Sky, MT, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/228-E; CONF-970564-3; DE97-054084; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Preliminary results from the D0 experiment on jet production with rapidity gaps in p(anti-p) collisions are presented. A class of dijet events with a forward rapidity gap is observed at center-of-mass energies radical-s = 1800 GeV and 630 GeV. The number of events with rapidity gaps at both center-of-mass energies is significantly greater than the expectation from multiplicity fluctuations and is consistent with a hard single diffractive process. A class of events with two forward gaps and central dijets are also observed at 1800 GeV. This topology is consistent with hard double pomeron exchange. We also present proposed plans for extending these analysis into Run II through the use of a forward proton detector.
DOE
Diffraction Patterns; Elementary Particles; Particle Collisions; High Energy Interactions

19980206777 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Determining tan beta at the NLC with SUSY Higgs bosons
Feng, J. L., California Univ., Lawrence Berkeley Lab., USA; Moroi, Takeo, California Univ., Lawrence Berkeley Lab., USA; Jul. 1997; 16p; In English; 5th; Supersymmetries In Physics, 27 - 31 May 1997, Philadelphia, PA, USA
Contract(s)/Grant(s): DE-AC03-76SF-00098; NSF PHY-95-14797
Report No.(s): LBNL-40535; CONF-9705195; DE97-054549; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors examine the prospects for determining tan beta from heavy Higgs scalar production in the minimal supersymmetric standard model at a future e(+)e(-) collider. Their analysis is independent of assumptions of parameter unification, and they consider general radiative corrections in the Higgs sector. Bounds are presented for radical-s = 500 GeV and 1 TeV, several Higgs masses, and a variety of integrated luminosities. For all cases considered, it is possible to distinguish low, moderate, and high tan (beta). In addition, the authors find stringent constraints for 3 approx. less than tan(beta) approx. less than 10, and, for some scenarios, also interesting bounds on high tan beta through tbH(+/-) production. Such measurements may provide strong tests of the Yukawa unifications in grand unified theories and make possible highly precise determinations of soft SUSY breaking mass parameters.
DOE
Higgs Bosons; Particle Production; Grand Unified Theory; Electron-Positron Pairs; Elementary Particle Interactions

19980206783 Fermi National Accelerator Lab., Batavia, IL USA
Hard diffraction results using D0
Shabalina, E., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Jun. 1997; 8p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22 - 29 Mar. 1997, Les Arcs, France
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/202-E; CONF-970393; DE97-054056; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The preliminary results on the search for hard diffraction in pp collisions with the D0 detector at Fermilab are presented. The presence of forward rapidity gaps is observed in events with high transverse momentum jet production at the center of mass energies 1800 and 630 GeV. The fraction of events with rapidity gaps is significantly higher than that expected due to multiplicity fluctuations and is consistent with predictions for hard single diffractive jet production. A class of events containing central dijets and two forward rapidity gaps is observed at radical-s = 1800 GeV consistent with a hard double pomeron exchange event topology.
DOE
Particle Collisions; Proton-Proton Reactions; Diffraction Patterns; Elementary Particles

19980209659 Fermi National Accelerator Lab., Batavia, IL USA

Jet fragmentation properties at the Tevatron

Goulianos, K., Rockefeller Univ., USA; May 16, 1997; 8p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22 - 29 Mar. 1997, Les Arcs, France

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/145-E; CONF-970393-8; DE97-053476; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Preliminary CDF results on inclusive momentum distributions of charged particles in high transverse momentum jets produced in (anti p)p collisions at radical-s = 1.8 TeV at the Tevatron are presented and compared with QCD predictions based on the Modified Leading Log Approximation.

DOE

Quantum Chromodynamics; Charged Particles; Elementary Particle Interactions

19980209693 Fermi National Accelerator Lab., Batavia, IL USA

Multijet production and double parton scattering at Tevatron

Chang, P., Academia Sinica, Nankang, Taiwan, Province of China; Jun. 1997; 9p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22 - 29 Mar. 1997, Les Arcs, France

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/175-E; CONF-970393-7; DE97-053428; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We report the differential cross-section for events with large total transverse energies, based on 112 pb(sup -1) p(anti p) collisions at radical-s = 1.8 TeV. The ratio of number of 3-jet to 2-jet events as a function of total transverse energy is also presented. Obtained results are compared with the QCD expectations. The properties of high mass six-jet events have been studied. Observed distributions are compared with the predictions of HER- WIG parton shower QCD, NJETS matrix element QCD, and a phase-space model in which events are uniformly distributed in the kinematic allowed region of phase space. A strong signal for Double Parton Scattering (DP) is observed in the process (anti-p)p yields gamma + 3 jets + X, using data from the CDF experiment. The fundamental DP parameter sigma(sub eff) obtained, sigma(sub eff) = 14.5 + 1.7(sup 1.7)(sub -2.3) mb, represents a significant improvement over previous measurements.

DOE

Quantum Chromodynamics; Elementary Particle Interactions; Particle Collisions; Particle Accelerators

19980209695 Fermi National Accelerator Lab., Batavia, IL USA

QCD results using the k(perpendicular) jet-finding algorithm in p(bar-p) collisions at radical-s = 1800 GeV

Lincoln, D., Michigan Univ., USA; May 1997; 5p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22 - 29 Mar. 1997, Les Arcs, France

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/149-E; CONF-970393; DE97-053477; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

An inclusive measurement of the jet mass as a function of jet p(perpendicular) has been made for jets with |eta| <0.5.Thismeasurementisthefrst in a hadron collider environment using the k(perpendicular) jet- finding algorithm. This analysis shows that the HERWIG Monte Carlo well reproduces the average jet mass for high p(perpendicular) jets. At lower p(perpendicular), the data jets are 5-10% more massive. A second analysis has been performed with the same algorithm which measures the distribution of subjets (jets within jets).

DOE

Quantum Chromodynamics; Elementary Particle Interactions; Algorithms; Hadrons

19980209696 Fermi National Accelerator Lab., Batavia, IL USA

Rapidity gaps and hard diffraction at the Tevatron

Abbott, B., New York Univ., USA; Jun. 1997; 18p; In English; 11th; Les Rencontres De Physique De La Vallee D'aoste: Results and Perspectives In Particle Physics, 2 - 8 Mar. 1997, LaThuile, Italy

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/180-E; CONF-9703116; DE97-053504; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Preliminary results on jet production with rapidity gaps in p(anti p) collisions are presented for both D0 and CDF. An excess of events with a forward rapidity gap is observed at both radical-s = 1800 GeV and 630 GeV, consistent with a hard single diffractive process. The first evidence for diffractive W production is presented. A class of events with two forward gaps and central dijets is observed at radical-s = 1800 GeV, a topology that is consistent with hard double pomeron exchange. Kinematic properties of events containing rapidity gaps are measured.
DOE
Particle Collisions; Particle Accelerators; Elementary Particle Interactions; Pomerons; Diffraction Patterns; Bosons

19980209697 Fermi National Accelerator Lab., Batavia, IL USA
Overview of results from the Fermilab fixed target and collider experiments
Montgomery, H. E., Fermi National Accelerator Lab., USA; Jun. 1997; 8p; In English; 5th; Deep Inelastic Scattering and QCD, 14 - 18 Apr. 1997, Chicago, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/193; CONF-970463-2; DE97-053505; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In this paper we present a review of recent QCD related results from Fermilab fixed target and collider experiments. Topics covered range from structure functions through W/Z production, heavy quark production and jet angular distributions. We also include the current state of knowledge about leptoquark pair production in hadronic collisions.
DOE
Quantum Chromodynamics; Pair Production; Quarks; Bosons; Leptons; Particle Collisions

19980209801 Osaka Univ., Dept. of Applied Physics, Osaka, Japan
Development of Simulation Code for Electron Microscope Images by Howie-Whelan Dynamical Electron Diffraction Theory
Zheng, Zhudan, Osaka Univ., Japan; Takai, Yoshizo, Osaka Univ., Japan; Shimizu, Ryuichi, Osaka Univ., Japan; Technology Reports of the Osaka University; Apr. 15, 1994; ISSN 0030-6177; Volume 44, Nos. 2163-2182, pp. 21-27; In English
Report No.(s): Rept-2165; Copyright; Avail: Issuing Activity (Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan), Hardcopy, Microfiche

A simulation code based on Howie-Whelan dynamical electron diffraction theory in many-beam form has been newly developed for the calculation of electron-microscope images. by considering the property of the symmetry of a crystal, the maximum number of excited beams in the program is considerably increased without increasing computation time. The computation space is also successfully reduced at the same time by utilizing the property that there are a lot of elements having the same value in the eigenstate matrix (A(gh)) of the theory. The two techniques made the program applicable to the image calculation involving a large number of beams. Plan-view electron microscope images of (011) gold surface steps were calculated by the program and compared with observed image contrasts.
Author
Computerized Simulation; Electron Diffraction; Image Processing; Eigenvectors; Dynamical Systems; Wave Scattering

19980209853 Los Alamos National Lab., NM USA
LSND neutrino oscillation results
White, D. H., Los Alamos National Lab., USA; [1997]; 17p; In English; Electroweak Interactions and Unified Theories Conference, 15 - 22 Mar. 1997, Les Arcs, France
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2916; CONF-9703122-; DE98-000979; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The LSND experiment at Los Alamos has conducted a search for (anti v)(sub (mu)) (yields) (anti v)(sub e) oscillations using (anti v)(sub (mu)) from (mu)(sup +) decay at rest. The (anti v)(sub e) are detected via the reaction (anti v)(sub e) p (yields) e(sup +)n, correlated with the 2.2 MeV gamma from n p (yields) d gamma. The use of tight cuts to identify e(sup +) events with correlated gamma rays yielded 22 events with e(sup +) energy between 36 and 60 MeV and only 4.6 +/- 0.6 background events. The probability that this excess is due entirely to a statistical fluctuation is 4.1 (times) 10(exp -8). A (chi)(sup 2) fit to the entire e(sup +) sample results in a total excess of 51.8(exp -16.9)(sup +18.7) +/- 8.0 events with e(sup +) energy between 20 and 60 MeV. If attributed

to (anti v)(sub (mu)) yields (anti v)(sub e) oscillations, this corresponds to an oscillation probability (averaged over the experimental energy and spatial acceptance) of 0.31 +/- 0.12 +/- 0.05%.
DOE
Neutrinos; Oscillations

19980209868 Istituto Nazionale di Fisica Nucleare, Lab. Nazionale di Frascati, Frascati, Italy
Photon-photon total inelastic cross-section
Corsetti, A., Northeastern Univ., USA; Godbole, R. M., Indian Inst. of Science, India; Pancheri, G., Istituto Nazionale di Fisica Nucleare, Italy; Jul. 1997; 7p; In English
Report No.(s): INFN-P-LNF-97-027; DE98-712213; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

They discuss predictions for the total inelastic (gamma) (gamma) cross-section and their model dependence on the input parameters. They compare results from a simple extension of the Regge Pomeron exchange model as well as predictions from the eikonalized mini-jet model with recent LEP data.
DOE
Photons; Cross Sections

19980209951 Oak Ridge National Lab., TN USA
Heavy quarkonium production and propagation in nuclei
Wong, C. Y., Oak Ridge National Lab., USA; [1997]; 8p; In English; Trends In Subatomic Physics, 7-23 Aug. 1997, Taipei, Taiwan, Province of China
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95285; CONF-9708133; DE98-001423; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In the search for the quark-gluon plasma, it has been suggested that the production of charmonium will be suppressed in a quark-gluon plasma because of the screening of the interaction between c and (anti c). to extract information on the suppression due to the quark-gluon plasma, it is necessary to study the suppression of J/(psi) production by sources different from the quark-gluon plasma. It is therefore useful to examine the mechanism of heavy quarkonium production and its propagation in nuclei. The authors describe a precursor in heavy quarkonium production in terms of a coherent admixture of states of different color, spin, and angular momentum quantum numbers, and obtain the production amplitudes for different quarkonium bound states by projecting out this precursor state onto these bound states. The precursor is absorbed in its passage through a nucleus in a pA reaction, and the total cross section between this precursor with a nucleon can be calculated with the two-gluon model of the Pomeron. Such a description of coherent precursors and their subsequent interactions with nucleons can explain many salient features of J/(psi) and (psi)(prime) production in pA collisions.
DOE
Collisions; Color; Plasmas (Physics); Quantum Numbers; Quarks; Charm (Particle Physics)

19980209952 Oak Ridge National Lab., TN USA
Collective flow as a probe of heavy-ion reaction dynamics
Awes, T. C., Oak Ridge National Lab., USA; 1997; 12p; In English; 6th; Nucleus-Nucleus Collisions, 2-6 Jun. 1997, Gatlinburg, TN, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95302; CONF-970622; DE98-001427; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Collective flow of nuclear matter probes the dynamics of heavy-ion reactions and can provide information about the nuclear-matter equation of state. In particular, the incident energy dependences of collective flow may be a sensitive means to deduce the existence of a Quark Gluon Plasma phase in the equation of state. Collective flow measurements from 30 A MeV to 200 A GeV incident energies are briefly reviewed. Preliminary results on collective flow from the WA98 experiment at the CERN SPS are presented.
DOE
Equations of State; Flow Measurement; Gluons; Matter (Physics); Nucleons; Plasmas (Physics)

19980209979 Oak Ridge National Lab., TN USA

Overview of target systems for the Spallation Neutron Source

Gabriel, T. A., Oak Ridge National Lab., USA; Barnes, J. M., Oak Ridge National Lab., USA; Charlton, L. A., Oak Ridge National Lab., USA; [1997]; 21p; In English; International Workshop on Cold Moderators for Pulsed Neutron Sources, 28 Sep. - 10 Oct. 1997, Argonne, IL, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-95584; CONF-9709132; DE98-001928; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The purpose and requirements of target systems as well as the technologies that are being utilized to design and build a state-of-the-art neutron spallation source, the Spallation Neutron Source (SNS), are discussed. Emphasis is given to the technology issues that present the greatest scientific challenges. The present facility configuration, ongoing analysis, and the planned hardware research and development program are also described.

DOE

Research and Development; Spallation; Neutron Sources

19980209980 Oak Ridge National Lab., TN USA

The ORNL Controlled Fusion Atomic Data Center

Schultz, D. R., Oak Ridge National Lab., USA; Krstic, P. S., Oak Ridge National Lab., USA; Ownby, F. M., Oak Ridge National Lab., USA; Meyer, F. W., Oak Ridge National Lab., USA; Havener, C. C., Oak Ridge National Lab., USA; Bannister, M. E., Oak Ridge National Lab., USA; Liu, W., Oak Ridge National Lab., USA; Jeffery, D. J., Oak Ridge National Lab., USA; Stancil, P. C., Oak Ridge National Lab., USA; [1997]; 4p; In English; International Conference on Atomic and Molecular Data and Their Applications, 29 Sep. - 2 Oct. 1997, Gaithersburg, MD, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-95415; CONF-970960; DE98-001930; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The principal mission of the Controlled Fusion Atomic Data Center is the collection evaluation, and dissemination of atomic collision data relevant to fusion energy development. With the advent of the widespread use of the World Wide Web, the data center's resources are being placed on-line to facilitate their use by end-users (cf. http://www-cfadc.phy.ornl.gov/). As this development continues, initially disparate, individually compiled resources will be transformed into integrated tools for retrieving recommended data, or displaying and manipulating the information available. The data center's present capabilities, recent data production/evaluation efforts, and goals for future development are highlighted here.

DOE

Controlled Fusion; World Wide Web; On-Line Systems; Atomic Collisions

19980209981 Oak Ridge National Lab., TN USA

Atomic collision databases and data services: A survey

Schultz, D. R., Oak Ridge National Lab., USA; [1997]; 12p; In English; International Conference on Atomic and Molecular Data and Their Applications, 29 Sep. - 2 Oct. 1997, Gaithersburg, MD, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-95569; CONF-970960-; DE98-001931; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Atomic collision databases and data services constitute an important resource for scientific and engineering applications such as astrophysics, lighting, materials processing, and fusion energy, as well as an important knowledge base for current developments in atomic collision physics. Data centers and research groups provide these resources through a chain of efforts that include producing and collecting primary data, performing evaluation of the existing data, deducing scaling laws and semiempirical formulas to compactly describe and extend the data, producing the recommended sets of data, and providing convenient means of maintaining, updating, and disseminating the results of this process. The latest efforts have utilized modern database, storage, and distribution technologies including the Internet and World Wide Web. Given here is an informal survey of how these resources have developed, how they are currently characterized, and what their likely evolution will lead them to become in the future.

DOE

Atomic Collisions; Astrophysics; Information Systems; Data Acquisition; Data Bases

19980210001 Fermi National Accelerator Lab., Batavia, IL USA

BFKL Tests at the Tevatron

Goussiou, A., Fermi National Accelerator Lab., USA; Jun. 1997; 5p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22-29 Mar. 1997, Les Arcs, France

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/208-E; CONF-970393; DE97-053607; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The azimuthal decorrelation of jets as a function of their rapidity separation and the dependence of the fraction of jet events with central rapidity gaps on the center of mass energy are studied in p(anti p) collisions at the Tevatron. The preliminary results on jet decorrelation are in disagreement with calculations based on the Leading Logarithmic Approximation for BFKL resummation. The preliminary results on the (radical)s--dependence of the central rapidity gap events are in disagreement with the two-gluon model for color-singlet exchange.

DOE

Collisions; Particle Accelerators; Elementary Particle Interactions; Protons; Antiprotons; Performance Tests

19980210087 Argonne National Lab., IL USA

Angular neutron transport investigation in the HZETRN free-space ion and nucleon transport and shielding computer program

Singleterry, R. C., Jr., Argonne National Lab., USA; Wilson, J. W., NASA Langley Research Center, USA; 1997; 12p; In English; Mathematical Methods and Supercomputing In Nuclear Applications, 6 - 10 Oct. 1997, Saratoga Springs, NY, USA

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/ED/CP-93185; CONF-971005-13; DE97-052982; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Extension of the high charge and energy (HZE) transport computer program HZETRN for angular transport of neutrons is considered. For this paper, only light ion transport, He4 and lighter, will be analyzed using a pure solar proton source. The angular transport calculator is the ANISN/PC program which is being controlled by the HZETRN program. The neutron flux values are compared for straight-ahead transport and angular transport in one dimension. The shield material is aluminum and the target material is water. The thickness of these materials is varied; however, only the largest model calculated is reported which is 50 gm/sq cm of aluminum and 100 gm/sq cm of water. The flux from the ANISN/PC calculation is about two orders of magnitude lower than the flux from HZETRN for very low energy neutrons. It is only a magnitude lower for the neutrons in the 10 to 20 MeV range in the aluminum and two orders lower in the water. The major reason for this difference is in the transport modes: straight-ahead versus angular. The angular treatment allows a longer path length than the straight-ahead approximation. Another reason is the different cross section sets used by the ANISN/PC-BUGLE-80 mode and the HZETRN mode. The next step is to investigate further the differences between the two codes and isolate the differences to just the angular versus straight-ahead transport mode. Then, create a better coupling between the angular neutron transport and the charged particle transport.

DOE

Electrical Measurement; Energy Transfer; Charge Transfer; Charged Particles; Flux Quantization; Electric Potential; Aluminum

19980210090 Fermi National Accelerator Lab., Batavia, IL USA

Measurement of the t(bar t) production cross section at the Tevatron

Castro, A., Istituto Nazionale di Fisica Nucleare, Italy; May 1997; 7p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22 - 29 Mar. 1997, Les Arcs, France

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/137-E; CONF-970393; DE97-053364; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We report on the measurement of the t(anti t) production cross section obtained by CDF and D0 experiments with p(anti p) collisions at (radical)s=1. 8 TeV. The analyses presented here refer to (integral) Ldt (approx)11O pb(sup -1) collected at the Fermilab Tevatron collider during the run 1992-96. About 85% of the possible t(anti t) decays have been studied in different channels classified according to the number of high P(sub T) leptons found in the final state. The production cross section has been measured in each individual channel and then combined into a single value for each experiment, which is (sigma)(sub tt) = 7.5(sup 1.9)(sub 1.6) pb for CDF and (sigma)(sub tt) = 5.77 (+/-) 1.76 pb for D0.

DOE

Collisions; Leptons; Particle Production; Cross Sections

19980210238 Fermi National Accelerator Lab., Batavia, IL USA

D0 results on W boson properties

Streets, K., Fermi National Accelerator Lab., USA; Jun. 1997; 17p; In English; 12th; Hadrons In Collisions, 5-11 Jun. 1997, Stony Brook, NY, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/222-E; CONF-9706103; DE97-053640; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The D0 experiment collected approx. 15 pb(sup -1) in run 1A (1992- 1993) and approx. 89 pb(sup -1) in run 1B (1994-1995) of the Fermilab Tevatron Collider using p(anti-p) collisions at radical-s = 1.8 TeV. Results from analyses of events with W and Z bosons are presented for the run 1B data samples. From W yields e(nu), (mu)(nu) and Z yields e(e), mu(mu) decays, the W and Z production cross sections and the W width are determined. Events with W (yields) (tau)(nu) decays are used to determine the ratio of the electroweak gauge coupling constants as a measure of lepton universality. Using W yields e(nu) and Z yields e(e) decays, the W boson mass is measured.

DOE

Electroweak Interactions (Field Theory); Particle Decay; Particle Production; Bosons

19980210241 Argonne National Lab., IL USA

Isolated prompt photon plus jet photoproduction at HERA

Gordon, L. E., Argonne National Lab., USA; Jun. 10, 1997; 7p; In English, 10-15 May 1997, Egmond aan Zee, Netherlands

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL-HEP-CP-97-41; CONF-9705136; DE97-053698; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The cross section for photoproduction of a prompt photon in association with a jet is studied in Next-to-Leading Order at the DESY e(p) collider HERA. The effect of various cuts imposed on the cross section by the ZEUS collaboration including isolation cuts on the photon is examined. Comparisons with the ZEUS preliminary data using various parametrizations of the photon structure function is made, and good agreement is found. The preliminary data is not yet precise enough to make a distinction between various models for the photon structure function.

DOE

Photoproduction; Photons; Elementary Particle Interactions

19980210242 Argonne National Lab., IL USA

Threshold resummation and the total cross section for top quark production

Berger, E. L., Argonne National Lab., USA; Contopanagos, H., Argonne National Lab., USA; Jun. 12, 1997; 8p; In English; 5th; Deep Inelastic Scattering and Qcd, 14-18 Apr. 1997, Chicago, IL, USA

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL-HEP-CP-97-33; CONF-970463; DE97-053699; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We discuss the motivation for resummation of the effects of initial-state soft gluon radiation, to all orders in the strong coupling strength, for processes in which the near-threshold region in the partonic subenergy is important. We summarize our calculation of the total cross section for top quark production at hadron colliders. Comments are included on the differences between our treatment of subleading logarithmic terms and other methods.

DOE

Particle Production; Quarks; Scattering Cross Sections; Quantum Chromodynamics; Gluons

19980210243 Argonne National Lab., IL USA

QCD subgroup on diffractive and forward physics

Albrow, M. G., Argonne National Lab., USA; Baker, W., Argonne National Lab., USA; Bhatti, A., Argonne National Lab., USA; [1997]; 11p; In English; New Directions for High Energy Physics, 25 Jun. - 12 Jul. 1996, Snowmass, CO, USA

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL-HEP-CP-97-40; CONF-9606243; DE97-053750; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Over the last few years, there has been a resurgence of interest in small-x or diffractive physics. This has been due to the realization that perturbative QCD techniques may be applicable to what was previously thought of as a non-perturbative problem and to the opening up of new energy regimes at HERA and the Tevatron collider. The goal is to understand the pomeron, and hence

the behavior of total cross sections, elastic scattering and diffractive excitation, in terms of the underlying theory, QCD. This paper is divided into experiments of hadron-hadron colliders and electron-proton colliders.
DOE
Quantum Chromodynamics; Elastic Scattering; Elementary Particle Interactions; Perturbation Theory; Photoproduction; Pomeranchuk Theorem; Diffraction Patterns; Pomerons

19980210244 Argonne National Lab., IL USA
New puzzles in nonleptonic B and D decays
Lipkin, H. J., Weizmann Inst. of Science, Israel; 1997; 6p; In English; B Physics and CP Violation, 24-27 Mar. 1997, Honolulu, HI, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL-HEP-CP-97-56; CONF-970352; DE97-053752; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Exclusive charged B decays show an unexplained enhancement in low-lying channels which must be reversed in other channels to equalise charged and neutral lifetimes. One suggested explanation involves decay modes with excited mesons like the a(sub 1). The anomalous behavior of decay modes of D and B mesons into final states containing the eta and eta' mesons is discussed.
DOE
Particle Decay; Annihilation Reactions; Mesons

19980210250 Los Alamos National Lab., NM USA
Stability and production of superheavy nuclei
Moeller, P., Los Alamos National Lab., USA; Nix, J. R., Los Alamos National Lab., USA; [1997]; 10p; In English; 3rd; Tours Symposium on Nuclear Physics, 2 - 5 Sep. 1997, Tours, France
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3580; CONF-9709162; DE98-001463; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Beyond uranium heavy elements rapidly become increasingly unstable with respect to spontaneous fission as the proton number Z increases, because of the disruptive effect of the long-range Coulomb force. However, in the region just beyond Z = 100 magic proton and neutron numbers and the associated shell structure enhances nuclear stability sufficient to allow observation of additional nuclei. Some thirty years ago it was speculated that an island of spherical, relatively stable superheavy nuclei would exist near the next doubly magic proton-neutron combination beyond (sup 208)Pb, that is, at proton number Z = 114 and neutron number N = 184. Theory and experiment now show that there also exists a rock of stability in the vicinity of Z = 110 and N = 162 between the actinide region, which previously was the end of the peninsula of known elements, and the predicted island of spherical superheavy nuclei slightly southwest of the magic numbers Z = 114 and N = 184. The authors review here the stability properties of the heavy region of nuclei. Just as the decay properties of nuclei in the heavy region depend strongly on shell structure, this structure also dramatically affects the fusion entrance channel. The six most recently discovered new elements were all formed in cold-fusion reactions. They discuss here the effect of the doubly magic structure of the target in cold-fusion reactions on the fusion barrier and on dissipation.
DOE
Heavy Nuclei; Alpha Decay; Fusion (Melting); Nuclear Structure; Isotopes; Shell Stability

19980210251 Los Alamos National Lab., NM USA
The quark and meson structure in the instanton liquid model
Blotz, A., Los Alamos National Lab., USA; Shuryak, E., State Univ. of New York, USA; [1997]; 4p; In English; 7th; Menu '97: Meson-nucleon Physics and the Structure of Nucleon, 28 Jul. - 1 Aug. 1997, Vancouver, Canada
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3700; CONF-9707137; DE98-001468; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Within an instanton based model of QCD the authors address the important question of how much of the proton spin is carried by the spins of the quarks and how much is due to orbital angular momentum and the spins of the gluons. Since this question arises already on the level of a single quark inside the proton, they study the axial vector correlation function as well as the anomaly

correlator for quarks in the so called Random Instanton Liquid Model (RILM) as well as for the Interacting Instanton Liquid Model (IILM).
DOE
Quarks; Mesons; Models; Gluons; Protons

19980210258 Argonne National Lab., IL USA
Investigation of TiO2 nanoparticles with XAS and scattering (SANS and SAXS) techniques
Thurnauer, M. C., Argonne National Lab., USA; Rajh, T., Argonne National Lab., USA; Chen, L. X., Argonne National Lab., USA; Zhang, R., Argonne National Lab., USA; Thiyagarajan, P., Argonne National Lab., USA; Tiede, D. M., Argonne National Lab., USA; [1997]; 4p; In English; Radiation and Photochemistry, 14-19 Jan. 1997, Trombay, India
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/CHM/CP-94691; CONF-970198; DE98-050100; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Semiconductor assisted photocatalysis that is based primarily on TiO2 has proven to be a promising technology for a variety of applications such as removal of organic and inorganic pollutants, metal ion reduction, or chemical syntheses. Surface modification of titanium dioxide nanoparticles can result in the enhanced kinetic and redox characteristics of this semiconductor. A variety of diagnostic techniques were used in order to understand the unique nature of 45 A TiO2 nanoparticles. Compared to bulk material, a shorter Ti-O bond distance and a decrease of the coordination number of surface Ti sites were found using XAS. IR spectroscopy suggests that upon surface modification with alpha mercaptocarboxylic acids surface Ti(IV) atoms become coordinated with five-membered ring formation to reestablish octahedral coordination. This results in the formation of a charge transfer complex with an optical absorption threshold at 520 nm. A rod-like, two-dimensional self-assembly of thiolactate modified 45 A TiO2 nanoclusters in water was detected by small angle neutron scattering (SANS).
DOE
Titanium Oxides; Semiconductors (Materials); Absorption Spectroscopy; X Ray Absorption; Metal Ions; Oxidation-Reduction Reactions

19980210260 Fermi National Accelerator Lab., Batavia, IL USA
Beautiful CP violation
Dunietz, I., Fermi National Accelerator Lab., USA; Sep. 24, 1997; 12p; In English
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/278-T; DE98-050245; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

CP violation is observed to date only in K(0) decays and is parameterizable by a single quantity epsilon. Because it is one of the least understood phenomena in the Standard Model and holds a clue to baryogenesis, it must be investigated further. Highly specialized searches in K(0) decays are possible. Effects in B decays are much larger. In addition to the traditional B(sub d) yields J/(psi)K(sub S), pi(+)pi(-) asymmetries, CP violation could be searched for in already existing inclusive B data samples. The rapid B(sub s)--(anti-B)(sub s) oscillations cancel in untagged B(sub s) data samples, which therefore allow feasibility studies for the observation of CP violation and the extraction of CKM elements with present vertex detectors. The favored method for the extraction of the CKM angle gamma is shown to be unfeasible and a solution is presented involving striking direct CP violation in charged B decays. Novel methods for determining the B(sub s) mixing parameter Delta(m) are described without the traditional requirement of flavor-specific final states.
DOE
Particle Decay; Kaons; Elementary Particle Interactions; Mesons

19980210270 Argonne National Lab., IL USA
Small angle neutron and X-ray scattering studies of carbons prepared using inorganic templates
Sandi, G., Argonne National Lab., USA; Thiyagarajan, P., Argonne National Lab., USA; Winans, R. E., Argonne National Lab., USA; Carrado, K. A., Argonne National Lab., USA; 1997; 6p; In English; 214th, 7-13 Sep. 1997, Las Vegas, NV, USA; Sponsored by American Chemical Society, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/CHM/CP-93247; CONF-970962; DE97-053815; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Small angle neutron (SANS) and X-ray (SAXS) scattering analyses of carbons derived from organic-loaded inorganic template materials, used as anodes in lithium ion cells, have been performed. Two clays were used as templates to load the organic

precursors, pillared montmorrillonite (PILC), a layered silicate clay whose sheets have been permanently propped open by sets of thermally stable molecular props, and sepiolite, a natural channeled clay. Five different organic precursors were used to load the PILC: pyrene, styrene, pyrene/trioxane copolymer, ethylene and propylene, whereas only propylene and ethylene were used to load sepiolite. Pyrolysis took place at 700 C under nitrogen. Values such as hole radius, fractal dimension, cutoff length and density of the final carbons will be compared as a function of the clay and carbon precursors.
DOE
X Ray Scattering; Neutron Scattering; Neutrons; Copolymers; Thermal Stability; Lithium; Hole Geometry (Mechanics)

19980210271 Argonne National Lab., IL USA
A dynamical (eta)(prime) - mass from an infrared enhanced gluon exchange
Smekal, L. von, Argonne National Lab., USA; Mecke, A., Tuebingen Univ., Germany; Alkofer, R., Tuebingen Univ., Germany; 1997; 3p; In English; 6th; Intersections of Particle and Nuclear Physics, 27 May - 2 Jun. 1997, Big Sky, MT, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/PHY/CP-93861; CONF-970564; DE97-053817; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The pseudo-scalar flavor-singlet meson mixes with two gluons. A dimensional argument by Kogut and Susskind shows that this can screen the Goldstone pole of the chiral limit in this channel, if the gluon correlations are infrared enhanced. Using a gluon propagator as singular as (sigma)/k(sup 4) for k(sup 2) (yields) 0 we relate the screening mass to the string tension (sigma). In the Written-Veneziano action to describe the (eta)-(eta)(prime) mixing this relation yields masses of about 810MeV for the (eta)(prime), 430MeV for the (eta) and a mixing angle of about -30(degrees) from the phenomenological value (sigma) (approx) 0.18GeV(sup 2). The very weak temperature dependence of the string tension should make this mechanism experimentally distinguishable from exponentially temperature dependent instanton model predictions.
DOE
Gluons; Infrared Radiation; Temperature Dependence; Veneziano Model; Mesons; Scalars

19980210273 Argonne National Lab., IL USA
Recent results for (e,e(prime)p) reactions at Jefferson Lab
Potterveld, D., Argonne National Lab., USA; Cummings, W. J., Argonne National Lab., USA; Geesaman, D. F., Argonne National Lab., USA; 1997; 9p; In English; Perspective In Hadronic Physics, 12-16 May 1997, Trieste, Italy
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/PHY/CP-93902; CONF-9705157; DE97-053820; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Coincidence cross sections for (e, e(prime)p) quasi-elastic scattering were measured at CEBAF with high statistical precision for C, Fe, and Au targets for 0.6 less than Q(sup 2) less than 3.3 GeV(sup 2). Missing energy and missing momentum distributions obtained from a preliminary analysis are in reasonable agreement with prior data from SLAC. The preliminary analysis are compared with a PWIA calculation to determine the nuclear transparency as a function of Q(sup 2) and A. A Rosenbluth analysis to extract the longitudinal and transverse cross sections from these data is anticipated.
DOE
Extraction; Linear Accelerators; Energy Distribution; Elastic Scattering

19980210313 Fermi National Accelerator Lab., Batavia, IL USA
Physics of the top quark at D0 new measurement of the production cross section and mass
Genser, K., Fermi National Accelerator Lab., USA; Jul. 1997; 20p; In English; 11th; Results and Perspectives In Particle Physics, 2-8 Mar. 1997, LaThuile, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/233-E; CONF-9703116; DE97-053685; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present a measurement of the t(anti-t) production cross section in p(anti-p) collisions at radical-s = 1.8 TeV and a measurement of top quark mass m(sub t) by the D0 experiment at the Fermilab Tevatron. The measurements are based on the data from the 1992- 1996 run during which the D0 detector was exposed to the integrated luminosity of approximately 125 pb(sup -1). We observe 39 t(anti t) candidate events in the dilepton and lepton+jets decay channels with an expected background of 13.7 +/- 2.2 events. We measure the top quark mass m(sub t) using a two constraint fit to m(sub t) in t(anti-t) yields bW(+) (anti-b)W(-) final states with one W decaying to q(anti-q) and the other to e(nu) or mu(nu). Events are binned in the fit mass versus a measure of

probability for events to be the signal rather than a background. Likelihood fits to the data yield m(sub t) = 173.3 +/- 5.6 (stat) +/- 6.2 (syst) GeV/sq c. For this mass we measure the t(anti-t) production cross section to be 5.5 +/- 1.8 pb.
DOE
Quarks; Particle Production; Scattering Cross Sections; Particle Mass

19980210318 Fermi National Accelerator Lab., Batavia, IL USA
Boson pair production and triple gauge couplings
Diehl, H. T., Fermi National Accelerator Lab., USA; Jun. 1997; 8p; In English; 5th; San Miniato Topical Seminar on the Irresistible Rise of the Standard Mode, 21-25 Apr. 1997, San Miniato, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/216-E; CONF-9704173; DE97-053639; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The D0 and CDF Collaborations measure boson pair production including W gamma, WW, WZ, ZZ and Z gamma production in p(anti p) collisions at radical s = 1800 GeV. New results, from direct measurements, are described including W gamma, WW, and Z gamma production cross sections and limits on non-Standard Model triple gauge boson couplings. The limits on anomalous WW gamma, WWZ, Z gamma gamma and ZZ gamma couplings are the most restrictive available. Prospects for Run II are discussed.
DOE
Bosons; Pair Production; Couplings; Measuring Instruments

19980210368 Fermi National Accelerator Lab., Batavia, IL USA
QCD in hadron-hadron collisions
Albrow, M., Fermi National Accelerator Lab., USA; Mar. 1997; 66p; In English; 24th; Particle Physics: the Strong Interaction, from Hadrons to Protons, 19-30 Aug. 1996, Stanford, CA, USA; Sponsored by Stanford Linear Accelerator Center, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/073; CONF-9608101; DE97-052736; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Quantum Chromodynamics provides a good description of many aspects of high energy hadron-hadron collisions, and this will be described, along with some aspects that are not yet understood in QCD. Topics include high E(sub T) jet production, direct photon, W, Z and heavy flavor production, rapidity gaps and hard diffraction.
DOE
Quantum Chromodynamics; Hadrons; Collisions; Conferences

19980210369 Fermi National Accelerator Lab., Batavia, IL USA
Top Quark Mass Measurements from the Tevatron
Raja, R., Fermi National Accelerator Lab., USA; Jun. 1997; 13p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22-29 Mar. 1997, Les Arcs, France
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/194-E; CONF-970393; DE97-053599; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We review the measurements of the top quark mass by the CDF and D0 collaborations using Run I data in excess of 1.00 pb(exp -1). The D0 collaboration has recently updated its measurement of the top quark mass in the lepton + jets channel. The world average of the top quark mass from the CDF and D0 measurements in the lepton + jets channel now stands at 175.6 +/- 5.5 GeV/c(exp 2).
DOE
Quarks; Conferences

19980210370 Fermi National Accelerator Lab., Batavia, IL USA
Jet Production at the Tevatron
Nang, F., Arizona Univ., USA; Jun. 1997; 5p; In English; 32nd; Rencontres De Moriond: Qcd and High Energy Hadronic Interactions, 22-29 Mar. 1997, Les Arcs, France
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/192-E; CONF-970393; DE97-053600; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Inclusive jet cross section and dijet angular distribution results from the CDF and DO collaborations are presented. The possibility that compositeness might be evident at high transverse energies is explored by both experiments. Using the angular distributions, the CDF analysis excludes at the 95% CL regions with (Lambda)(exp +) less than 1.8 TeV and (Lambda)(exp -) less than 1.6 TeV for a model where all quarks are allowed to be composite objects. The DO preliminary result excludes at the 95% CL regions with (Lambda)(exp +) less than 2.0 TeV for the same model.
DOE
Cross Sections; Jets; Particle Production

19980210371 Fermi National Accelerator Lab., Batavia, IL USA
Production of Gauge Bosons at the Tevatron
Gerber, C. E., Fermi National Accelerator Lab., USA; Jun. 1997; 8p; In English; 5th; San Miniato Topical Seminar on the Irresistible Rise of the Standard Mode, 21-25 Apr. 1997, San Miniato, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/218-E; CONF-9704173; DE97-053608; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The CDF and D0 collaborations have used recent data taken at the Tevatron to perform QCD tests with W and Z bosons decaying leptonically. D0 measures the production cross section times branching ratio for W and Z bosons and determines the branching ratio B(W yields l(nu)) = (10.43 +/- 0.44)% (l = e, mu). This also gives an indirect measurement of the total width of the W boson: Gamma(sub W) = 2.16 +/- 0.09 GeV. The W cross section times branching ratio into tau leptons is measured to be sigma((anti p)p yields W + X)B(W yields (tau)(nu)) = 2.38 +/- 0.13 nb, from which the ratio of the coupling constants is determined: g(sub (tau))(exp W)/g(sub e)(exp W) = 1.004 +/- 0.019 (+-) 0.026. D0's measurement of the differential d sigma/dP(sub T) distribution for the Z boson decaying to electrons, discriminates between different phenomenologic vector boson production models. CDF measures the cross section for the Drell-Yan continuum, and extracts improved limits on compositeness scales for quarks and leptons of (Lambda)(sub ql) approximately 3 - 6 TeV, depending on the model. Studies of W + Jet production at CDF and D0 find that the QCD prediction underestimates the production rate of W + 1 Jet events by about a factor of 2 as measured by both collaborations.
DOE
Bosons; Measuring Instruments; Conferences; Particle Production; Couplings

19980210372 Fermi National Accelerator Lab., Batavia, IL USA
Measurement of double parton scattering at CDF
Behrends, S. B., Brandeis Univ., USA; Lamoureux, J., Brandeis Univ., USA; Jun. 1997; 7p; In English; 5th; Deep Inelastic Scattering and Qcd, 14-18 Apr. 1997, Chicago, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/204-E; CONF-970463; DE97-054001; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A strong signal for Double Parton scattering (DP) is observed in (anti p)p yields gamma + 3 jets data from the CDF experiment. The process-independent DP parameter, sigma (sub eff), is obtained using a new technique. The result, sigma (sub eff) =(14.5 +/- 1.7(exp + 1.7)(sub -2.3)) mb, represents a significant improvement over previous measurements. For the first time, the Feynman x dependence of the sigma (sub eff) parameter is investigated, and no dependence is seen.
DOE
Partons; Scattering

19980210373 Fermi National Accelerator Lab., Batavia, IL USA
Hard Diffraction at CDF
Melese, P., Rockefeller Univ., USA; Jun. 1997; 9p; In English; 5th; Deep Inelastic Scattering and Qcd, 14-18 Apr. 1997, Chicago, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/211-E; CONF-970463; DE97-054014; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present results on diffractive production of hard processes in (anti p)p collisions at radical s = 1.8 TeV at the Tevatron using the CDF detector. The signatures used to identify diffractive events are the forward rapidity gap and/or the detection of a

recoil antiproton with high forward momentum. We have observed diffractive W- boson, dijet, and heavy quark production. We also present results on double-pomeron production of dijets.
DOE
Diffraction; Collisions; Bosons; Quarks; Jets

19980210374 Fermi National Accelerator Lab., Batavia, IL USA
Search for leptoquarks at d-Zero
Norman, D. M., Texas A&M Univ., USA; Jun. 1997; 25p; In English; 12th; Hadrons In Collisions, 5-11 Jun. 1997, Stony Brook, NY, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/224-E; CONF-9706103; DE97-054015; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present in this paper the current status of searches for leptoquarks at D0. These results include the use of next leading order theoretical predictions for the cross section for pair production of leptoquarks at hadron colliders. We also present a new optimized analysis for first generation leptoquarks with significant increase in sensitivity relative to earlier searches using DO data. The mass limits derived from this first generation leptoquark search are relevant to the recently reported high mass events at HERA.
DOE
Hadrons; Pair Production

19980210375 Fermi National Accelerator Lab., Batavia, IL USA
Top quark physics: Overview
Parke, S., Fermi National Accelerator Lab., USA; Jan. 1998; 17p; In English; Qcd Corrections and New Physics, 27-29 Oct. 1997, Hiroshima, Japan
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/431-T; CONF-9710149; DE98-051887; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In this presentation I will primarily focus on top quark physics but I will include a discussion of the W-boson mass and the possibility of discovering a light Higgs boson via associated production at the Tevatron.
DOE
Quarks; Physics; Higgs Bosons

19980210376 Fermi National Accelerator Lab., Batavia, IL USA
Recent results on top quark physics and B physics at CDF
Kim, S., Fermi National Accelerator Lab., USA; Jan. 1998; 19p; In English; 12th; Quantum Field Theory (Qfthep 1997), 4-10 Sep. 1997, Samara, Russian Federation
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/004-E; CONF-9709186; DE98-051888; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present the recent results on top quark physics and B physics with the Collider Detector at Fermilab (CDF). These results come from analyses using a full data sample at an integrated luminosity of 109 pb(exp -1) cross section in 1.8-TeV p(anti p) collisions. We measure the top quark mass to be 175.8 +/- 6.5 GeV/c(exp 2) and the t(anti t) production cross section to be 7.6(exp +1.8)(sub -1.5) pb. We also present measurements of the lifetimes of B-hadrons and the time- dependent B(exp 0)-(anti B)(exp 0) mixing which results in the mass difference between heavy and light B(sup 0)(sub d) mesons ((Delta)m(sub d)) of 0.464 +/- 0.030(stat)(+-)0.026(syst) ps(exp -1).
DOE
Quarks; Physics; Hadrons

19980210377 Fermi National Accelerator Lab., Batavia, IL USA
B-physics results from D-Zero
Baarmand, M. M., State Univ. of New York, USA; Jan. 1998; 9p; In English; 5th; Physics In Hadron Machines (Beauty 1997), 13-17 Oct. 1997, Santa Monica, CA, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/014-E; CONF-9710143; DE98-051889; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A number of B-physics results from the D0 experiment at the Fermilab Tevatron Collider is reported. Measurements of b(anti b) production in p(anti p) interactions at radical s = 1800 GeV and 630 GeV are used to evaluate, for the first time with the same detector, the center-of-mass energy and rapidity dependence of b-quark production cross section. A measurement of the b(anti b) angular correlations using dimuon triggers is also presented. Preliminary results from these measurements are compared with the next-to-leading order QCD predictions. Finally, dimuon data samples are used to study P(sub T) and rapidity dependence of b-produced and direct charmonium production.
DOE
Physics; Quantum Chromodynamics; Pair Production

19980210382 Fermi National Accelerator Lab., Batavia, IL USA
Recent D-Zero results on the top quark
Li, Q., Fermi National Accelerator Lab., USA; Jul. 1997; 8p; In English; 5th; San Miniato Topical Seminar on the Irresistible Rise of the Standard Mode, 21-25 Apr. 1997, San Miniato, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/229-E; CONF-9704173; DE97-053686; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Recent results on top quark physics with the D0 experiment in (anti p)p collisions at radical s = 1.8 TeV for an integrated luminosity of 125 pb(exp -1) are reported. The direct measurement of the top quark mass uses single lepton events, giving the result m(sub top) = 173.3 +/- 5.6(stat) +/- 6.2(syst) GeV=c(exp 2). The measurement of the t(anti t) production cross section includes analyses from 8 top decay channels: dilepton (t(anti t) yields e mu, ee, and mu mu, electron and neutrino (t(anti t) yields e nu), and single leptons (t(anti t) yields e + jets and t(anti t) yields mu + jets) with and without b tagging. We measure the t(anti t) production cross section to be 5.5 +/- 1.8 pb at m(sub top) = 173.3 GeV/c(exp 2).
DOE
Quarks; Physics; Collisions; Particle Production

19980210421 Argonne National Lab., IL USA
Dynamic response of physisorbed hydrogen molecules on lanthanide-modified zirconia nanoparticles
Loong, C. K., Argonne National Lab., USA; Trouw, F., Argonne National Lab., USA; Ozawa, Masakuni, Nagoya Inst. of Tech., Japan; Suzuki, Suguru, Nagoya Inst. of Tech., Japan; 1997; 6p; In English; Satellite, 25-26 Aug. 1997, Argonne, IL, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/ER/CP-94630; CONF-970893; DE98-050019; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Ultrafine lanthanide (Ln = Ce and Nd)-modified zirconia powders synthesized by a coprecipitation method exhibit high surface areas and adsorption sites that are essential for catalytic applications. We report a study of the surface chemistry of Ce(0.1)Zr(0.9)O2 and Nd(0.1)Zr(0.9)O(1.95) powders. First, the specific surface area and porosity are characterized by nitrogen isotherm-adsorption measurements. Second, the motion of hydrogen molecules physisorbed on Ce- and Nd-doped zirconias is studied by inelastic neutron scattering. Nitrogen adsorption-desorption isotherm measurements yield a BET surface area (26.1 sq m/g) and mesopore size ((approximately)5 nm radius) in Ce(0.1)Zr(0.9)O2 as compared to those (72.3 sq m/g and (approximately)3 nm) in Nd(0.1)Zr(0.9)O(1.95). The vibrational densities of states of H2 on Ce(0.1)Zr(0.9)O2 and Nd(0.1)Zr(0.9)O(1.95) were measured at 20 K over the 0-200 meV energy range for three hydrogen coverage. The spectra for both samples consist of two parts: a sharp peak at (approximately)14.5 meV and a broad component extending beyond 200 meV. The sharp peak corresponds to transitions from the J=0 to J=1 rotational states of bulk hydrogen molecules, and its intensity decreases with decreasing H(sub 2) coverage. The broad component corresponds to overdamped motion of surface adsorbed hydrogen molecules. The major difference in the latter component between the Ce- and Nd-doped samples is an excess of intensities in the 5-14 meV region in Nd(0.1)Zr(0.9)O(1.95). The confined motion of adsorbed H2 on the different micropore and mesopore surfaces of Ce(0.1)Zr(0.9)O2 and Nd(0.1)Zr(0.9)O(1.95) is discussed.
DOE
Doped Crystals; Microporosity; Molecular Gases; Neutron Scattering; Electrical Measurement; Inelastic Scattering; Zirconium Oxides

19980210464 Energia Nucleare e Delle Energie Alternative, Dipt. Innovazione, Rome, Italy
Point defects induced in LiF by low energy electrons
Baldacchini, Giuseppe, Energia Nucleare e Delle Energie Alternative, Italy; Montereali, Rosa Maria, Energia Nucleare e Delle Energie Alternative, Italy; Scacco, Augusto, Rome Univ., Italy; Cremona, Marco, Rome Univ., Italy; DAuria, Giuliano, Rome

Univ., Italy; Sep. 1997; ISSN 1120-5571; 29p; In English
Report No.(s): ENEA-RT-INN-97-18; DE98-728616; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

A systematic study of the coloring of LiF crystals and films irradiated by 3 keV electrons at various temperatures was carried out analysing their absorption and luminescence spectra. The three stage behaviour of the F coloring curve as a function of the irradiation dose was revealed and the saturation of the process was identified for the first time with this kind of radiation. The kinetics of the defect formation confirmed the expectations derived from the most comprehensive theoretical model developed to explain the coloring process. The irradiation temperature was found to have an influence on both the proportion of different defects created and on their stability and the overall coloring efficiency turned out to be higher when the irradiation was performed on films. Various explanations to these observations are put forward and discussed.

DOE

Point Defects; Lithium Fluorides; Electrons; Crystal Structure; Irradiation; Luminescence; Radiation Dosage; Thin Films

19980210465 Energia Nucleare e Delle Energie Alternative, Dipt. Innovazione, Rome, Italy

Molecular beam gas dynamics ***Fondamenti fisici dei fasci molecolari supersonicie, Parte 4, Riflessioni ed intersezioni di onde di rarefazione e compressione***

Tomassetti, G., Aquila Univ., Italy; Sanna, Giovanna, Aquila Univ., Italy; Sep. 1997; ISSN 1120-5571; 21p; In Italian
Report No.(s): ENEA-RT-INN-97-19; DE98-728617; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

The use of the hodograph plane for the solution of planar isoentropic flow problems is introduced. The reflections and intersection of waves of infinitesimal and finite amplitude are also considered.

DOE

Hodographs; Molecular Beams; Shock Waves; Supersonic Flow; Amplitude Distribution Analysis

19980210467 Fermi National Accelerator Lab., Batavia, IL USA

The HyperCP data acquisition system

Kaplan, D. M., Fermi National Accelerator Lab., USA; Jun. 1997; 15p; In English; 6th; Electronics for Particle Physics, 28-29 May 1997, Chestnut Ridge, NY, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/220-E; CONF-970565; DE97-054016; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

For the HyperCP experiment at Fermilab, we have assembled a data acquisition system that records on up to 45 Exabyte 8505 tape drives in parallel at up to 17 MB/s. During the beam spill, data are acquired from the front-end digitization systems at (approx) 60 MB/s via five parallel data paths. The front-end systems achieve typical readout deadtime of (approx) 1 (micro)s per event, allowing operation at 75-kHz trigger rate with (approx lt)30% deadtime. Event building and tapewriting are handled by 15 Motorola MVME167 processors in 5 VME crates.

DOE

Data Acquisition; Readout; Digital Techniques

19980210468 Fermi National Accelerator Lab., Batavia, IL USA

Extracting (ital alpha)(sub s)from Tevatron data

Giele, W. T., Fermi National Accelerator Lab., USA; Jul. 1997; 7p; In English; 5th; Deep Inelastic Scattering and QCD, 14-18 Apr. 1997, Chicago, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/240-T; CONF-970463; DE97-054018; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In this contribution we explore one of the many possibilities of determining the strong coupling constant (alpha)(sub s) at hadron colliders. The method considered is quite unique compared to other methods in that the value of (alpha)(sub s) is determined by the ''evolution rate'' of the parton density functions rather than by the ''event rate''.

DOE

Couplers; Partons; Particle Interactions; Hadrons

19980210469 Fermi National Accelerator Lab., Batavia, IL USA

Searches for new phenomena at CDF

Wilson, P. J., Chicago Univ., USA; Jul. 1997; 14p; In English; 11th; Results and Perspectives In Particle Physics, 2-8 Mar. 1997, LaThuile, Italy

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/241-E; CONF-9703116; DE97-054019; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present recent results of searches for new physics in 110 pb(sup -1) of p(anti p) collisions at (radical)s = 1800 GeV using the CDF detector. Presented are searches for third generation leptoquarks, charged and neutral Higgs bosons and the supersymmetric partner of the top quark ((tilde t)). A search for new physics in diphoton events tests some models attempting to explain the CDF ''ee(gamma)(gamma)E(sub T)'' event. Finding no signal in any of these channels, production limits are presented.

DOE

Higgs Bosons; Quarks; Collisions

19980210470 Fermi National Accelerator Lab., Batavia, IL USA

Physics of the top quark at CDF

Vejcik, S., Fermi National Accelerator Lab., USA; Jul. 1997; 8p; In English; 11th; Results and Perspectives In Particle Physics, 2-8 Mar. 1997, LaThuile, Italy

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/249-E; CONF-9703116; DE97-054020; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Measurements of Top quark properties with the CDF detector are reported. The production cross section and mass provide a consistent picture of the Top quark as described by the Standard Model. Initial studies of other properties such as estimates of branching ratios are also reported.

DOE

Quarks; Particle Production; Cross Sections; Particle Decay

19980210471 Fermi National Accelerator Lab., Batavia, IL USA

SUSY searches at the Tevatron

Culbertson, R., Chicago Univ., USA; Aug. 1997; 12p; In English; 5th; Supersymmetries In Physics, 27-31 May 1997, Philadelphia, PA, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/277-E; CONF-9705195; DE97-054154; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Current results of searches for Supersymmetry from the CDF and D0 collaborations are summarized. Analyses include searches in jets and missing E(sub t), leptons and missing E(sub t), and searches for charged and neutral Higgs particles. The CDF ee(gamma)(gamma)E (sub t) event and related analyses are presented.

DOE

Higgs Bosons; Charged Particles; Supersymmetry

19980210473 Fermi National Accelerator Lab., Batavia, IL USA

Search for high mass photon pairs in p(anti p) yields gamma gamma jj events at square root of s = 1.8 TeV

Abbott, B., Fermi National Accelerator Lab., USA; Oct. 1997; 13p; In English; 18th; Lepton Photon Interactions, 28 Jul. - 1 Aug. 1997, Hamburg, Jerusalem, Germany, Israel

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/325-E; CONF-970787; CONF-970870; DE98-050422; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A search for new physics in the channel p(anti p) (yields) (gamma)(gamma)jj has been studied. In some extended Higgs models, a light neutral scalar Higgs boson is produced with suppressed couplings to fermions and standard model(SM) strength couplings to vector bosons(bosonic Higgs), thus enhancing the H (yields) (gamma)(gamma) channel. We required one photon in the event with E(sup (gamma))(sub T) greater than 20 GeV, (vert bar)(eta)(sup (gamma))(vert bar) less than 1.1 or 1.5 less than (vert bar)(eta)(sup (gamma))(vert bar) less than 2.0 and a second photon with E(sup (gamma))(sub T) greater than 15 GeV, (vert bar)(eta)(sup (gamma))(vert bar) less than 1.1 or 1.5 less than (vert bar)(eta)(sup (gamma))(vert bar) less than 2.25. Additionally, we required one hadronic jet in the event with E(sup jet)(sub T) greater than 20 GeV, (vert bar)(eta)(sup jet)(vert bar) less than

2.0 and a second hadronic jet with E(sup jet)(sub T) greater than 15 GeV, (vert bar)(eta)(sup jet)(vert bar) less than 2.25. The photons are required to have a (summation)(rvec E)(sub T)((gamma)) (greater than or equal to) 10 GeV, and likewise the jets are required to have a (summation)(rvec E)(sub T)(jet) (greater than or equal to) 10 GeV. The final M(sub (gamma)(gamma)) distribution is consistent with background and no resonance is observed. A 90(95)% C.L. upper limit cross section vs M(sub (gamma)(gamma)) is calculated, which ranges from 0.6(0.7) pb(sup -1) for M(sub (gamma)(gamma)) = 60 GeV/c(sup 2) to 0.3(0.4) pb(sup -1) for M(sub (gamma)(gamma)) = 130 GeV/c(sup 2). With standard model coupling strengths between the bosonic Higgs and vector bosons, a 90(95)% C.L. bosonic Higgs lower mass limit is set at 86(81) GeV/c(sup 2).
DOE
Couplings; Higgs Bosons; Scalars

19980210474 Fermi National Accelerator Lab., Batavia, IL USA
Search for ZX yields nu (anti (nu)) b (anti b) Events in the D-Zero Detector
Abbott, B., Fermi National Accelerator Lab., USA; Oct. 1997; 11p; In English; 18th; Lepton Photon Interactions, 28 Jul. - 1 Aug. 1997, Hamburg, Jerusalem, Germany, Israel
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/358-E; CONF-970787; CONF-970870; DE98-050584; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We report on a search for a new particle, X, decaying via X (yields) b(anti b), made through associated production with a Z boson. We use data collected with the D0 detector operating at the Fermilab Tevatron p(anti p) collider with (radical)s = 1.8 TeV. We utilize muon-tagged jets to identify b-quarks and the (nu)(anti (nu)) channel to detect Z bosons. Preliminary results on cross section limits for X masses between 90 GeV/c(sup 2) and 180 GeV/c(sup 2) are presented.
DOE
Quarks; Muons; Bosons; Particle Decay

19980210499 Fermi National Accelerator Lab., Batavia, IL USA
Search for leptoquarks at CDF
Kambara, H. S., Fermi National Accelerator Lab., USA; Jul. 1997; 7p; In English; 12th; Hadrons In Collisions, 5-11 Jun. 1997, Stony Brook, NY, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/225-E; CONF-9706103; DE97-054017; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present the result of direct leptoquark searches based on 110 pb(sup -1) of integrated luminosity collected by the Collider Detector at Fermilab during the 1992-93 and 1994-95 Tevatron runs at (radical)s = 1.8 TeV. We present upper limits on the production cross sections as a function of the leptoquark mass. Using the NLO calculation of the leptoquark-pair production cross sections we extract lower-mass limits for 1(sup st), 2(sup nd), and 3(sup d) generation leptoquarks. We also present the result of an indirect search for Pati-Salam leptoquarks via exclusive e(mu) decay modes of B(sup 0)(sub s) and B(sup 0)(sub d)
DOE
Extraction; Pair Production; Data Acquisition; Invariance

19980210500 Fermi National Accelerator Lab., Batavia, IL USA
Branching fractions and polarization of CP eigenstates: CDF and CLEO
Lewis, J. D., Fermi National Accelerator Lab., USA; Aug. 1997; 12p; In English; B Physics and CP Violation, 24-27 Mar. 1997, Honolulu, HI, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/291-E; CONF-970352; DE97-054337; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Recent experimental results on branching ratios and polarization in B(sup 0)(yields)J/(psi)K(sup (*)) decays including the first measurements of three independent amplitudes that describe B(yields)J/(psi)K(sup *) decays are reviewed and compared to theoretical predictions. Results of the CLEO search for B(sub 0) (yields) D(sup (*)+) D(sup (*)-) are summarized.
DOE
Angular Distribution; Eigenvectors; Neutral Particles

19980210524 Fermi National Accelerator Lab., Batavia, IL USA

Prospects for CP violation searches at Tevatron

Lucchesi, D., Fermi National Accelerator Lab., USA; Sep. 1997; 6p; In English; 16th; Weak Interactions and Neutrinos, 22-28 Jun. 1997, Capri, Italy

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/302-E; CONF-9706187; DE98-050617; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In the near future CP violation measurements will be one of the most crucial test for the Standard Model. Several B factories are going to be built to study these phenomena in the B system. These goals can be achieved also at the Tevatron Collider by the two experiments: CDF and D0. Starting from data collected during Run 1 the sensitivity expected in Run 2 is shown.

DOE

Sensitivity; Experimentation; Data Acquisition; Invariance; Broken Symmetry

19980210525 Fermi National Accelerator Lab., Batavia, IL USA

Properties of events with a rapidity gap between jets in CDF

Melese, P., Rockefeller Univ., USA; Jun. 1997; 6p; In English; 5th; Deep Inelastic Scattering and QCD, 14-18 Apr. 1997, Chicago, IL, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/215-E; CONF-970463; DE98-050622; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present the (eta) and E(sub T) dependence of dijet events produced by color-singlet exchange in (anti p)p collisions at (radical)s = 1.8 TeV using data collected by the CDF collaboration at the Fermilab Tevatron. In a sample of events with two forward jets, where the jets are on opposite sides in rapidity with absolute value of (eta) greater than 1.8 and E(sub T) greater than 20 GeV, we find 1.13 +/- 0.12(stat) +/- 0. 11(syst)% have a rapidity gap between the jets consistent with color-singlet exchange. This signal has no significant dependence on the jet E(sub T) or the rapidity interval between the jets.

DOE

Particle Collisions; Collisions; Protons; Plasma Jets

19980210526 Fermi National Accelerator Lab., Batavia, IL USA

Tau physics at CDF

Gallinaro, M., Fermi National Accelerator Lab., USA; Aug. 1997; 7p; In English; 5th; Irresistible Rise of the Standard Mode, 21-25 Apr. 1997, San Miniato, Italy

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/282-E; CONF-9704173; DE98-050629; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We discuss tau identification techniques at hadron colliders, and present the measurements and the searches performed so far. We report on the first evidence of t(anti t) production in the channel containing one hadronically decaying (tau) lepton. We also present a search for the charged Higgs boson in the tau decay channel, as well as for the leptoquark family containing tau leptons. In addition, we underline the importance of tau physics both at present and future collider experiments.

DOE

Procedures; Particle Accelerators; Hadrons; Quarks

19980210527 Fermi National Accelerator Lab., Batavia, IL USA

Photons and diphotons from the Tevatron

Blair, R., Fermi National Accelerator Lab., USA; Aug. 1997; 8p; In English; 5th; Deep Inelastic Scattering and QCD, 14-18 Apr. 1997, Chicago, IL, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/294-E; CONF-970463; DE98-050630; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Photon measurements from the CDF and D0 collaboration are described. The subjects touched on are loosely organized around the fact that they all have some bearing on the structure functions and pQCD. The methodology of collider measurements

is briefly reviewed, and the results for single photons, photons plus jets, photons plus charm and diphotons are discussed. Finally there is a very brief indication of what is expected from the Tevatron based experiments in the future.
DOE
Photons; Structural Analysis; Particle Accelerators; Jet Flow

19980210528 Fermi National Accelerator Lab., Batavia, IL USA
Measurement of the W boson mass at the Tevatron
Flattum, E., Fermi National Accelerator Lab., USA; Aug. 1997; 6p; In English; 16th; Weak Interactions and Neutrinos, 22-28 Jun. 1997, Capri, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/297-E; CONF-9706187; DE98-050631; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Presented are measurements of the W boson mass from the D0 and CDF collaborations at the Tevatron from the 1994-1996 run. The W events are produced in p(anti p) collisions at (radical)s = 1.8 TeV. The W mass extracted from W (yields) e(nu) decays at D0 is determined to be 80.45 +/- 0.12 GeV; and from W (yields) (mu)(nu) decays at CDF is 80.43 +/- 0.16 GeV. The world average W mass from the hadron collider measurements is 80.41 +/- 0.09 GeV.
DOE
Bosons; Mass; Particle Accelerators; Particle Collisions

19980210529 Fermi National Accelerator Lab., Batavia, IL USA
Recent results on top quark physics at CDF
Gallinaro, M., Fermi National Accelerator Lab., USA; Jan. 1997; 15p; In English; 11th; High Energy Physics and Quantum Field Theory, 12-18 Sep. 1996, St. Petersburg, Russian Federation
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/004-E; CONF-9609343; DE98-050633; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present the latest results on the top quark obtained by the CDF experiment using a data sample of about 110 pb(sup -1). The data sample has been collected at the FermiLab Tevatron Collider with p(anti p) collisions at (radical)s = 1.8 TeV. We briefly describe the candidate event selection and then discuss the production cross section determination and the mass measurement. Combining the results from the channels with at least one W decaying leptonically into an electron or muon, we measure (sigma)(sub t(anti t)) = 7.5(sup +1.9)(sub -1.6) pb. Our best measured value for the top mass gives M(sub t) = 176.8 +/- 6.5 GeV/c(sup 2). We also report on the observation of t(anti t) production in the all hadronic decay channel using kinematic selection and b identification, and in the channel containing one hadronically decaying (tau) lepton. Finally we discuss the kinematics of top events and measure the matrix element absolute value of V(sub tb) = 1.12 +/- 0.12.
DOE
Quarks; Elementary Particle Interactions; Hadrons; Particle Decay

19980210531 Fermi National Accelerator Lab., Batavia, IL USA
The dijet mass spectrum at D-Zero
Abbott, B., Fermi National Accelerator Lab., USA; Nov. 1997; 16p; In English; 18th; Lepton Photon Interactions, 28 Jul. - 1 Aug. 1997, Hamburg, Jerusalem, Germany, Israel
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/360-E; CONF-970787; CONF-970870; DE98-050855; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present preliminary results from an analysis of jet data collected during the 1994-95 Tevatron Collider run with an integrated luminosity of 93 pb(sup -1). Measurements of dijet mass spectra in (anti p)p collisions at (radical)s = 1.8 TeV are compared to next-to-leading order QCD calculations.
DOE
Mass Spectra; Collisions; Plasma Jets; Data Processing

19980210532 Fermi National Accelerator Lab., Batavia, IL USA
The azimuthal decorrelation of jets widely separated in rapidity
Abbott, B., Fermi National Accelerator Lab., USA; Nov. 1997; 11p; In English; 18th; Lepton Photon Interactions, 28 Jul. - 1 Aug. 1997, Hamburg, Jerusalem, Germany, Israel

Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/371-E; CONF-970787; CONF-970870; DE98-050856; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We study the azimuthal decorrelation between jets with pseudorapidity separation up to six units. The data were accumulated using the D0 detector during the 1994-1995 collider run of the Fermilab Tevatron at (radical)s = 1.8 TeV. The data are compared to two parton shower Monte Carlos (HERWIG and PYTHIA) and an analytical prediction using the leading logarithmic BFKL resummation. The final state jets as predicted by the parton showering Monte Carlos describe the data over the entire pseudorapidity range studied. The prediction based on the leading logarithmic BFKL resummation shows more decorrelation than the data as the rapidity interval increases.

DOE

Azimuth; Correlation; Plasma Jets; Multiplication; Data Acquisition

19980210534 Fermi National Accelerator Lab., Batavia, IL USA

Hyperon production asymmetries in 500 GeV/c pion nucleus Interactions

Solano, J., Centro Brasileiro de Pesquisas Fisicas, Brazil; Magnin, J., Centro Brasileiro de Pesquisas Fisicas, Brazil; Simao, F. R. A., Centro Brasileiro de Pesquisas Fisicas, Brazil; Oct. 1997; 7p; In English; Relativistic Aspects of Nuclear Physics, 26-29 Aug. 1997, Rio de Janeiro, Brazil
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/368; CONF-9708124; DE98-051103; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present a preliminary study from Fermilab experiment E791 of (Lambda)(sup 0)/(anti (Lambda))(sup 0), (Xi)(sup -)/(Xi)(sup +) and (Omega)(sup -)/(Omega)(sup +) production asymmetries from (pi)(sup -) nucleus interactions at 500 Gev/c. The production asymmetries for these particles are studied as a function of x(sub F) and p(sup 2)(sub T). We observed an asymmetry in the target fragmentation region for (Lambda)(sup 0)'s larger than that for (Xi)'s, suggesting diquark effects. The asymmetry for (Omega)'s is significatively smaller than for the other two hyperons consistent with the fact that (Omega)'s do not share valence quarks with either the pion or the target particle. In the beam fragmentation region, the asymmetry tends to 0.1 for both (Lambda)(sup 0)'s and (Xi)'s. The asymmetries vs p(sup 2)(sub T) are approximately constant for the three strange baryons under study.

DOE

Particle Production; Hyperons; Pions; Asymmetry

19980210536 Fermi National Accelerator Lab., Batavia, IL USA

Search for supersymmetry at the Tevatron

Flattum, E., Fermi National Accelerator Lab., USA; Dec. 1997; 8p; In English; Front End of the Muon Colliders, 6-9 Nov. 1997, Batavia, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/404-E; CONF-971194; DE98-051437; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We discuss is the search for supersymmetry at the Fermilab Tevatron by the D0 and CDF collaborations in p(anti p) collisions at (radical)s = 1.8 TeV. The searches are performed in the jets plus E(sub T), leptons plus E(sub T), and photons plus E(sub T) channels. In these channels there is no excess of events over the expected backgrounds.

DOE

Supersymmetry; Particle Collisions; Elementary Particle Interactions

19980210546 Fermi National Accelerator Lab., Batavia, IL USA

Hard diffraction in CDF

Albrow, M. G., Fermi National Accelerator Lab., USA; Oct. 1997; 9p; In English; 7th; Blois Workshop: International Conference on Elastic and Diffractive Scattering - Recent Advances In Hadron Physics, 10 - 14 Jun. 1997, Seoul, Korea, Republic of
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/361-E; CONF-9706197; DE98-051149; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The aim of these studies is to use hard (large Q(sup 2)) processes to investigate the partonic nature of the pomeron. We have measured events with large rapidity gaps between balancing high E(sub T) jets, events with two forward (same-side) jets and a

large gap (diffractive di-jet production), diffractive W(sup (+-)) production and diffractive heavy flavor (J/(psi) and b-quark) production. Candidate events of the type double-pomeron (yields) di-jet are observed. I close with a look at the future (Run II).
DOE
Pomerons; Quarks

19980210547 Fermi National Accelerator Lab., Batavia, IL USA
Lifetime results from heavy quark systems
Papadimitriou, V., Fermi National Accelerator Lab., USA; Nov. 1997; 15p; In English; 17th; Physics In Collisions (Pic 97), 25-27 Jun. 1997, Bristol, UK
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/385-E; CONF-9706196; DE98-051225; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We present the latest measurements of weakly decaying b-hadrons from experiments at e(sup +)e(sup -) and p(anti p) colliders. These measurements include the average lifetime of b-hadrons, lifetimes of the B(sup -), B(sup 0) and B(sup 0)(sub s) mesons, the average lifetime of b-baryons and lifetimes of the (Lambda)(sub b) and (Xi)(sub b) baryons.
DOE
Baryons; Quarks

19980210548 Fermi National Accelerator Lab., Batavia, IL USA
31305: Tevatron searches for compositeness
Gallas, E., Texas Univ., USA; Nov. 1997; 6p; In English; High Energy Physics, 19-26 Aug. 1997, Jerusalem, Israel
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/390-E; CONF-970870; DE98-051233; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Tevatron experiments have recently set or improved limits on quark and lepton compositeness. Included here are results from (radical)s = 1.8 TeV p(anti p) collider experiments D0 and CDF and from fixed target neutrino experiment CCFR, who report limits on quark-quark, quark-lepton, and quark-neutrino compositeness, respectively.
DOE
Quarks; Radicals; Targets

19980210551 Fermi National Accelerator Lab., Batavia, IL USA
Photon and diphoton production, and k(sub T) Effects
Abbott, B., Fermi National Accelerator Lab., USA; Nov. 1997; 13p; In English; 18th; Lepton Photon Interactions, 28 Jul. - 1 Aug. 1997, Hamburg, Jerusalem, Germany, Israel
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/370-E; CONF-970787; CONF-970870; DE98-051276; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Isolated photon production at the D0 experiment is reviewed and recent results on di-photon production are presented.
DOE
Photons; Particle Production; Scattering Cross Sections

19980210552 Fermi National Accelerator Lab., Batavia, IL USA
Beautiful physics at CDF
Bauer, G., Massachusetts Inst. of Tech., USA; Jan. 1998; 15p; In English; 5th; Physics In Hadron Machines, 13-17 Oct. 1997, Santa Monica, CA, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/015-E; CONF-9710143; DE98-051852; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

B-physics with p(anti p) collisions at CDF is reviewed, including production cross sections, masses, and decay properties. with a focus on lifetime and mixing measurements. A two-component lifetime fit of B(sup 0)(sub s) (yields) l(sup +)D(sup -)(sub s)X results in the limit (Delta)(Gamma)(sub s)/(Gamma)(sub s) less than 0.81 (95% C.L.), which is converted into an indirect

upper bound on (Delta)m(sub s). From our five B(sup 0)(sub d)-(anti B)(sup 0)(sub d) oscillation analyses, we highlight the use of ''same side'' flavor tagging.
DOE
Collisions; Elementary Particle Interactions; Mesons; Life (Durability); Particle Decay

19980210554 Sandia Labs., Livermore, CA USA
Parallel unconstrained minimization of potential energy in LAMMPS
Plantenga, T., Sandia Labs., USA; Oct. 13, 1997; 24p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-8201; DE98-050976; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report describes a new minimization capability added to LAMMPS V4.0. Minimization of potential energy is used to find molecular conformations that are close to structures found in nature. The new minimization algorithm uses LAMMPS subroutines for calculating energy and force vectors, and follows the LAMMPS partitioning scheme for distributing large data objects on multiprocessor machines. Since gradient-based algorithms cannot tolerate nonsmoothness, a new Coulomb style that smoothly cuts off to zero at a finite distance is provided. This report explains the minimization algorithm and its parallel implementation within LAMMPS. Guidelines are given for invoking the algorithm and interpreting results.
DOE
Algorithms; Multiprocessing (Computers); Optimization

19980210566 Argonne National Lab., IL USA
H atom probes of radiation chemistry: Solids and liquids
Trifunac, A. D., Argonne National Lab., USA; Shkrob, I. A., Argonne National Lab., USA; [1998]; 7p; In English; Radiation and Photochemistry, 14-19 Jan. 1998, Mumbai, India
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/CHM/CP-94299; CONF-980122; DE97-054139; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

H atoms are ubiquitous in radiation chemistry. Radiolysis of most substances yield H atoms and studies of the mechanisms of their production are as old as the field of radiation chemistry. The problem is that study or products does not easily reveal the chemical mechanisms involved even with the clever use of isotopes. Time-resolved pulsed electron paramagnetic resonance (EPR) was used to study formation and decay kinetics of spin-polarized mobile H atoms in radiolysis of wet fused silica containing approximately 1,200 ppm of SiOH groups. Two reactions of H atoms can be distinguished: a slow component corresponding to scavenging of H atoms by metastable paramagnetic centers and a fast component which is ascribed to a reaction of a short-lived small polaron (intrinsic hole) with H atoms.
DOE
Radiation Chemistry; Reaction Kinetics; Hydrogen; Radiolysis; Silica Glass; Electron Paramagnetic Resonance

19980210579 Florida Univ., Inst. for Fundamental Theory, Gainesville, FL USA
Using collider event topology in the search for the six-jet decay of top quark-antiquark pairs
Field, R. D., Florida Univ., USA; Kanev, Y. A., Florida Univ., USA; Nov. 1997; 19p; In English
Contract(s)/Grant(s): DE-FG05-86ER-40272
Report No.(s): DOE/ER/40272-289; UFIFT-HEP-97-31; DE98-001991; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The authors investigate the use of the event topology as a tool in the search for the six-jet decay of top-pair production in proton-antiproton collisions at 1.8 TeV. Modified-Fox-Wolfram shape variables, (cflx H)(sub (ell)), are employed to help distinguish the top-pair signal from the ordinary QCD multi-jet background. The (cflx h)(sub (ell))'s can be constructed directly from the calorimeter cells or from jets. Events are required to lie in a region of (cflx H)(sub (ell))-space defined by L(sub (ell)) less than (cflx h)(sub (ell)) less than R(sub (ell)) for (ell) = 1, ..., 6, where the Left, L(sub (ell)), and right, R(sub (ell)), cuts are determined by a genetic algorithm (GA) procedure to maximize the signal over the square root of the background. They are able to reduce the background over the signal to less than a factor of 100 using purely topological methods without using jet multiplicity cuts and without the aid of b-quark tagging.
DOE
Quarks; Data Processing; Multiplication; Pair Production

19980210582 Massachusetts Inst. of Tech., Cambridge, MA USA

Deuteron threshold electrodisintegration at high momentum transfer

Schmitt, W. M., Massachusetts Inst. of Tech., USA; Turchinetz, W., Massachusetts Inst. of Tech., USA; Williamson, C. F., Massachusetts Inst. of Tech., USA; Aug. 25, 1997; 38p; In English

Contract(s)/Grant(s): DE-FC02-94ER-40818; DE-FG02-88ER-40415; DE-AC02-76ER-03069

Report No.(s): DOE/ER/40818-T1; DE98-001995; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Absolute differential cross sections for the threshold electrodisintegration of the deuteron with good resolution were measured at a laboratory scattering angle of 160(degree) for five values of Q(sup 2) ranging from 8.66 to 42.4 /sq fm. Comparisons of the data averaged over E(sub np) from 0-3 MeV and 0-10 MeV are made with nonrelativistic meson-exchange calculations. These calculations are sensitive to the nucleon electromagnetic form factors, nucleon-nucleon potential, and relativistic effects. The data are also compared with a hybrid quark-hadron model calculation that describes the deuteron as a six-quark cluster for the short range part of the interaction. Some of these calculations can describe the data reasonably well over certain ranges of Q(sup 2); however, none of these calculations can accurately describe the data over the entire measured Q(sup 2) range.

DOE

Deuterons; Thresholds; Targets; Data Acquisition; Quark Models; Nucleon-Nucleon Interactions

19980210605 Massachusetts Inst. of Tech., Cambridge, MA USA

Quasielastic electron scattering from Ca-40

Williamson, C. F., Massachusetts Inst. of Tech., USA; Yates, T. C., Massachusetts Inst. of Tech., USA; Schmitt, W. M., Massachusetts Inst. of Tech., USA; [1998]; 47p; In English

Contract(s)/Grant(s): DE-FC02-94ER-40818

Report No.(s): DOE/ER/40818-T2; DE98-001996; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Differential cross sections for quasielastic electron scattering on Ca-40 have been measured at laboratory scattering angles of 45.5 degree, 90 degree, and 140 degree with bombarding energies ranging from 130 to 840 MeV. Transverse and longitudinal response functions have been extracted for momentum transfers from 300 to 500 MeV/c. Contrary to some previously reported results, the total observed longitudinal strength agrees with the relativistic Fermi gas prediction to within +/- 18%.

DOE

Calcium Isotopes; Scattering Cross Sections; Electron Scattering

19980210616 Fermi National Accelerator Lab., Batavia, IL USA

QCD results from D-Zero

Varelas, N., Fermi National Accelerator Lab., USA; Oct. 1997; 10p; In English; Quantum Photodynamics, 3-9 Jul. 1997, Montpellier, France

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/346-E; CONF-9707114; DE98-050625; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present recent results on jet production, dijet angular distributions, W+ Jets, and color coherence from p(anti p) collisions at (radical)s = 1.8 TeV at the Fermilab Tevatron Collider using the D0 detector. The data are compared to perturbative QCD calculations or to predictions of parton shower based Monte Carlo models.

DOE

Quantum Chromodynamics; Data Acquisition; Elementary Particle Interactions; Particle Accelerators; Collisions; Angular Distribution

19980210698 Fermi National Accelerator Lab., Batavia, IL USA

Observations of the Scalar Meson f(sub 0) (980) in the photoproduction experiment E687 at Fermi lab.

Lebrun, P., Fermi National Accelerator Lab., USA; Nov. 1997; 9p; In English; Hadron Spectroscopy, 28-30 Aug. 1997, Upton, NY, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/388-E; CONF-970842; DE98-051675; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Observation of the scalar meson f(sub 0)(980) is reported in the E687 photoproduction experiment at Fermi lab. Evidence is given also for the quasi-exclusive associated (phi)(1020)f(sub 0)(980) photoproduction.
DOE
Scalars; Photoproduction; Mesons

19980210699 Fermi National Accelerator Lab., Batavia, IL USA
Flavor and CP violations from sleptons at the Muon Collider
Cheng, H.-C., Fermi National Accelerator Lab., USA; Dec. 1997; 12p; In English; Front End of the Muon Colliders Workshop, 6 - 9 Nov. 1997, Batavia, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/418-T; CONF-971194; DE98-051676; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Supersymmetric theories generally have new flavor and CP violation sources in the squark and slepton mass matrices. They will contribute to the lepton flavor violation processes, such as mu yields e gamma, which can be probed far below the current bound with an intense muon source at the front end of the muon collider. In addition, if sleptons can be produced at the muon collider, the flavor violation can occur at their production and decay, allowing us to probe the flavor mixing structure directly. Asymmetry between numbers of mu(exp +)e(exp -) and e(exp +)mu(exp -) events will be a sign for CP violation in supersymmetric flavor mixing.
DOE
Supersymmetry; Muons

19980210701 Fermi National Accelerator Lab., Batavia, IL USA
Top quark physics and searches for new phenomena at the Tevatron
Hall, R.E., California Univ., USA; Jan. 1998; 9p; In English; 27th; Multiparticle Dynamics (ISMD 97), 8 - 12 Sep. 1997, Frascati, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/010-E; CONF-9709174; DE98-051679; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The CDF and D0 collaborations each have collected over 110 pb(exp -1) from top quark physics and searches for first generation leptoquarks (LQ), using the entire statistics of these large data sets. After careful selection, both collaborations have collected top quark data samples consisting of several dozen events each. From these events both experiments have measured the top quark mass and pair production cross section in a variety of decay channels, including the so-called dilepton, lepton plus jets, and all jets channels. The combined top quark mass from both experiments in the lepton plus jets channels is m(sub t) = 175.6(+/-)5.5 GeV/c(exp 2). CDF and D0 have also performed optimized searches for the pair production of first generation leptoquarks. No candidate events were found. Combining the results from the ee+jets, e nu+jets, and nu nu+jets channels both experiments set 95% confidence level (CL) upper limits on the LQ pair production cross section as a function of mass and of beta, the branching fraction to a charged lepton.
DOE
Quarks; Neutrinos

19980210724 Fermi National Accelerator Lab., Batavia, IL USA
Electroweak and flavor dynamics at hadron colliders - 1
Elchtent, E., Boston Univ., USA; Lane, K., Boston Univ., USA; Feb. 1998; 16p; In English; 1996 Dpf/dpb Workshop on New Directions for High Energy Physics, 25 Jun. - 12 Jul. 1996, Snowmass, CO, USA; Sponsored by American Physical Society, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-96/297-T; CONF-9606243; DE98-052295; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This is the first of two reports cataloging the principal signatures of electroweak and flavor dynamics at (anti p)p and pp colliders. Here, we discuss some of the signatures of dynamical electroweak and flavor symmetry breaking. The framework for dynamical symmetry breaking we assume is technicolor, with a walking coupling (alpha)(sub TC), and extended technicolor. The reactions discussed occur mainly at subprocess energies (radical)(cflx s)(approx lt) 1 TeV. They include production of color-singlet and octet technirhos and their decay into pairs of technipions, longitudinal weak bosons, or jets. Technipions, in turn, decay

predominantly into heavy fermions. This report will appear in the Proceedings of the 1996 DPF/DPB Summer Study on New Directions for High Energy Physics (Snowmass 96).
DOE
Broken Symmetry; Proton-Proton Reactions; Antiprotons; Coupling; Hadrons; Collisions; Electroweak Interactions (Field Theory); Dynamic Characteristics

19980210729 Fermi National Accelerator Lab., Batavia, IL USA
Top Quark Physics at a Polarized Muon Collider
Parke, S., Fermi National Accelerator Lab., USA; Feb. 1998; 9p; In English; Front End of the Muon Colliders, 6-9 Nov. 1997, Batavia, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/056-T; CONF-971194; DE98-052134; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Top quark pair production is presented at a polarized Muon Collider above the threshold region. The off-diagonal spin basis is the natural basis for this discussion as the top quark pairs are produced in an essentially unique spin configuration for 100% polarization. Modest polarization, say 30%, can lead to 90% of all top quark pair events being in one spin configuration. This will lead to sensitive tests on anomalous top quark couplings.
DOE
Quarks; Muons; Collisions; Pair Production; Beams (Radiation)

19980210746 Fermi National Accelerator Lab., Batavia, IL USA
Pion Production and Targetry at (mu) (sup +) (mu) (sup -) Colliders
Mokhov, N. V., Fermi National Accelerator Lab., USA; VanGinneken, A., Fermi National Accelerator Lab., USA; Jan. 1998; 8p; In English; 4th; Physics Potential and Development of Muon-muon Colliders, 10.6. - 12 Dec. 1997, San Francisco, CA, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/041; CONF-971215; DE98-052011; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Results of simulations of pion production and power dissipation by 8 to 30 GeV proton beams in co-axial and tilted targets of liquid gallium and platinum oxide, placed in a 20 T solenoid, are reported. Pion and muon distributions are followed through the matching solenoid and decay channel.
DOE
Pions; Collisions; Proton Beams; Particle Production

19980210748 Fermi National Accelerator Lab., Batavia, IL USA
Measurement of sin (sup 2)(Theta)(sub W) at the First Muon Collider
Yu, J., Fermi National Accelerator Lab., USA; Kotwal, A. V., Fermi National Accelerator Lab., USA; Jan. 1998; 10p; In English; Front End of the Muon Colliders Workshop, 6-9 Nov. 1997, Batavia, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/027; CONF-971194; DE98-052006; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report summarizes the study of the possibility of measuring sin(sup 2)(theta)(sub W) using the intense neutrino beam expected from the straight sections of the First Muon Collider ring. This study is based on realistic error calculations from the CCFR and the NuTeV experiments. Using a neutrino detector that is capable of identifying and distinguishing electrons and muons, along with a light isoscalar target, it is conceivable to measure sin(sup 2)(theta)(sub W) to the precision equivalent to the W mass uncertainty (experimental) of 30 MeV.
DOE
Neutrinos; Geometry; Muons; Neutrino Beams; Collisions

19980210750 Fermi National Accelerator Lab., Batavia, IL USA
Production and fragmentation of heavy quarks
Napier, A., Fermi National Accelerator Lab., USA; Jan. 1998; 20p; In English; 17th; Physics In Collisions (Pic 97), 25-27 Jun. 1997, Bristol, UK
Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-98/002; CONF-9706196; DE98-052003; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This talk is a review of recent results on the production and fragmentation of heavy quarks from fixed target experiments, from e(sup +)e(sup -) and p(anti p) colliders, and from HERA.

DOE

Quarks; Fragmentation; Particle Production; Pair Production

19980210751 Fermi National Accelerator Lab., Batavia, IL USA

The cosmological constant: Plus CA change, plus C'est La Meme Chose

Frieman, J. A., Fermi National Accelerator Lab., USA; Feb. 1998; 18p; In English; 3rd; Colloque Cosmologie, Jun. 1995, Paris, France

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-95/261-A; CONF-9506433; DE98-051977; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Recent measurements of the cosmological parameters have renewed interest in the cosmological constant (Lambda). I briefly review the current status of these measurements and the corresponding arguments for and against cosmological models with non-zero (Lambda). I outline a scenario which attempts to incorporate non-zero vacuum energy into the framework of particle physics, based on an ultra-light pseudo-Nambu-Goldstone boson. With global spontaneous symmetry breaking scale f (approx equal) 10(sup 18) GeV and explicit breaking scale comparable to MSW neutrino masses, M (approximately) 10(sup -3) eV, such a field, which acquires a mass M(sub (phi)) (approximately) M(sup 2)/f (approximately) H(sub 0), would have become dynamical at recent epochs and currently dominate the energy density of the universe. The field acts as an effective cosmological constant for several expansion times and then relaxes into a condensate of coherent non-relativistic bosons. Such a model can reconcile dynamical estimates of the density parameter, (Omega)(sub m) (approximately) 0.2, with a spatially flat universe, and can yield an expansion age H(sub 0)t(sub 0) (approx equal) 1 while remaining consistent with limits from gravitational lens statistics.

DOE

Broken Symmetry; Bosons; Time Measurement; Scalars; Mass; Cosmology

19980210755 Brookhaven National Lab., Upton, NY USA

Design and processing of various configurations of silicon pixel detectors for high irradiation tolerance up to 6x10(exp 14) n/cm(exp 2) in LHC application

Chen, W., Brookhaven National Lab., USA; Li, Z., Brookhaven National Lab., USA; Chien, C. Y., Johns Hopkins Univ., USA; Xie, X., Johns Hopkins Univ., USA; Nov. 1997; 5p; In English; Nuclear Science Symposium, 11-13 Nov. 1997, Albuquerque, NM, USA

Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-64979; CONF-971147; DE98-001636; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Various new configurations of silicon pixel detector have been designed and are in prototype production. The material selection and detector design are aimed to produce silicon detectors with radiation tolerance up to 6x10(exp 14) n/cm(exp 2) (or 4x10(exp 14) (pi)/cm(exp 2)) in LHC environment, which corresponds to a net increase (with long term anneal) of space charge of about 4.2x10(exp 13) cm(exp -3). The configuration of n(exp +)/n/p(exp +), with multi-guard-rings structure for high voltage (up to 300 volts) operation, has been used for the purpose to make the detector insensitive to space charge sign inversion. The material selection of medium resistivity (1.9k Omega-cm) n-type silicon has been made to try a new solution in extending detector lifetime: it should be the first step toward the use of low resistivity silicon, to prevent type inversion. The traditional configuration of p(exp +)/n/n(exp +), with multi-guard-ring structure and n-type material, has also been used with the same layout, to get a comparison. It is shown as the fabrication of n(wxp +)/n/p(exp +) pixel detectors requires eight mask steps, while just four mask steps are required for the p(exp +)/n/n(exp +) configuration.

DOE

Silicon; Pixels; Irradiation; Prototypes; Radiation Tolerance

19980210759 Brookhaven National Lab., Upton, NY USA

The DHG sum rule measured with medium energy photons

Hicks, K., Ohio Univ., USA; Ardashev, K., Ohio Univ., USA; Babusci, D., Istituto Nazionale di Fisica Nucleare, Italy; [1997]; 9p; In English; Exciting Physics with New Accelerator Facilities, 11-13 Mar. 1997, Nishi-Harima, Japan

Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-64985; CONF-9703135; DE98-001620; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The structure of the nucleon has many important features that are yet to be uncovered. of current interest is the nucleon spin-structure which can be measured by doing double-polarization experiments with photon beams of medium energies (0.1 to 2 GeV). One such experiment uses dispersion relations, applied to the Compton scattering amplitude, to relate measurement of the total reaction cross section integrated over the incident photon energy to the nucleon anomalous magnetic moment. At present, no single facility spans the entire range of photon energies necessary to test this sum rule. The Laser-Electron Gamma Source (LEGS) facility will measure the double-polarization observables at photon energies between 0.15-0.47 MeV. Either the Spring8 facility, the GRAAL facility (France), or Jefferson Laboratory could make similar measurements at higher photon energies. A high-precision measurement of the spin-polarizability and the Drell-Hearn-Gerasimov sum rule is now possible with the advent of high-polarization solid HD targets at medium energy polarized photon facilities such as LEGS, GRAAL and SPring8. Other facilities with lower polarization in either the photon beam or target (or both) are also pursuing these measurements because of the high priority associated with this physics. The Spin-asymmetry (SASY) detector that will be used at LEGS has been briefly outlined in this paper. The detector efficiencies have been explored with simulations studies using the GEANT software, with the result that both charged and uncharged pions can be detected with a reasonable efficiency greater than 30% over a large solid angle. Tracking with a TPC, which will be built at LEGS over the next few years, will improve the capabilities of these measurements.

DOE

Sum Rules; Photons; Nucleons

19980210795 Fermi National Accelerator Lab., Batavia, IL USA

Top pair production in e+e- and (gamma)(gamma) processes

Hori, M., Hiroshima Univ., Japan; Kiyo, Y., Hiroshima Univ., Japan; Kodaira, J., Hiroshima Univ., Japan; Nasuno, T., Hiroshima Univ., Japan; Parke, S., Fermi National Accelerator Lab., USA; Feb. 1998; 12p; In English; Qcd Corrections and New Physics, 27 - 29 Oct. 1997, Hiroshima, Japan

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-98/022-T; CONF-9710149; DE98-052309; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We analyze spin correlations between top quark and anti-top quark produced at polarized e(sup +) e(sup -) and (gamma)(gamma) colliders. We consider a generic spin basis to find a strong spin correlation. Optimal spin decompositions for top quark pair are presented for e(sup +)e(sup -) and (gamma)(gamma) colliders. We show the cross- section in these bases and discuss the characteristics of results.

DOE

Pair Production; Elementary Particle Interactions; Photon-Electron Interaction; Quarks; Spin Dynamics

19980210797 Fermi National Accelerator Lab., Batavia, IL USA

Recent results from CDF

Takikawa, K., Tsukuba Univ., Japan; Feb. 15, 1998; 19p; In English; Qcd Corrections and New Physics, 27-29 Oct. 1997, Hiroshima, Japan

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-98/054-E; CONF-9710149; DE98-052133; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We first present recent CDF results on the top quark, covering the measurement of the t(anti t) production cross section and the top quark mass, the observation of hadronic W decays in top events, the measurement of V(sub tb), the search for flavor changing neutral current decays, and kinematical properties of t(anti t) production. Then we present one topic from CDF exotic physics results, i.e., the search for first-generation leptoquarks, and one topic from CDF B physics results, i.e., the measurement of time-dependent B(sup 0)-(anti B)(sup 0) mixing. Finally we conclude by briefly mentioning the prospects for Run 2.

DOE

Quarks; Collisions; Pair Production; Particle Decay; Collision Parameters

19980210823 Fermi National Accelerator Lab., Batavia, IL USA

Higgs boson and Z physics at the first muon collider

Demarteau, M., Fermi National Accelerator Lab., USA; Han, T., Fermi National Accelerator Lab., USA; Jan. 1998; 18p; In English; Front End of the Muon Colliders Workshop, 6-9 Nov. 1997, Batavia, IL, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-98/030; CONF-971194; DE98-052007; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The potential for the Higgs boson and Z-pole physics at the first muon collider is summarized, based on the discussions at the ''Workshop on the Physics at the First Muon Collider and at the Front End of a Muon Collider''.

DOE

Higgs Bosons; Muons; Collisions

19980210824 Lawrence Livermore National Lab., Livermore, CA USA

TART97 a coupled neutron-photon 3-D, combinatorial geometry Monte Carlo transport code

Cullen, D. E., Lawrence Livermore National Lab., USA; Nov. 22, 1997; 93p; In English

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-ID-126455-Rev.1; DE98-052065; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

TART97 is a coupled neutron-photon, 3 Dimensional, combinatorial geometry, time dependent Monte Carlo transport code. This code can on any modern computer. It is a complete system to assist you with input preparation, running Monte Carlo calculations, and analysis of output results. TART97 is also incredibly FAST; if you have used similar codes, you will be amazed at how fast this code is compared to other similar codes. Use of the entire system can save you a great deal of time and energy. TART97 is distributed on CD. This CD contains on- line documentation for all codes included in the system, the codes configured to run on a variety of computers, and many example problems that you can use to familiarize yourself with the system. TART97 completely supersedes all older versions of TART, and it is strongly recommended that users only use the most recent version of TART97 and its data riles.

DOE

Photons; Combinatorial Analysis; Computerized Simulation; Three Dimensional Models; Neutrons

19980210826 Fermi National Accelerator Lab., Batavia, IL USA

Testing technicolor with scalars at the first muon collider

Dobrescu, B. A., Fermi National Accelerator Lab., USA; Feb. 1998; 10p; In English; Front End of the Muon Colliders, 6-9 Nov. 1997, Batavia, IL, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-98/044-T; CONF-971194; DE98-052297; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An interesting class of models of dynamical electroweak symmetry breaking allows only the third generation fermions to acquire dynamical masses, such that the masses of the first two generations should be given by coupling to a nonstandard ''Higgs'' doublet. The scalars in this case have large couplings to the second generation, so that they are copiously produced at a muon collider. We analyze the potential for discovery of the neutral scalars in the s-channel, and we show that at resonance there will be observed in excess of 10(exp 5) events per year.

DOE

Couplings; Broken Symmetry; Collisions; Full Scale Tests

73
NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory. For space radiation see 93 Space Radiation.

19980206500 Oak Ridge National Lab., TN USA

Varying temperature irradiation experiment for operation in HFIR

Qualls, A. L., Oak Ridge National Lab., USA; Muroga, T., National Inst. for Fusion Science, Japan; 1997; 13p; In English; 8th; Fusion Reactor Materials, 26-31 Oct. 1997, Sendai, Japan

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): ORNL/CP-94982; CONF-971090; DE98-001051; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An experiment to directly compare the effects of neutron fluence received at steady temperature on microstructure and mechanical properties of candidate fusion reactor structural materials to the effects of receiving 10% of the fluence at reduced temperature has been designed. The Varying Temperature Experiment is being fabricated for irradiation in a large Removable

Beryllium (RB) position of the High Flux Isotope Reactor (HFIR). For this experiment, specimen temperatures are elevated and controlled whenever there is substantial neutron fluence to the specimens (reactor power > 10%). Half of the specimens are irradiated at two distinct temperatures, and half are irradiated at constant temperature. The capsule features to meet these requirements are described. The experiment will operate for ten reactor cycles beginning in early 1998. This project is a collaborative effort under the Japan-USA cooperative program (Jupiter Project).
DOE
Fusion Reactors; Reactor Materials; Microstructure; High Flux Isotope Reactors; Fabrication; Fluence; Irradiation

19980206739 Oak Ridge National Lab., TN USA
Separation of beam and electrons in the spallation neutron source H(-) ion source
Whealton, J. H., Oak Ridge National Lab., USA; Raridon, R. J., Oak Ridge National Lab., USA; Leung, K. N., California Univ., Lawrence Berkeley Lab., USA; 1997; 12p; In English; 8th; 7th; Production of Neutralization of Negative Ions and Beams, 15 - 19 Sep. 1997, Giens, Giens, France, France
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95051; CONF-9709134; DE98-001099; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Spallation Neutron Source (SNS) requires an ion source producing an H(-) beam with a peak current of 35mA at a 6.2 percent duty factor. For the design of this ion source, extracted electrons must be transported and dumped without adversely affecting the H(-) beam optics. Two issues are considered: (1) electron containment transport and controlled removal; and (2) first-order H(-) beam steering. For electron containment, various magnetic, geometric, and electrode biasing configurations are analyzed. A kinetic description for the negative ions and electrons is employed with self-consistent fields obtained from a steady-state solution to Poisson's equation. Guiding center electron trajectories are used when the gyroradius is sufficiently small. The magnetic fields used to control the transport of the electrons and the asymmetric sheath produced by the gyrating electrons steer the ion beam. Scenarios for correcting this steering by split acceleration and focusing electrodes will be considered in some detail.
DOE
Ion Beams; Electrons; Beam Steering; Spallation; Ion Sources

19980206775 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Numerical simulation studies of the LBNL heavy-ion beam combiner experiment
Fawley, W. M., California Univ., Lawrence Berkeley Lab., USA; Seidl, P., California Univ., Lawrence Berkeley Lab., USA; Haber, I., California Univ., Lawrence Berkeley Lab., USA; Friedman, A., California Univ., Lawrence Berkeley Lab., USA; Grote, D. P., California Univ., Lawrence Berkeley Lab., USA; Jan. 1997; 6p; In English; 17th; Particle Accelerator, 12 - 16 May 1997, Vancouver, Canada; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-76SF-00098; DE-AI02-94ER-54232; W-7405-eng-48
Report No.(s): LBNL-39892; CONF-970503; DE97-054540; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Transverse beam combining is a cost-saving option employed in many designs for heavy-ion inertial fusion energy drivers. A major area of interest, both theoretically and experimentally, is the resultant transverse phase space dilution during the beam merging process. Currently, a prototype combining experiment is underway at LBNL and we have employed a variety of numerical descriptions to aid in both the initial design of the experiment data. These range from simple envelope codes to detailed 2- and 3-D PIC simulations. We compare the predictions of the different numerical models to each other and to experimental data at different longitudinal positions.
DOE
Ion Beams; Heavy Ions; Inertial Confinement Fusion; Fusion Reactors

19980209660 Argonne National Lab., IL USA
Critical database technologies for high energy physics
Malon, D. M., Argonne National Lab., USA; May, E. N., Argonne National Lab., USA; 1997; 7p; In English; 23rd; VLDB Conference, 26 - 29 Aug. 1997, Athens, Greece
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL-HEP-CP-97-45; CONF-970882-1; DE97-053540; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A number of large-scale high energy physics experiments loom on the horizon, several of which will generate many petabytes of scientific data annually. A variety of exploratory projects are underway within the physics computing community to investigate

approaches to managing the data. There are conflicting views of this massive data problem: (1) there is far too much data to manage effectively within a genuine database; and (2) there is far too much data to manage effectively without a genuine database; and many people hold both views. The purpose of this paper is to begin a dialog between the computational physics and very large database community on such problems, and to simulate research in directions that will be of benefit to both groups. This paper will attempt to outline the nature and scope of these massive data problems, survey several of the approaches being explored by the physics community, and suggest areas in which high energy physicists hope to look to the database community for assistance.
DOE
High Energy Interactions; Data Bases; Data Base Management Systems; Data Acquisition

19980209717 Lawrence Livermore National Lab., Livermore, CA USA
Measurement of high energy neutrons via Lu(n,xn) reactions
Henry, E. A., Lawrence Livermore National Lab., USA; Becker, J. A., Lawrence Livermore National Lab., USA; Archer, D. E., Lawrence Livermore National Lab., USA; Younes, W., Lawrence Livermore National Lab., USA; Stoyer, M. A., Lawrence Livermore National Lab., USA; Slaughter, D., Lawrence Livermore National Lab., USA; Jul. 1997; 10p; In English, 16 - 20 Nov. 1997, Albuquerque, NM, USA; Sponsored by American Nuclear Society, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-126221; CONF-971125-; DE98-051085; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

High energy neutrons can be assayed by the use of the nuclear diagnostic material lutetium. We are measuring the (n,xn) cross sections for natural lutetium in order to develop it as a detector material. We are applying lutetium to diagnose the high energy neutrons produced in test target/blanket systems appropriate for the Accelerator Production of Tritium Project.
DOE
Neutron Counters; Lutetium; Neutron Spectra; Tritium; Neutrons

19980210140 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Production of highly charged ion beams from ECR ion sources
Xie, Z. Q., California Univ., Lawrence Berkeley Lab., USA; Sep. 1997; 16p; In English; 7th; Ion Sources, 7-13 Sep. 1997, Taormina, Italy
Contract(s)/Grant(s): DE-AC03-76SF-00098
Report No.(s): LBNL-40835; CONF-970958; DE98-001370; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Electron Cyclotron Resonance (ECR) ion source development has progressed with multiple-frequency plasma heating, higher mirror magnetic fields and better technique to provide extra cold electrons. Such techniques greatly enhance the production of highly charged ions from ECR ion sources. So far at cw mode operation, up to 300 e(mu)A of O(sup 7+) and 1.15 emA of O(sup 6+), more than 100 e(mu)A of intermediate heavy ions for charge states up to Ar(sup 13+), Ca(sup 13+), Fe(sup 13+), Co(sup 14+) and Kr(sup 18+), and tens of e(mu)A of heavy ions with charge states to Kr(sup 26+), Xe(sup 28+), Au(sup 35+), Bi(sup 34+) and U(sup 34+) have been produced from ECR ion sources. At an intensity of at least 1 e(mu)A, the maximum charge state available for the heavy ions are Xe(sup 36+), Au(sup 46+), Bi(sup 47+) and U(sup 48+). An order of magnitude enhancement for fully stripped argon ions (I (ge) 60 enA) also has been achieved. This article will review the ECR ion source progress and discuss key requirement for ECR ion sources to produce the highly charged ion beams.
DOE
Ion Beams; Electron Cyclotron Resonance; Argon; Xenon; Uranium; Plasmas (Physics); Oxygen Ions

19980210144 Brookhaven National Lab., Upton, NY USA
Proceedings of the Third ICFA Mini-Workshop on High Intensity, High Brightness Hadron Accelerators
Roser, T., Brookhaven National Lab., USA; 1997; 239p; In English, 7-9 May 1997, Upton, NY, USA
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-64754; CONF-9705197-Summ; DE98-000840; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The third mini-workshop on high intensity, high brightness hadron accelerators was held at Brookhaven National Laboratory on May 7-9, 1997 and had about 30 participants. The workshop focussed on rf and longitudinal dynamics issues relevant to intense

and/or bright hadron synchrotrons. A plenary session was followed by four sessions on particular topics. This document contains copies of the viewgraphs used as well as summaries written by the session chairs.
DOE
Conferences; Brightness; Hadrons; Acceleration (Physics); Elementary Particle Interactions; Beams (Radiation); Particle Accelerators

19980210145 Argonne National Lab., IL USA
Parallelization of the MAAP: A code neutronics/thermal hydraulics coupling
Froehle, P. H., Argonne National Lab., USA; Wei, T. Y. C., Argonne National Lab., USA; Weber, D. P., Argonne National Lab., USA; Henry, R. E., Argonne National Lab., USA; [1998]; 7p; In English; Simulation Technology for Nuclear Power Plants and Systems, 11-14 Jan. 1998, San Diego, CA, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/RE/CP-94525; CONF-980120; DE98-000350; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A major new feature, one-dimensional space-time kinetics, has been added to a developmental version of the MAAP code through the introduction of the DIF3D-K module. This code is referred to as MAAP-A. to reduce the overall job time required, a capability has been provided to run the MAAP-A code in parallel. The parallel version of MAAP-A utilizes two machines running in parallel, with the DIF3D-K module executing on one machine and the rest of the MAAP-A code executing on the other machine. Timing results obtained during the development of the capability indicate that reductions in time of 30 - 40% are possible. The parallel version can be run on two SPARC 20 (SUN OS 5.5) workstations connected through the ethernet. MPI (Message Passing Interface standard) needs to be implemented on the machines. If necessary the parallel version can also be run on only one machine. The results obtained running in this one-machine mode identically match the results obtained from the serial version of the code.
DOE
Computer Networks; Parallel Processing (Computers); Time Functions; Computer Programs

19980210265 Fermi National Accelerator Lab., Batavia, IL USA
The Fermilab program for the next decade a response to the Gilman HEPAP subpanel
Pordes, S., Editor, Fermi National Accelerator Lab., USA; Oct. 1997; 71p; In English
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL-TM-2028; DE98-051147; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We have divided this description of our plans for the Laboratory program into seven parts. The first five sections describe the ongoing technical work and the broad range of physics opportunities available at Fermilab. These are organized into: our plans for the accelerator complex; our plans for facilities for performing experiments; the program of experiments we presently foresee; our plans for involvement with the LHC; and our plans for R & D towards a future facility which recaptures the energy frontier. The final sections summarize: our priorities and our planning strategy for making choices for the future, and our budget request to support the Fermilab program as we approach the fundamental challenges of elementary particle physics over the next ten years.
DOE
Particle Accelerators; Neutrinos; Research and Development

19980210310 Los Alamos National Lab., NM USA
A third generation mobile high energy radiography system
Fry, D. A., Los Alamos National Lab., USA; Valdez, J. E., Los Alamos National Lab., USA; Johnson, C. S., Los Alamos National Lab., USA; Kimerly, H. J., Los Alamos National Lab., USA; Vananne, J. R., Los Alamos National Lab., USA; 1997; 3p; In English; Ndt: Keystone of Quality, 20 - 24 Oct. 1997, Pittsburgh, PA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3558; CONF-971093; DE98-001479; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A third generation mobile high energy radiographic capability has been completed and put into service by the Los Alamos National Laboratory. The system includes a 6 MeV linac x-ray generator, Co-60 gamma source, all-terrain transportation, onboard power, real-time radiography (RTR), a control center, and a complete darkroom capability. The latest version includes upgraded and enhanced portability, flexibility, all-terrain operation, all-weather operation, and ease of use features learned from experience with the first and second generation systems. All systems were required to have the following characteristics; all-ter-

rain, all-weather operation, self-powered, USAF airlift compatible, reliable, simple to setup, easy to operate, and all components two-person portable. The systems have met these characteristics to differing degrees, as is discussed in the following section, with the latest system being the most capable.
DOE
X Ray Sources; Radiography; Portable Equipment; Nuclear Weapons; Inspection; Image Intensifiers; Charge Coupled Devices

19980210428 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A study on the nuclear fusion reactor: Development of the neutral particle analyzer for the measurement of plasma temperature
Kang, Hee Dong, Kyungpook National Univ., Korea, Republic of; Kim, Do Sung, Kyungpook National Univ., Korea, Republic of; Sep. 1996; 99p; In Korean
Report No.(s): KAERI-CM-003/95; DE98-724903; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

For measurements of the plasma ion temperature of KT-1 tokamak the charge exchange neutral particle analyzer was made. The NPA was contain stripping cell, cylinderical electrostatic plate type energy analyzer, and detector. The stripping cell has three beam path. The one is empty, the one is covered with Ni-mesh, and the other is covered with Ni-mesh and carbon foil. The mesh no. of the Ni-mesh is 70 lines/inch and the thickness of the carbon foil is 50 A . The radii of the cylinderical plate of the energy analyzer are 112 mm, 95 mm, and the height of the plate is 50 mm. The voltage of the plate is 0 approx. 1 kV. The ion and neutral particle detector are channeltron (Galileo 4839).
DOE
Ion Temperature; Temperature Measurement; Neutral Particles; Nuclear Fusion; Electrostatic Probes; Fusion Reactors; Tokamak Devices; Plasma Temperature

19980210429 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A study on the nuclear fusion reactor: A study on the data acquisition system for the nuclear fusion reactor
Hong, Seoung Jong, Kyungpook National Univ., Korea, Republic of; Son, Dong Chul, Kyungpook National Univ., Korea, Republic of; Park, Il Hung, Kyungpook National Univ., Korea, Republic of; Oh, Young Do, Kyungpook National Univ., Korea, Republic of; Chang, Doo Hee, Hanyang Univ., Korea, Republic of; Sep. 1996; 97p; In Korean
Report No.(s): KAERI-CM-004/95; DE98-724904; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

We have constructed a VXI data acquisition system to measure plasma position at KT-1 in KAERI, using HP-VEE, HP V/382 and HP E1429A. Currently we are analyzing data. We have also established basic concepts for the plasma feedback control system at KT-1, and selected necessary hardwares and softwares. The system has been set up and is being tested. The digital feedback control system provides more versatile control of plasma position and shape than the analog system by software programming. The digital system has been chosen so that the plasma feedback control could be done in real-time (target feedback loop-time : less than 0.5 msec). After considering compatibility and extensibility of the system, we have selected VxWorks for a real-time operating system, MVME 167, Pentek 4284 VME DSP based on the platform of TI TMS320C40, Pentek 4248 ADC, Pentek 4253 DAC. These Pentek modules uses a local bus to maximize the data transfer rate. to evaluate MMI which may provide operators of fusion devices for easy and simple access to data acquisition, we have written test codes with free Tcl/Tk. Tcl/Tk turned out to be easy to write powerful programs and can be useful for MMI of fusion devices.
DOE
Fusion Reactors; Nuclear Fusion; Data Acquisition; Real Time Operation; Thermonuclear Reactions

19980210430 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A study on the fusion reactor: Development of x-ray spectrometer for diagnosis of tokamak plasma
Jang, Hong Young, Korean Atomic Energy Research Inst., Korea, Republic of; Choi, Duk In, Korean Atomic Energy Research Inst., Korea, Republic of; Seo, Sung Hun, Korean Atomic Energy Research Inst., Korea, Republic of; Kwon, Gi Chung, Korean Atomic Energy Research Inst., Korea, Republic of; Jun, Sang Jin, Korean Atomic Energy Research Inst., Korea, Republic of; Heo, Sung Hoi, Korean Atomic Energy Research Inst., Korea, Republic of; Lee, Chan Hui, Korean Atomic Energy Research Inst., Korea, Republic of; Sep. 1996; 82p; In Korean
Report No.(s): KAERI-CM-021/95; DE98-724910; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

This report of research is on the development of X-ray Photo-Electron Spectrometer (PES) for diagnosis of tokamak plasma. The spectrometer utilizes the fact that the energy of photo-electron is given by the difference between the energy of X-ray and

the binding energy of materials. In the research of this year, we constructed two spectrometers; one is operated in KAIST tokamak and the other in KT1 tokamak. In addition, we reviewed the characteristics of the x-ray filter, the photo-electric effect of carbon foils and the detection efficiency of MCP and x-ray radiation of plasma. We measured the x-ray radiation in tokamak and diagnosed the qualitative plasma parameters from the analysis of data. The major interesting plasma parameters, which we can diagnose with the spectrometer, are the electron temperature, Z(sub eff), the spatial distribution of x-ray radiation and etc.
DOE
Fusion Reactors; X Ray Spectrometers; Electron Spectroscopy; Plasma Diagnostics; Tokamak Devices

19980210431 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A study on the fusion reactor: Study of ICRF coupling in the KAIST tokamak plasma
Choi, Duk In, Korean Atomic Energy Research Inst., Korea, Republic of; Chang, Hong Young, Korean Atomic Energy Research Inst., Korea, Republic of; Lee, Sun Chil, Korean Atomic Energy Research Inst., Korea, Republic of; Jun, Sang Jin, Korean Atomic Energy Research Inst., Korea, Republic of; Kwon, Gi Chung, Korean Atomic Energy Research Inst., Korea, Republic of; Seo, Sung Hun, Korean Atomic Energy Research Inst., Korea, Republic of; Heo, Sung Hoi, Korean Atomic Energy Research Inst., Korea, Republic of; You, Kwang Il, Korean Atomic Energy Research Inst., Korea, Republic of; Song, Soo Bin, Korean Atomic Energy Research Inst., Korea, Republic of; Lee, Sung Chul, Korean Atomic Energy Research Inst., Korea, Republic of; Kim, Min Chul, Korean Atomic Energy Research Inst., Korea, Republic of; Lee, Chan Hui, Korean Atomic Energy Research Inst., Korea, Republic of; Sep. 1996; 131p; In Korean
Report No.(s): KAERI-CM-022/95; DE98-724911; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

Research objectives are to design and fabricate an antenna, for measuring the property of absorption transmitted to the plasma, and research the physical phenomena about the ICRF coupling, Main heating method is ohmic heating at the KAIST tokamak. The power of the plasma produced by ohmic heating is about 100 kW. Because the toroidal field is 5 approx. 8 kG, the RF system's output power is about 10 kW and frequency range is 7 approx. 30 MHz. In the first year, a 1 kW RF preamplifier was bought. In this year, a CW 2 kW RF main amp. and RF power monitoring system was bought. In the research on antenna, we study the method how to measure electric field emitted from antenna using piezo elements. The matching network composed of two VVC (35 kV), 100 approx. 1000 pF match firmly up to 50 kW power. We studied the measurement method of antenna impedance theoretically, and measured power efficiency and antenna impedance in the helicon plasma.
DOE
Fusion Reactors; Ion Cyclotron Radiation; Plasma Heating; Radio Frequency Heating; Tokamak Devices; Toroidal Plasmas; Fabrication; Antennas

19980210432 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A Study on the fusion reactor: Development of a flat-field XUV spectrograph for tokamak diagnostics
Nam, Chang Hee, Korean Atomic Energy Research Inst., Korea, Republic of; Choi, Il Woo, Korean Atomic Energy Research Inst., Korea, Republic of; Shin, Hyun Joon, Korean Atomic Energy Research Inst., Korea, Republic of; Cha, Yong Ho, Korean Atomic Energy Research Inst., Korea, Republic of; Yang, Ho Soon, Korean Atomic Energy Research Inst., Korea, Republic of; Ra, Sun Ae, Korean Atomic Energy Research Inst., Korea, Republic of; Park, Chan Hong, Korean Atomic Energy Research Inst., Korea, Republic of; Sep. 1996; 67p; In Korean
Report No.(s): KAERI-CM-023/95; DE98-724912; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

The research on the development of a flat-field XUV spectrograph for tokamak fusion diagnostics investigated the following items: Theoretical investigation of a flat-field XUV spectrograph to determine the position of toroidal mirror, incident slit, varied-line spacing concave grating, detector, etc, Design and fabrication of spectrograph components using Auto CAD, Design and fabrication of film cassette holder and translator, Design and fabrication of vacuum chamber for spectrograph, Computer simulation of aberration, Installation of spectrograph to tokamak, Design of components for soft x-ray CCD.
DOE
Plasma Diagnostics; Spectrographs; Fusion Reactors; Fabrication; Extreme Ultraviolet Radiation; Tokamak Devices; Ultraviolet Spectrometers

19980210434 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A study on the fusion reactor: Heat flow analysis of plasma facing components in mid-size tokamak
Yoo, Seong Yeon, Chungnam National Univ., Korea, Republic of; Lee, Sang Yoon, Chungnam National Univ., Korea, Republic of; Kim, Ho Young, Chungnam National Univ., Korea, Republic of; Park, Dong Sung, Chungnam National Univ., Korea, Republic

of; Ju, Byung Soo, Chungnam National Univ., Korea, Republic of; Sep. 1996; 84p; In Korean
Report No.(s): KAERI-CM-050/95; DE98-724921; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

For the optimal design of plasma facing components of a fusion reactor, thorough understanding of thermal behavior of high heat flux components is required. The purpose of this research is to investigate the characteristics of heat flow and thermal stress in divertor which are exposed to high heat load varying with time and space. Numerical simulations of heat flow and thermal stress in three type of divertor are performed using finite volume method and finite element method, respectively. Commercial FLUENT code is used in the heat flow simulation, and maximum surface temperature, temperature distribution and cooling rate are calculated discussed. Commercial ABAQUS code is used in the thermal stress simulation, and temperature distribution, thermal stress, strain and displacement are calculated and discussed. These simulation results can be used as database for the optimal design of structure and cooling system of divertor.

DOE

Fusion Reactors; Heat Flux; Heat Transmission; Numerical Analysis; Cooling Systems; Heat Transfer

19980210435 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of

A study on the fusion reactor: Development of MHD stability and transport code for KT-2 tokamak

Lee, Jae Koo, Pohang Univ. of Science and Technology, Korea, Republic of; Shin, Kyo Jin, Pohang Univ. of Science and Technology, Korea, Republic of; Aug. 1996; 53p; In Korean
Report No.(s): KAERI-CM-053/95; DE98-724926; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

MHD Stability analyses for KT-2 Tokamak were carried out by using CART (Resistive 3-D) Code. Linear Growth rates and linear perturbed eigen function of both N=0 axisymmetric mode and N=1 kink modes of highly elongated tokamak plasmas, in the presence of a conducting wall at various distances are computed and linear and nonlinear evolution of N=0 axisymmetric modes are simulated.

DOE

Tokamak Devices; Fusion Reactors; Magnetohydrodynamic Stability

19980210436 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of

A study on the fusion reactor: Design study for tokamak control system

Ko, In Soo, Pohang Univ. of Science and Technology, Korea, Republic of; Nam, Kung Won, Pohang Univ. of Science and Technology, Korea, Republic of; Cho, Moo Hyun, Pohang Univ. of Science and Technology, Korea, Republic of; Kim, Ji Hwa, Pohang Univ. of Science and Technology, Korea, Republic of; Kim, Jae Myung, Pohang Univ. of Science and Technology, Korea, Republic of; Kim, Sung Chul, Pohang Univ. of Science and Technology, Korea, Republic of; Lee, Ki Sun, Pohang Univ. of Science and Technology, Korea, Republic of; Sep. 1996; 33p; In Korean
Report No.(s): KAERI-CM-054/95; DE98-724927; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

Based on the experience accumulated during the construction of Pohang Light Source, we strongly suggest that the control system must have a hierarchical structure linked with multiple ethernets. Some UNIX-based workstation are recommended in the top layer where KSTAR operators are faced with several control/monitoring windows. As a supervisors to individual subsystem, realtime computers such as VME system are recommended. Choice of realtime operating system is up to the actual developer. However, we strongly suggest to use Lynx which is UNIX-based realtime OS and is getting more attentions after its introduction in the market. Graphic interface for operators will be developed by adopting development toolkit such as RTWorks and EPICS. We also recommend to use EPICS because it is introduced by Los Alamos National Laboratory, U. S. A. and several laboratories around world are now adopting it to their control system. This report is also pointing out several key issues relating the system development. Among them are the cabling plan, signal list, and noise suppressions. It is also suggested that early decision of communication protocol will help to integrated control system in the future.

DOE

Tokamak Devices; Fusion Reactors; Design Analysis; Real Time Operation; Systems Engineering; Control Systems Design

19980210439 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of

Research on nuclear fusion reactor: Development of mm-wve (Electron cyclotron) heating device

Ahn, Sae Young, Institute for Advanced Engineering, Korea, Republic of; Myung, Jung Su, Institute for Advanced Engineering, Korea, Republic of; Lee, Keun Ho, Institute for Advanced Engineering, Korea, Republic of; Lee, Myung Jae, Institute for Advanced Engineering, Korea, Republic of; Kim, Hyung Suk, Institute for Advanced Engineering, Korea, Republic of; Hur, Jin

Woo, Institute for Advanced Engineering, Korea, Republic of; Song, Ho Young, Institute for Advanced Engineering, Korea, Republic of; Aug. 1996; 34p; In Korean
Report No.(s): KAERI-CM-065/95; DE98-724940; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

To establish cooperating system with foreign relevant research institutes, consultation has been given to IAE by Dr. T. V. George regarding ECRH and gyrotron development plan. Discussions with Prof. Temkin and Dr. Kreisher at MIT, who are working for ITER gyrotron development, were made and those helped IAE to collect necessary information for fundamental parameters of ECCD. Also, Prof. Vic Granatstein, U. of Maryland, and Dr. Baruch Levush, NRL, were consulted for computer codes of the gyrotron R and D. It will also be prepared for cooperation in ECCD and mm-wave heating with device research teams of General Atomics and Russia. by visiting various University labs and research institutes and investigating the up-to-date research results, the basic operating parameters of gyrotron for KSTAR project has been determined. By cooperation with MIT, a conceptual design has been made for the KSTAR gyrotron that should generate 1 MW and 110 GHz CW waves. The simulation result of EGUN using self-consistent theory shows that 1.2 MW power with the efficiency of 42.8% can be obtained for TE22,6,1 mode where the average ohmic loss is 0.54 kW/sq cm assuming 77 kV cathode voltage, 34 A beam current, velocity ratio of 1.62 and perpendicular velocity spread of 6.5%.
DOE
Fusion Reactors; Nuclear Fusion; Design Analysis; Cyclotron Resonance Devices; Feasibility Analysis

19980210492 Korean Atomic Energy Research Inst., Daeduk, Korea, Republic of
A study on the fusion reactor: A study on wave physics of fast wave heating and the current drive in tokamaks
Cho, Su Won, Kyonggi Univ., Korea, Republic of; Yeom, Hyun Ju, Kyonggi Univ., Korea, Republic of; Hong, Sang Hee, Seoul National Univ., Korea, Republic of; Chung, Mo Se, Seoul National Univ., Korea, Republic of; Sep. 1996; 89p; In Korean
Report No.(s): KAERI-CM-005/95; DE98-724905; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

A full 3-dimensional code for fast wave heating and the current drive has been developed and its results are compared with those of FASTWA for Phaedrus-T tokamak. The finite Larmour radius expansion and the order reduction method have been used to derive the wave equation in the toroidal coordinate from the Maxwell-Vlasov equations. by expanding the fields in poloidal Fourier series, the wave equations are reduced to the system of ordinary differential equations in the radial axis, which are then numerically integrated via the shooting method. In addition, the convergence of the solutions and energy conservation are discussed. Finally, and example calculation of the current drive is presented for the advanced superconducting tokamak which is in its conceptual design phase.
DOE
Fusion Reactors; Tokamak Devices; Vlasov Equations; Wave Equations; Fourier Series; Heating; Toroidal Plasmas

19980210493 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A study on the fusion reactor: Development of an analysis code for tokamak plasma transport studies
Chang, Choong Seock, Korean Atomic Energy Research Inst., Korea, Republic of; Chang, Ho Gun, Korean Atomic Energy Research Inst., Korea, Republic of; Kim, Sung Sik, Korean Atomic Energy Research Inst., Korea, Republic of; Lee, Young Dong, Korean Atomic Energy Research Inst., Korea, Republic of; Park, Gun Young, Korean Atomic Energy Research Inst., Korea, Republic of; Sep. 1996; 61p; In Korean
Report No.(s): KAERI-CM-024/95; DE98-724913; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

In the first year of the projects, we derived the transport equations, calculated the background and alpha-particle driven bootstrap current. Also, we evaluated the amount of FWCD-driven current. In the second year, we transported the famous tokamak simulation code such as TSC, JSOLVER and PEST from PPPL. We study the vertical stability of model elongated tokamak plasma and investigation of the MHD instability of a model tokamak plasma using these codes.
DOE
Tokamak Devices; Boltzmann Transport Equation; Plasma Diagnostics; Alpha Particles; Computer Programs

19980210562 Argonne National Lab., IL USA
EPR in B physics and elsewhere
Lipkin, H. J., Weizmann Inst. of Science, Israel; [1997]; 3p; In English; Bottom Physics, 29 Jun. - 2 Jul. 1997, Chicago, IL, USA
Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL-HEP-CP-97-61; CONF-9706203; DE97-054047; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The application of Einstein-Podolsky-Rosen correlations in Upsilon(4s) yields B(anti-B) decays to research in CP violation is the first and probably only use of EPR as a technique for research in new physics. Elsewhere highly sophisticated EPR projects question EPR and test its predictions to look for violations of quantum mechanics, hidden variables, Bell's inequalities, etc.
DOE

Quantum Mechanics; Mesons; Elementary Particle Interactions; Invariance

19980210564 Argonne National Lab., IL USA

A white beam neutron spin splitter

Krist, T., Freie Univ., Germany; Klose, F., Argonne National Lab., USA; Felcher, G. P., Argonne National Lab., USA; Jul. 23, 1997; 13p; In English; 5th; Surface X-ray and Neutron Scattering, 13-17 Jul. 1997, Oxford, UK
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/MSD/CP-93049; CONF-970712; DE97-054052; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The polarization of a narrow, highly collimated polychromatic neutron beam is tested by a neutron spin splitter that permits the simultaneous measurement of both spin states. The device consists of a Si-Co(0.11)Fe(0.89) supermirror, which totally reflects one spin state up to a momentum transfer q = 0.04/A, whilst transmits neutrons of the opposite spin state. The supermirror is sandwitched between two thick silicon wafers and is magnetically saturated by a magnetic field of 400 Oe parallel to its surface. The neutron beam enters through the edge of one of the two silicon wavers, its spin components are split by the supermirror and exit from the opposite edges of the two silicon wafers and are recorded at different channels of a position-sensitive detector. The device is shown to have excellent efficiency over a broad range of wavelengths.
DOE

Beam Splitters; Cobalt Compounds; Iron Compounds; Mirrors; Neutron Beams; Silicon Compounds; Particle Spin

19980210600 Argonne National Lab., IL USA

US assessment of free surface liquid metal divertors:-- Design analysis and R and D needs

Mattas, R. F., Argonne National Lab., USA; [1997]; 5p; In English; Liquid Metal Blanket Experimental Activities, 16-18 Sep. 1997, Paris, France
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/TD/CP-93893; CONF-9709165; DE97-054584; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

One of the objectives of the restructured US Fusion Energy Sciences Program is to identify and evaluate new high performance concepts for advanced technology with high neutron wall load capability and attractive safety and environmental features. One promising technology specified by the Advanced Technologies and Materials Working Group is liquid plasma-facing surfaces for divertors. Some of the possible advantages of using liquid surfaces in divertors, relative to conventional solid surface approaches, include higher surface heat flux capability, continuously renewable surfaces, and higher temperature operation. A planning activity has been undertaken to identify the work to be performed over approximately three years to evaluate liquid surface concepts on the basis of such factors as their compatibility with fusion plasmas, high power density handling capabilities, engineering feasibility, lifetime, safety, and R and D requirements. A group, known as the Advanced Liquid Plasma-facing Surface (ALPS) planning group, was organized to prepare a plan for the activities needed to conduct such an evaluation. This paper will summarize the work of the ALPS group including recommendations on specific activities and a tentative schedule.
DOE

Divertors (Fusion Reactors); Liquid Metals; Neutrons; Design Analysis; Thermonuclear Reactions; Fusion Reactors

19980210702 Fermi National Accelerator Lab., Batavia, IL USA

Compositeness test at the FMC with Bhabha scattering

Eichten, E. J., Fermi National Accelerator Lab., USA; Keller, S., Fermi National Accelerator Lab., USA; Jan. 1998; 10p; In English; Front End of the Muon Colliders Workshop, 6-9 Nov. 1997, Batavia, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/011-T; CONF-971194; DE98-051680; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

It is possible that quarks and/or leptons have substructure that will become manifest at high energies. Here we investigate the limits on the muon compositeness scale that could be obtained at the First Muon Collider using Bhabha scattering. We study this limit as a function of the collider energy and the angular cut imposed by the detector capability.
DOE
Scattering; Quarks; Leptons; Muons

19980210710 Lawrence Livermore National Lab., Livermore, CA USA
Design of the target area for the National Ignition Facility
Foley, R. J., Lawrence Livermore National Lab., USA; Karpenko, V. P., Lawrence Livermore National Lab., USA; Adams, C. H., Lawrence Livermore National Lab., USA; Jan. 1997; 15p; In English; 2nd; Annual Solid State Lasers for Applications to Inertial Confinement Fusion (LCF), 22 5 Oct. 1996, Paris, France
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-124387; CONF-9610225-43; DE97-053446; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The preliminary design of the target area for the National Ignition Facility has been completed. The target area is required to meet a challenging set of engineering system design requirements and user needs. The target area must provide the appropriate conditions before, during, and after each shot. The repeated introduction of large amounts of laser energy into the chamber and subsequent target emissions represent new design challenges for ICF facility design. Prior to each shot, the target area must provide the required target illumination, target chamber vacuum, diagnostics, and optically stable structures. During the shot, the impact of the target emissions on the target chamber, diagnostics, and optical elements is minimized and the workers and public are protected from excessive prompt radiation doses. After the shot, residual radioactivation is managed to allow the required accessibility. Diagnostic data is retrieved, operations and maintenance activities are conducted, and the facility is ready for the next shot. The target area subsystems include the target chamber, target positioner, structural systems, target diagnostics, environmental systems, and the final optics assembly. The engineering design of the major elements of the target area requires a unique combination of precision engineering, structural analysis, opto-mechanical design, random vibration suppression, thermal stability, materials engineering, robotics, and optical cleanliness. The facility has been designed to conduct both x- ray driven targets and to be converted at a later date for direct drive experiments. The NIF has been configured to provide a wide range of experimental environments for the anticipated user groups of the facility. The design status of the major elements of the target area is described.
DOE
Laser Targets; Design Analysis; Structural Analysis; Plant Design; Ignition

19980210747 Fermi National Accelerator Lab., Batavia, IL USA
A new MARS and its applications
Krivosheev, O. E., Fermi National Accelerator Lab., USA; Mokhov, N. V., Fermi National Accelerator Lab., USA; Jan. 1998; 12p; In English; Sare-3: Simulation of Accelerator Radiation Environments, 7-9 May 1997, Tsukuba, Japan
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/043; CONF-9705113; DE98-052009; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This paper describes MARS14(98) - the newest version of the MARS Monte Carlo code system for fast simulation of hadronic and electromagnetic cascades in shielding, accelerator and detector components in the energy range from a fraction of an electronvolt up to 30 TeV. The main changes compared to the previous release, MARS 13, concern the hadron production model tuned with evaluated data and the DPMJET-II code, improved photo- and electro- production of hadrons and muons, improved algorithms for the 3-body decays, particle tracking in magnetic fields, synchrotron radiation by electrons and muons, significantly extended histograming capabilities and material description, and improved computational performance. In addition to direct energy deposition calculations, a new set of fluence-to-dose conversion factors for all particles including neutrino are built into the code. The MARS 14(98) system includes links to the MCNP code for neutron transport below 20 MeV, to the ANSYS code for thermal and stress analyses and to the STRUCT code for multi-turn particle tracking in large synchrotrons and collider rings.
DOE
Monte Carlo Method; Electromagnetic Shielding; Cascade Flow; Computerized Simulation; Magnetic Fields

19980210757 Brookhaven National Lab., Upton, NY USA
Investigation of high-energy-proton effects in aluminum
Czajkowski, C. J., Brookhaven National Lab., USA; Snead, C. L., Jr., Brookhaven National Lab., USA; Todosow, M., Brookhaven

National Lab., USA; 1997; 6p; In English; 126th, 9-13 Feb. 1997, Orlando, FL, USA; Sponsored by Minerals, Metals and Materials Society, USA
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-64953; CONF-970201; DE98-001630; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Specimens of 1100 aluminum were exposed to several fluences of 23.5-GeV protons at the Brookhaven Alternating Gradient Synchrotron. Although this energy is above those currently being proposed for spallation-neutron applications, the results can be viewed as indicative of trends and other microstructural evolution with fluence that take place with high-energy proton exposures such as those associated with an increasing ratio of gas generation to dpa. TEM investigation showed significantly larger bubble size and lower density of bubbles compared with lower-energy proton results. Additional testing showed that the tensile strength increased with fluence as expected, but the microhardness decreased, a result for which an intepretation is still under investigation.
DOE
Protons; Aluminum; Aluminum Alloys

19980210760 Los Alamos National Lab., NM USA
Liquid metal focused ion beam etch sensitization and related data transmission processes
Lamartine, B. C., Los Alamos National Lab., USA; [1998]; 9p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3610; DE98-001618; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a one-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The ion micromilling process, while already successful, can be enhanced by ion beam sensitization to wet or dry anisotropic chemical etch reactions. The ion beam sensitization to wet or dry anisotropic chemical etch reactions. The ion beam sensitization is unique from conventional lithography in that many levels of feature depth are potentially available (depending on the local spatial ion dose) and that no organic or inorganic resist is required. This process is applicable to the production of both digital and human-readable grey-scale data on archival media, such as silicon or other single crystals or amorphous coatings. Furthermore, it has been shown that a suitable micromachined data medium having an appropriate format can be read by (1) a phase-sensitive interference microscope, (2) a laser intensity feedback microscope, or (3) a conventional scanning electron microscope.
DOE
Liquid Metals; Ion Beams; Etching; Data Transmission; Micromachining

19980210794 Fermi National Accelerator Lab., Batavia, IL USA
From HERA to the Tevatron: A scaling law in hard diffraction
Goulianos, K., Fermi National Accelerator Lab., USA; Dec. 04, 1997; 12p; In English; 27th; Multiparticle Dynamics (Ismd 97), 8 - 12 Sep. 1997, Frascati, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/408-E; CONF-9709174; DE98-052377; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Results on hard diffraction from Collider Detector at Fermilab (CDF)are reviewed and compared with predictions based on the diffractive structure function of the proton measured in deep inelastic scattering at HERA. The predictions are generally larger than the measured rates by a factor of approximately 6, suggesting a breakdown of conventional factorization. Correct predictions are obtained by scaling the rapidity gap probability distribution of the diffractive structure function to the total integrated gap probability. The scaling of the gap probability is traced back to the pomeron flux renormalization hypothesis, which was introduced to unitarize the soft diffraction amplitude.
DOE
Inelastic Scattering; Diffraction; Protons; Scaling Laws; Structured Grids (Mathematics)

19980210804 Rutherford Appleton Lab., Chilton, UK
Proceedings of the School for Young High Energy Physicists
Dunbar, D. C., Wales Univ., UK; Forshaw, J., Manchester Univ., UK; Glover, E. W. N., Durham Univ., UK; Morris, Tim R., Southampton Univ., UK; Lloyd, Steve, Editor, Queen Mary and Westfield Coll., UK; Mar. 1998; ISSN 1358-6254; 244p; In English, 31 Aug. - 12 Sep. 1997, Abingdon, UK
Report No.(s): RAL-TR-1998-023; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot,

Oxfordshire, OX11 0QX, UK); US Sales Only, Hardcopy, Microfiche

Thirty young experimental particle physicists attended the 1997 Summer School, held as normal, at Coseners House in Abingdon in September. The purpose of this course is to provide a simple introduction to quantum field theory and consider the quantization of gauge theories. This year the number of students was significantly lower than last year due to the transition from three to four year undergraduate physics courses. The lower numbers meant that everybody could be accommodated in Coseners House and there were a much more reasonable number of student talks each evening.

Derived from text

Gauge Theory; Quantum Theory; Quantum Chromodynamics; Standard Model (Particle Physics)

19980210829 Fermi National Accelerator Lab., Batavia, IL USA

Precision Supersymmetry Measurement at the e(exp -) e(exp -) Collider

Cheng, H.-C., Fermi National Accelerator Lab., USA; Jan. 1998; 14p; In English; 2nd; Electron-electron Interactions at TeV Energies, 22-24 Sep. 1997, Santa Cruz, CA, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-98/005-T; CONF-9709181; DE98-051678; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Measurements of supersymmetric particle couplings provide important verification of supersymmetry. If some of the superpartners are at the multi-TeV scale, they will escape direct detection at planned future colliders. However, such particles induce nondecoupling corrections in processes involving the accessible superparticles through violations of the supersymmetric equivalence between gauge boson and gaugino couplings. These violations are analogous to the oblique corrections in the electroweak sector of the standard model, and can be parametrized in terms of super-oblique parameters. The e(exp -)e(exp -) collision mode of a future linear collider is shown to be an excellent environment for such high precision measurements of these SUSY parameters, which will provide an important probe of superparticles beyond reachable energies.

DOE

Supersymmetry; Measuring Instruments; Collisions; Precision; Couplings

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OPTICS

Includes light phenomena; and optical devices. For lasers see 36 Lasers and Masers.

19980206471 Oak Ridge National Lab., TN USA

Automated indexing of wide bandpass Laue images

Chung, Jin-Seok, Oak Ridge National Lab., USA; 1997; 7p; In English; Making and Using Small X-ray Beams: Advanced Photon Source Workshop, 15 Apr. 1997, Argonne, IL, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): CONF-9704138-1; DE97-007780; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

An important goal of x-ray microdiffraction is to characterize texture and strain in two or three dimensions with micron resolution. With this scanning x-ray microdiffraction, it is essential to accelerate data collection and to automate the diffraction data analysis. One solution is to collect wide bandpass Laue images which have information equivalent to that of many monochromatic diffraction scans. However, to get a scanned image, tens of thousands of Laue images must be analyzed in reasonable time; automated indexing of Laue points is essential. by comparing measured angles between scattering vectors of Laue points to angles between possible indexes derived from the bandpass, a unique set of indexes can be found. Indexing multi-grain images can also be done by repeating the indexing process for points which do not match an allowed reflection.

DOE

Diffraction; Scanners; X Rays; Data Acquisition

19980206642 Brookhaven National Lab., Upton, NY USA

Unique interactive projection display screen

Veligdan, J. T., Brookhaven National Lab., USA; [1997]; 8p; In English; Technology Transfer, 22-24 Sep. 1997, Boston, MA, USA

Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-64780; CONF-970954; DE98-000994; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Projection systems continue to be the best method to produce large (1 meter and larger) displays. However, in order to produce a large display, considerable volume is typically required. The Polyplanar Optic Display (POD) is a novel type of projection display screen, which for the first time, makes it possible to produce a large projection system that is self-contained and only inches thick. In addition, this display screen is matte black in appearance allowing it to be used in high ambient light conditions. This screen is also interactive and can be remotely controlled via an infrared optical pointer resulting in mouse-like control of the display. Furthermore, this display need not be flat since it can be made curved to wrap around a viewer as well as being flexible. DOE

Display Devices; Fiber Optics

19980206778 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

Progress towards sub-micron hard x-ray imaging using elliptically bent mirrors

MacDowell, A. A., California Univ., Lawrence Berkeley Lab., USA; Celestre, R., California Univ., Lawrence Berkeley Lab., USA; Chang, C. H., California Univ., Lawrence Berkeley Lab., USA; Frank, K., California Univ., Lawrence Berkeley Lab., USA; Jul. 1997; 11p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): DE-AC03-76SF-00098

Report No.(s): LBNL-40650; CONF-970706; LSBL-393; DE97-054557; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The use of mirrors with an elliptical curvature, of the many methods used to focus x-rays, shows the most promise of providing a sub-micron white light focus. Our group has been developing the techniques of controlled bending of mirror substrates in order to produce the desired elliptical shape. We have been successful in producing surfaces with the required microradian slope error tolerances. Details of the bending techniques used, results from laboratory slope error measurements using a Long Trace Profiler (LTP) and data from the measurement of focus shape using knife edge and imaging methods using x-rays in the 5-12 KeV energy range are presented. The development of a white light focusing opens many possibilities in diffraction and spectroscopic studies. DOE

Mirrors; X Ray Imagery; Focusing; Laser Beams; X Ray Diffraction

19980209682 Department of the Navy, Washington, DC USA

Fiber-Optic Connector

Ames, Gregory H., Inventor, Department of the Navy, USA; Morency, Roger L., Inventor, Department of the Navy, USA; Oct. 07, 1997; 14p; In English

Patent Info.: Filed 25 Nov. 1994; US-Patent-Appl-SN-345,957; US-Patent-5,675,680

Report No.(s): AD-D018850; No Copyright; Avail: US Patent and Trademark Office, Microfiche

There is presented a fiber-optic connector and a method of mailing same. The connector comprises a plurality of ferrules, each of the ferrules having extending centrally there through a single optical fiber. The connector further includes structure abutting at least a portion of the ferrules for exercising a radially compressive force on the ferrules for urging the ferrules into a configuration in which said ferrules are co-parallel and nested so as to form a stable bundle which in transverse section is substantially axisymmetrical, and retaining the ferrules in the configuration. The connector still further includes alignment structure for angular positioning of said ferrules in said connector in said transverse section about a nominal longitudinal axis of said bundle for registry of the connector with a second connector of complementary configuration.
DTIC

Fiber Optics; Alignment; Positioning; Connectors; Compressibility

19980209802 Osaka Univ., Dept. of Applied Physics, Osaka, Japan

Automatic Design of Radial Grin-Lens Arrays for an Optical Interconnects Lens System

Renero-Carrillo, Francisco-Javier, Osaka Univ., Japan; Ichioka, Yoshiki, Osaka Univ., Japan; Technology Reports of the Osaka University; Apr. 15, 1994; ISSN 0030-6177; Volume 44, Nos. 2163-2182, pp. 9-20; In English

Report No.(s): Rept-2164; Copyright; Avail: Issuing Activity (Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan), Hardcopy, Microfiche

A design of a one-to-one optical-interconnects (OTO-OI) lens system, composed of two radial graded-index (GRIN) lens arrays, is described. The lens arrays are set up on different boards. The main problem of the OTO-OI lens system is misalignment between lens arrays. We optimized lens parameters by ALSIE (Automatic Lens design by Solving InEqualities), introducing mis-

alignment by off-setting one radial-GRIN lens array with respect to the other one. The optimized lens parameters are refractive index coefficients of the radial-GRIN lens, thickness of lenses, and curvatures of surfaces. Optimizing in this way, ensures that the radial-GRIN lens arrays will have a preferable optical performance even if the OTO-OI lens system has misalignment.
Author
Lens Design; Lenses; Arrays; Optical Interconnects; Optical Equipment; Misalignment; Optimization; Computerized Simulation

19980209809 Department of the Navy, Washington, DC USA
Intrinsically Self Deforming Fiber Optic Microbend Pressure and Strain Sensor
Sansone, Louis E., Inventor, Department of the Navy, USA; Dec. 02, 1997; 6p; In English; Supersedes AD-D018019
Patent Info.: Filed 19 Jun. 1995; US-Patent-Appl-SN-491692; US-Patent-5,694,497
Report No.(s): AD-D018840; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The present invention relates to a sensor for measuring pressure and strain. The sensor is formed by an optical fiber having at least one section wherein the fiber is twisted about itself. The at least one twisted section acts as an intrinsically self-deforming microbend deformer. The sensor further includes a source of light attached to a first end of the fiber and a power meter for measuring the amount of light lost in the at least one section. The optical fiber may have multiple twisted sections with different twist pitches and thus different sensitivities. In an alternative embodiment. the sensor may have two optical fibers twisted about each other.
DTIC
Fiber Optics; Deformation; Optical Fibers; Pressure Sensors

19980209820 Department of the Navy, Washington, DC USA
Infrared Protector Countermeasure System
Meeker, Delbert B., Inventor, Department of the Navy, USA; Dec. 30, 1997; 6p; In English
Patent Info.: Filed 20 Nov. 1996; US-Patent-5,7003,314; US-Patent-Appl-SN-752779
Report No.(s): AD-D018820; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A countermeasure system adapted for use on board an aircraft for confusing an incoming missile as to the location and heading of the aircraft. The countermeasure system generates for each side of the aircraft at least two infrared energy images which are projected onto the aircraft's fuselage and then swept across the aircraft's fuselage to confuse the incoming missile's infrared seeker. Each infrared energy image is generated by at least two lasers operating at different frequencies within the infrared region of the electromagnetic spectrum. A beam combiner combines the beams of infrared energy from each laser forming a single collimated beam of infrared energy having multiple frequencies which is then directed to a beam former. The beam former spreads the collimated beam of infrared energy which it then directs to a scanner. The scanner, which is mounted in a wing tip pod on the aircraft, directs the collimated beam to the fuselage of the aircraft sweeping the beam of infrared energy over the fuselage of the aircraft to confuse the infrared seeker of the incoming missile as to the flight path of the aircraft.
DTIC
Optical Countermeasures; Infrared Radiation; Electromagnetic Spectra; Infrared Imagery; Guidance (Motion)

19980209831 Osaka Univ., Dept. of Electromagnetic Energy Engineering, Osaka, Japan
Development of Multilayer Polarizer with High Laser Damage Resistance
Motokoshi, Shinji, Osaka Univ., Japan; Yoshida, Hidetsugu, Osaka Univ., Japan; Yoshida, Kunio, Osaka Inst. of Tech., Japan; Nakai, Sadao, Osaka Univ., Japan; Technology Reports of the Osaka University; Apr. 15, 1994; ISSN 0030-6177; Volume 44, Nos. 2163-2182, pp. 53-58; In English
Report No.(s): Rept-2169; Copyright; Avail: Issuing Activity (Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan), Hardcopy, Microfiche

A multilayer thin film polarizer with high damage resistance has been developed by adopting a new coating design that minimizes the induced electric field intensity within the multilayer coating. The damage threshold was > or = to 11 J/sq cm for the p-polarized incident beam from the coating side and > or = to 17 J/sq cm, for the s-polarized backward-reflected beam from the substrate side for a 1,053 micron laser with a pulse width of 1 ns.
Author
Polarizers; Yield Point; Radiation Tolerance; Laser Damage; Coatings

19980209848 Sandia Labs., Livermore, CA USA
Efficient broadband second-harmonic generation by dispersive achromatic nonlinear conversion using only prisms
Richman, B. A., Sandia Labs., USA; Bisson, S. E., Sandia Labs., USA; Trebino, R., Sandia Labs., USA; Dec. 1997; 17p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-98-8209; DE98-051307; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Using a lossless dispersive apparatus consisting of six prisms, optimized to match a second-harmonic crystal phase-matching angle vs. wavelength to second order, we efficiently doubled tunable fundamental light near 660 nm over a range of 80 nm using a 4-mm-long type-I beta-Barium Borate (BBO) crystal. Another lossless set of six prisms after the crystal realigned the propagation directions of the various second-harmonic frequencies to be collinear to within 1/4 spot diameter in position and 200 microrad in angle. The measured conversion efficiency of a 40-mJ, 5-ns fundamental pulse was 10%.
DOE
Prisms; Phase Matching; Harmonic Generations; Nonlinear Optics

19980209967 Sandia National Labs., Albuquerque, NM USA
Optical measurement of LIGA milliengine performance
Dickey, F. M., Sandia National Labs., USA; Holswade, S. C., Sandia National Labs., USA; Christenson, T. R., Sandia National Labs., USA; Garcia, E. J., Sandia National Labs., USA; Polosky, M. A., Sandia National Labs., USA; [1997]; 9p; In English; Biomedical Optics, 24-30 Jan. 1998, San Jose, CA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3180C; CONF-980117; DE98-001732; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Understanding the parameters that affect the performance of milliscale and microscale actuators is essential to the development of optimized designs and fabrication processes, as well as the qualification of devices for commercial applications. This paper discusses the development of optical techniques for motion measurements of LIGA fabricated milliengines. LIGA processing permits the fabrication of precision millimeter-sized machine elements that cannot be fabricated by conventional miniature machining techniques because of their small feature sizes. In addition, tolerances of 1 part in 10(sup 3) to 10(sup 4) may be maintained in millimeter sized components with this processing technique. Optical techniques offer a convenient means for measuring long term statistical performance data and transient responses needed to optimize designs and manufacturing techniques. Optical techniques can also be used to provide feedback signals needed for control and sensing of the state of the machine. Optical probe concepts and experimental data obtained using a milliengine developed at Sandia National Laboratories are presented.
DOE
Machining; Millimeter Waves; Miniaturization; Optical Measurement; Transient Response; Actuators; Feedback

19980209974 Oak Ridge National Lab., TN USA
Mechanisms of formation of nonlinear optical light guide structures in metal cluster composites produced by ion beam implantation
Sarkisov, S. S., Alabama A & M Univ., USA; Williams, E. K., Alabama A & M Univ., USA; Curley, M., Alabama A & M Univ., USA; Smith, C. C., Alabama A & M Univ., USA; Ila, D., Alabama A & M Univ., USA; Venkateswarlu, P., Alabama A & M Univ., USA; Poker, D. B., Oak Ridge National Lab., USA; Hensley, D. K., Oak Ridge National Lab., USA; Nov. 1997; 6p; In English, 1-5 Dec. 1997, Boston, MA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95647; CONF-971201; DE98-001844; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Ion implantation has been shown to produce a high density of metal colloids in glasses and crystalline materials. The high-precipitate volume fraction and small size of metal nanoclusters formed leads to values for the third-order susceptibility much greater than those for metal doped solids. This has stimulated interest in use of ion implantation to make nonlinear optical materials. On the other side, LiNbO(sub 3) has proved to be a good material for optical waveguides produced by MeV ion implantation. Light confinement in these waveguides is produced by refractive index step difference between the implanted region and the bulk material. Implantation of LiNbO(sub 3) with MeV metal ions can therefore result into nonlinear optical waveguide structures with great potential in a variety of device applications. The authors describe linear and nonlinear optical properties of a waveguide structure in LiNbO(sub 3)-based composite material produced by silver ion implantation in connection with mechanisms of its formation.
DOE
Colloids; Composite Materials; Concentration (Composition); Crystallinity; Doped Crystals; Implantation; Ion Beams; Ion Implantation; Metal Clusters; Metal Ions; Metallic Glasses; Optical Properties; Optical Waveguides

19980209993 Oak Ridge National Lab., TN USA

Robust tracking with spatio-velocity snakes: Kalman filtering approach

Peterfreund, N., Oak Ridge National Lab., USA; 1998; 23p; In English; International Conference on Computer Vision 1998, 4-10 Jan. 1998, Bombay, India

Contract(s)/Grant(s): DE-AC05-96OR-22464

Report No.(s): CONF-980106-1; DE97-006321; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Using results from robust Kalman filtering, we present a new Kalman filter-based snake model for tracking of nonrigid objects in combined spatio-velocity space. The proposed model is the stochastic version of the velocity snake, an active contour model for combined tracking of position and velocity of nonrigid boundaries. The proposed model uses image gradient and optical flow measurements along the contour as system measurements. An optical-flow based measurement error is used to detect and reject image measurements which correspond to image clutter or to other objects. The method was applied to object tracking of both rigid and nonrigid objects, resulting in good tracking results and robustness to image clutter, occlusions and numerical noise. 19 refs., 3 figs.

DOE

Tracking (Position); Kalman Filters; Robustness (Mathematics); Flow Measurement; Velocity; Nonlinear Systems

19980210095 Lawrence Livermore National Lab., Livermore, CA USA

Color separation gratings for diverting the unconverted light away from the NIF target

Dixit, S. N., Lawrence Livermore National Lab., USA; Rushford, M. C., Lawrence Livermore National Lab., USA; Thomas, I. M., Lawrence Livermore National Lab., USA; Herman, S. M., Lawrence Livermore National Lab., USA; Britten, J. A., Lawrence Livermore National Lab., USA; Shore, B. W., Lawrence Livermore National Lab., USA; Perry, M. D., Lawrence Livermore National Lab., USA; Mar. 11, 1997; 11p; In English; 2nd; Annual Solid State Lasers for Applications to Inertial Confinement Fusion LCF), 22 - 25 Oct. 1996, Paris, France

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-124512; CONF-9610225-41; DE97-053415; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Most of the glass laser based inertial confinement fusion systems around the world today employ non-linear frequency conversion for converting the 1.053 micrometer light at the fundamental frequency (referred to as 1(omega) light) to either its second harmonic (called 2(omega)) at 527 nm or to its third harmonic (called 3(omega)) at 351 nm. Shorter wavelengths are preferred for laser fusion because of the improved coupling of the laser light to the fusion targets due to reduced fast electron production at shorter wavelengths. The frequency conversion process, however, is only about 60-70% efficient and the residual 30-40% of the energy remains at 1(omega) and 2(omega) frequencies. Color separation gratings (CSGs) offer a versatile approach to reducing and possibly eliminating the unconverted light at the target region. A CSG consists of a three- level lamellar grating designed so that nearly all of the 3(omega) light passes through undiffracted while the residual 1(omega) and 2(omega) energy is diverted into higher diffraction orders. The diffraction angle is determined solely by the grating period. We have demonstrated the concept of using a color separation grating. We fabricated a 345 micrometer period CSG in fused silica using lithographic processes and wet etching. The measured far field indicates that greater than 95% of the incident light is preserved in the 3(omega) zeroth order while less than 5% of unconverted 1(omega) and 2(omega) light is remaining in the zeroth order. We would like to add that diffractive optics fabricated in fused silica by wet etching in hydrofluoric acid should have high damage threshold. Our experience suggests that the damage threshold of the etched substrate is at least as high as the unetched part.

DOE

Inertial Confinement Fusion; Diffractive Optics; Etching

19980210127 Los Alamos National Lab., NM USA

Information content of low-dose radiographs, Part 1

Morris, R. A., Los Alamos National Lab., USA; Jun. 1997; 14p; In English

Contract(s)/Grant(s): W-7405-eng-36

Report No.(s): LA-13322-MS; DE98-001875; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Two measures (not independent) of radiographic image quality are contrast and spatial frequency response. At normal radiographic exposure levels, noise is not a significant factor in evaluating these parameters. However, when the photon fluence on the detector is less than 100 photons/pixel, the statistical noise in the image significantly degrades the image contrast. This paper presents a method of characterizing the image quality that utilizes both contrast and noise by calculating the net information con-

tent of the image (in bits) using the image entropy. An algorithm for calculating information content (IC) is developed and results are presented for simulated radiographs as various radiographic parameters are varied. This Mathematica code is listed in the Appendix. A copper step wedge is radiographed and the actual IC is measured for all the steps which are taken two at a time. This experimental data is compared to simulated results with good agreement. A companion report will show how varying such radiographic parameters as x-ray energy and total dose affect the IC of the image.
DOE
Dosage; Information; Radiography; Image Resolution; Image Contrast; Image Processing

19980210186 Purdue Research Foundation, IN USA
Spectral Methods for High-Speed Optical Transmultiplexing and Coding ***Final Report, 30 Sep. 1995 - 29 Nov. 1997***
Weiner, Andrew M., Purdue Research Foundation, USA; Jun. 02, 1998; 9p; In English
Contract(s)/Grant(s): F49620-95-1-0533; AF Proj. 3484
Report No.(s): AD-A346411; AFRL-SR-BL-TR-98-0476; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This program is demonstrated all-optical methods for generation, processing, and transmultiplexing (data format conversion) of ultrafast lightwave signals. This work is based on a generalized space-time processing concept, where ultrafast time-domain signals are converted into the spatial domain, where they can be processed using parallel optical and smart pixel optoelectronic techniques, and then subsequently reconverted back into the ultrafast time domain. The program investigated GaAs/GaAlAs photorefractive quantum wells as a dynamic holographic medium for femtosecond pulse processing in spectral holography systems. Several optical error control code techniques and optical codes have been investigated over the last year, most based on optical spectral encoding technique (”spectal-null codes”) improved bandwidth utilization and drastically reduced dispersion sensitivity can be achieved by encoding individual bits shaped as specific orthogonal waveforms. The results from this work, show that particular orthogonally coded waveforms can indeed be multiplexed ”on top of each other” both in time and frequency and still remain orthogonal at the receiver end. We also show that dispersion, linear and nonlinear chips do not affect the orthogonality properties of these waveforms.
DTIC
Fiber Optics; Photonics; Multiplexing; Data Processing; Aluminum Gallium Arsenides; Gallium Arsenides; Quantum Wells; Spectral Methods

19980210212 Department of the Navy, Washington, DC USA
Rapid, High-Resolution Scanning of Flat and Curved Regions for Gated Optical Imaging
Brashkansky, Mark, Inventor, Department of the Navy, USA; Duncan, Michael, Inventor, Department of the Navy, USA; Reintjes, John, Inventor, Department of the Navy, USA; Mar. 31, 1998; 19p; In English
Patent Info.: Filed 31 Mar. 1998; US-Patent-Appl-SN-050,964
Report No.(s): AD-D018864; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A scanning system for scanning in first and second dimensions a desired surface topology of a sample, the scanning device comprising: a light source for producing a collimated light beam; a first scanning device responsive to the collimated light beam from the light source for producing a first scanned beam in a first dimension with a constant optical path length; and a second scanning device coupled between the first scanning device and the sample for focusing and scanning the first scanned beam in a second dimension onto the surface region of the sample to cause the collimated light beam to scan the surface topology of the sample with a constant optical path length in each of the first and second dimensions of the desired topology of the sample. In a second embodiment of the invention, a beam of light is focused by a first lens before a scanner and the scanner is rotated. Second and third lenses arranged in a 4-f combination are used to image rotated focal spots along a spherical convex surface of a sample while the optical path length stays constant. Slow scanning in other dimensions can be performed by mechanical means.
DTIC
Optical Paths; Imaging Techniques; Light Sources; Guy Wires; High Resolution; Images

19980210303 Department of the Navy, Washington, DC USA
Wavelength Multiplexed, Electro-Optically Controllable Fiber Optic Multi-Tap Delay Line
Burns, William K., Inventor, Department of the Navy, USA; Chipman, Leslie E., Inventor, Department of the Navy, USA; Moeller, Robert P., Inventor, Department of the Navy, USA; Apr. 21, 1998; 15p; In English
Patent Info.: Filed 21 Apr. 1998; US-Patent-Appl-SN-063269
Report No.(s): AD-D018883; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
The wavelength multiplexed, electro-optically controllable, fiber optic multi-tap delay line utilizes a first output signal from a plurality of amplitude adjustable continuous-wave (CW) optical lasers multiplexed to form a combined optical signal onto which

a radio frequency signal is imposed thereby shifting the combined optical signal which is then demultiplexed. A second output signal of the plurality of CW lasers is phase adjusted and combined with the demultiplexed combined optical signal to form a RF phase adjusted modulated optical signal. The plurality of phase adjusted modulated optical signals pass through associated optical delay lines and are multiplexed to form a single optical signal containing a plurality of optical channels having different characteristics which is applied to a detector to produce an output electrical signal for transmission to using devices.
DTIC
Optical Communication; Fiber Optics; Continuous Wave Lasers; Signal Transmission; Delay Lines; Radio Frequencies; Wavelength Division Multiplexing

19980210308 Department of the Navy, Washington, DC USA
Efficient Spatial Image Separator
Levitt, Hal L., Inventor, Department of the Navy, USA; Prather, Dennis W., Inventor, Department of the Navy, USA; Gill, Edward, Inventor, Department of the Navy, USA; Mar. 31, 1998; 34p; In English
Patent Info.: Filed 31 Mar. 1998; US-Patent-Appl-SN-050960
Report No.(s): AD-D018878; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A spatial image separator includes a separating arrangement that separates an incident image pattern into a plurality of segments. The spatial image separator additionally includes a manner of relocating and selectively of the segments toward at least one output position. This is accomplished in a manner which preserves information content while significantly improving energy utilization.
DTIC
Separators; Image Processing; Images

19980210364 Sandia National Labs., Albuquerque, NM USA
Uncooled thin film pyroelectric IR detector with aerogel thermal isolation
Ruffner, J. A., Sandia National Labs., USA; Clem, P. G., Sandia National Labs., USA; Tuttle, B. A., Sandia National Labs., USA; Jan. 1998; 26p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-98-0138; DE98-003219; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche
Uncooled pyroelectric IR imaging systems, such as night vision goggles, offer important strategic advantages in battlefield scenarios and reconnaissance surveys. Until now, the current technology for fabricating these devices has been limited by low throughput and high cost which ultimately limit the availability of these sensor devices. We have developed and fabricated an alternative design for pyroelectric IR imaging sensors that utilizes a multilayered thin film deposition scheme to create a monolithic thin film imaging element on an active silicon substrate for the first time. This approach combines a thin film pyroelectric imaging element with a thermally insulating SiO(sub 2) aerogel thin film to produce a new type of uncooled IR sensor that offers significantly higher thermal, spatial, and temporal resolutions at a substantially lower cost per unit. This report describes the deposition, characterization and optimization of the aerogel thermal isolation layer and an appropriate pyroelectric imaging element. It also describes the overall integration of these components along with the appropriate planarization, etch stop, adhesion, electrode, and blacking agent thin film layers into a monolithic structure.
DOE
Aerogels; Thin Films; Infrared Imagery; Infrared Detectors; Imaging Techniques; Thermal Absorption; Thermal Insulation

19980210378 Fermi National Accelerator Lab., Batavia, IL USA
Light collection from scintillation counters using WLS fibers and bars
Evdokimov, V., Fermi National Accelerator Lab., USA; Jan. 1998; 14p; In English; Scintillating and Fiber Detectors (Scifi 1997), 2-6 Nov. 1997, South Bend, IN, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/025; CONF-9711110; DE98-051890; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
Several methods of collecting light on scintillation counters using WLS fibers and WLS bars were studied. Nearly 20 prototype counters with different designs and with sizes ranging from 14 x 11 x 1 cm(exp 3) to 105 x 60 x 1 cm(exp 3) have been tested using cosmic muons and radioactive source. The efficiency of light collection on number of photoelectrons, uniformity of response, and time resolution have been measured. Test results for two new designs of light collection from scintillator based on WLS fibers around perimeter of scintillator plate and WLS fibers placed in machined on scintillator plate deep grooves are pre-

sented. Two out of the studied designs have been chosen as the basic options for the D0 muon system upgrade: light collection using two WLS bars for the forward muon scintillation counters and light collection using WLS fibers in deep grooves on scintillator for central area muon counters.
DOE
Collection; Scintillation Counters; Optical Fibers; Luminaires

19980210387 Massachusetts Inst. of Tech., Space Engineering Research Center, Cambridge, MA USA
Dynamic Reconstruction and Multivariable Control for Force-Actuated, Thin Facesheet Adaptive Optics
Grocott, Simon C. O., Massachusetts Inst. of Tech., USA; Miller, David W., Massachusetts Inst. of Tech., USA; May 1997; 140p; In English
Contract(s)/Grant(s): NAS1-19622; NAG1-1717; NAG8-1291
Report No.(s): NASA/CR-1997-207555; NAS 1.26:207555; SERC-3-97; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Multiple Mirror Telescope (MMT) under development at the University of Arizona takes a new approach in adaptive optics placing a large (0.65 m) force-actuated, thin facesheet deformable mirror at the secondary of an astronomical telescope, thus reducing the effects of emissivity which are important in IR astronomy. However, The large size of the mirror and low stiffness actuators used drive the natural frequencies of the mirror down into the bandwidth of the atmospheric distortion. Conventional adaptive optics takes a quasi-static approach to controlling the, deformable mirror. However, flexibility within the control bandwidth calls for a new approach to adaptive optics. Dynamic influence functions are used to characterize the influence of each actuator on the surface of the deformable mirror. A linearized model of atmospheric distortion is combined with dynamic influence functions to produce a dynamic reconstructor. This dynamic reconstructor is recognized as an optimal control problem. Solving the optimal control problem for a system with hundreds of actuators and sensors is formidable. Exploiting the circularly symmetric geometry of the mirror, and a suitable model of atmospheric distortion, the control problem is divided into a number of smaller decoupled control problems using circulant matrix theory. A hierarchic control scheme which seeks to emulate the quasi-static control approach that is generally used in adaptive optics is compared to the proposed dynamic reconstruction technique. Although dynamic reconstruction requires somewhat more computational power to implement, it achieves better performance with less power usage, and is less sensitive than the hierarchic technique.
Author
Adaptive Optics; Deformable Mirrors; Telescopes; Dynamic Control; Optimal Control

19980210398 Physics and Electronics Lab. TNO, The Hague, Netherlands
Infrared Ducting Measurements at Lorient (France)
Schwering, P. B. W., Physics and Electronics Lab. TNO, Netherlands; Winkel, J., Physics and Electronics Lab. TNO, Netherlands; Kemp, R. A. W., Physics and Electronics Lab. TNO, Netherlands; Apr. 1998; 74p; In English; Original contains color illustrations
Contract(s)/Grant(s): A93/K/725; Proj. 23388.2
Report No.(s): TD97-0355; FEL-95-A-A117; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., P.O. Box 96864, 2509 JG The Hague, The Netherlands); US Sales Only, Hardcopy, Microfiche

This report gives TNO-FEL results of the infrared measurements during the NATO AC/243 (Panel 3/RSG.21) Lorient trials. The meteorological conditions at the Lorient trials were such that only infrared subrefraction situations occurred. Therefore the angles of arrival between the two sources were not very different. Based on more observations and model calculations it is expected that in coastal environments effects as sub-refraction and super-refraction occur regularly.
Author
Infrared Radiation; Electromagnetic Measurement; Ducts

19980210544 Lawrence Livermore National Lab., Livermore, CA USA
First significant image improvement from a sodium-layer laser guide star adaptive optics system at Lick Observatory
Olivier, S. S., Lawrence Livermore National Lab., USA; Max, C. E., Lawrence Livermore National Lab., USA; Friedman, H. W., Lawrence Livermore National Lab., USA; An, J., Lawrence Livermore National Lab., USA; Avicola, K., Lawrence Livermore National Lab., USA; Beeman, B. V., Lawrence Livermore National Lab., USA; Bissinger, H. D., Lawrence Livermore National Lab., USA; Brase, J. M., Lawrence Livermore National Lab., USA; Erbert, G. V., Lawrence Livermore National Lab., USA; Gavel, D. T., Lawrence Livermore National Lab., USA; Kanz, K., Lawrence Livermore National Lab., USA; Macintosh, B., Lawrence Livermore National Lab., USA; Neeb, K. P., Lawrence Livermore National Lab., USA; Waltjen, K. E., Lawrence Livermore National Lab., USA; Jul. 14, 1997; 12p; In English, 27 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-128088; CONF-970706; DE98-051086; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Atmospheric turbulence severely limits the resolution of ground-based telescopes. Adaptive optics can correct for the aberrations caused by the atmosphere, but requires a bright wavefront reference source in close angular proximity to the object being imaged. Since natural reference stars of the necessary brightness are relatively rare, methods of generating artificial reference beacons have been under active investigation for more than a decade. In this paper, we report the first significant image improvement achieved using a sodium-layer laser guide star as a wavefront reference for a high- order adaptive optics system. An artificial beacon was created by resonant scattering from atomic sodium in the mesosphere, at an altitude of 95 km. Using this laser guide star, an adaptive optics system on the 3 m Shane Telescope at Lick Observatory produced a factor of 2.4 increase in peak intensity and a factor of 2 decrease in full width at half maximum of a stellar image, compared with image motion compensation alone. The Strehl ratio when using the laser guide star as the reference was 65% of that obtained with a natural guide star, and the image full widths at half maximum were identical, 0.3 arc sec, using either the laser or the natural guide star. This sodium-layer laser guide star technique holds great promise for the world's largest telescopes.
DOE
Image Motion Compensation; Laser Guide Stars; Mesosphere; Observatories; Reference Stars; Atmospheric Turbulence

19980210595 Allied-Signal Aerospace Co., Kansas City, MO USA
Fabrication, measurement, and alignment uniformity analysis of linear arrays of optical fibers
Klingsporn, P. E., Allied-Signal Aerospace Co., USA; Jun. 1997; 32p; In English
Contract(s)/Grant(s): DE-AC04-76DP-00613
Report No.(s): KCP-613-5317; DE97-053280; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Techniques were developed for assembling a linear array of optical fibers between two silicon plates and polishing the fiber ends in a plane perpendicular to the fiber axis. The silicon plates contained etched V-grooves for capturing the fibers. Optical fibers from two sources were evaluated, along with silicon plates supplied by two sources. Most of the arrays were assembled by epoxy bonding, but some effort was made to form a eutectic bond using gold metallized fibers with gold-coated silicon plates. Measurements were made of the uniformity of spacing of the fiber mode field centers in the linear array. The work was performed to develop a multi-fiber linear array connector to couple optical signals to and from optoelectronic devices.
DOE
Optical Fibers; Alignment; Fabrication; Electronic Equipment; Optoelectronic Devices

19980210660 Wright Lab., Targeting Systems Branch, Wright-Patterson AFB, OH USA
Advanced Electro Optic Targeting System
Jacobs, Richard W., Wright Lab., USA; Lapp, Henry S., Wright Lab., USA; Multi-Sensor Systems and Data Fusion for Telecommunications, Remote Sensing and Radar; Apr. 1998; 7p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Future Aircraft targeting systems are integrating sensor inputs for automated target detection, location and identification with the goal to both lower system cost and increase system performance. This paper describes a common aperture electro optical (EO) targeting concept for an integrated air-to-ground EO targeting system using promising developments in multispectral target detection and in laser target identification. The integrated capability allows use of a minimum system aperture while increasing recognition and targeting ranges outside missile treat envelopes. The technical status and preliminary test results of the Wright Laboratory thrusts to develop both laser identification and thermal spectral detection capabilities will be discussed. These involve developments and demonstrations of multi-spectral detection using a few thermal bands and non-cooperative target identification using a burst illumination laser with eyesafe wavelength and a short wave infrared gated camera. These individual concepts will be mature enough to support an integration effort in the 1999/2000 timeframe. The cost, performance and level of automation supports use for both manned and unmanned air vehicle targeting and reconnaissance missions.
Author
Target Acquisition; Infrared Radiation; Electro-Optics; Laser Targets; Missiles

19980210686 Wright Lab., Materials Directorate, Wright-Patterson AFB, OH USA
Pixelless Infrared Imaging Using Quantum Wells
Brown, Gail J., Wright Lab., USA; Szmulowicz, Frank, Wright Lab., USA; Apr. 1998; 7p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A new concept for designing infrared imaging systems is under development. In this concept, absorbed long wavelength infrared light is up-converted to near infrared emission through the vertical integration of a p-type multiple quantum well infrared photodetector (QWIP) heterostructure and a light emitting diode (LED). The infrared (IR) radiation is absorbed in the QWIP part of the heterostructure. The optically excited charge carriers from the QWIP are used to stimulate near IR emission from the LED layers. This emitted radiation can then be imaged using a commercial, high resolution silicon CCD camera. Because of the extremely short path that the photoexcited charge carrier traverses between the QWIP and LED layers, the emitted photon originates at the same spatial position as the absorbed photon, such that there is a one-to-one correspondence between the long wavelength infrared image and the near infrared image. With this device, the need for fabricating thousands of tiny pixels on the infrared array to generate a high resolution image is eliminated. With the elimination of pixels comes the elimination of the need for thousands of contacts to apply a bias voltage to each individual pixel. Only two wires are required to bias this QWIP and LED heterostructure. For a two color infrared system, this concept would require only three wires for the entire large area imaging array. Our preliminary results for a vertically integrated p-type GaAs/AlGaAs QWIP and LED heterostructure will be discussed.
Author
Quantum Wells; Semiconductors (Materials); Pixels; Imaging Techniques; Infrared Imagery; Photoexcitation; Charge Carriers

19980210753 Los Alamos National Lab., NM USA
Information content of low-dose radiographs, Part 2
Morris, R. A., Los Alamos National Lab., USA; Oct. 1997; 9p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-13322-MS-Pt.2; DE98-001770; No Copyright; Avail: Issuing Activity (Technology Transfer Office, NASA CASI, 800 Elkridge Landing Road,, Hardcopy, Microfiche

The previous paper described the concept of using the net number of information bits transmitted in a radiographic image as a measure of the contrast parameter of image quality. The concept is particularly useful when the image contrast is limited by the statistics of the photon fluence incident on the detector (low doses). The Wolfram Research Mathematica program (described in Ref. 1) that was used to simulate a noisy image of an object with two thicknesses and to calculate the resulting IC (information content). The only noise source in the simulation was fluctuations in the photon fluence incident on the detector. The results from the simulation were compared to data obtained from actual radiographs of a copper step wedge radiographed with 10 and 50 pulses from a 150-p, V x-ray machine. Good agreement between the simulation and experiment was obtained when the photon fluence was considered a free, adjustable parameter. This report extends the simulation described in Ref. 1 and shows how IC varies as the following radiographic parameters change: object thickness; object Z number; x-ray energy; and incident x-ray fluence.
DOE
Information; Radiography; Radiation Dosage

19980210803 Fermi National Accelerator Lab., Batavia, IL USA
Technical design report for the upgrade of the ICD for D-Zero Run 2
Sawyer, L., Louisiana Tech Univ., USA; De, K., Texas Univ., USA; Draper, P., Texas Univ., USA; Gallas, E., Texas Univ., USA; Li, J., Texas Univ., USA; Sosebee, M., Texas Univ., USA; Stephens, R. W., Texas Univ., USA; White, A., Texas Univ., USA; Jan. 1998; 78p; In English
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL-TM-2041; DE98-052012; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Inter Cryostat Detector (ICD) used in Run 1 of the D0 Experiment will be inoperable in the central, high magnetic field planned for Run 2. In Run 1, the ICD enhanced the hermeticity and uniformity of the D0 calorimeter system, improving both missing transverse energy and jet energy resolution. The goals for the Run 2 ICD are the same. In this document, the physics arguments for maintaining the ICD are presented, followed by a detailed description of the planned design changes, prototype tests, construction, installation, and commissioning of the device for the Run 2 D0 detector. Estimates of costs and schedule can be found on //DOSERVER2/Operations/Upgrade Project/ subareas available via DZERO's WinFrame Program Manager. This detector is not intended to provide any ''L0'' capabilities (for luminosity monitoring), or to provide any EM coverage in the intermediate region, or to provide additional coverage in the intermediate regions, unlike previous upgrades proposed in this detector region. The ICD upgrade described here maintains most of the Run I capabilities in a high magnetic field environment.
DOE
Magnetic Fields; Optical Fibers; Scintillation Counters; Photomultiplier Tubes; Calibrating; Revisions

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19980206475 Wisconsin Univ., Dept. of Physics, Madison, WI USA
Measurement of fast ion dynamics in a high temperature plasma
Den Hartog, D. J., Wisconsin Univ., USA; Almagri, A. F., Wisconsin Univ., USA; Chapman, J. T., Wisconsin Univ., USA; 1997; 19p; In English; 9th; High-temperature Plasma Diagnostics, 2 - 4 Jun. 1997, St. Petersburg, Russian Federation
Contract(s)/Grant(s): DE-FG02-96ER-54345
Report No.(s): DOE/ER/54345-289; CONF-9706154-1; DE97-008722; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Measurement of fast changes and fluctuations in ion flow and/or temperature is critical to understanding a diversity of plasma phenomena. We have developed a high-resolution spectrometer to measure impurity ion temperatures and flow velocities in high temperature plasmas with 250 kHz bandwidth. This device is actually a duo-spectrometer: measurements from two different chordal views of the plasma can be made simultaneously. All 32 spectral channels on the exit plane of the duo-spectrometer are read out and digitized at 1 MHz in parallel to achieve high time resolution. We have obtained these key results: (1) The toroidal velocity fluctuations of the plasma are coherent with the large-scale magnetic tearing modes; during a sawtooth event the scaler product of v(phi) and B(sub r) is similar to that expected for the MHD dynamo electromotive force. (2) Toroidal plasma flow closely tracks the toroidal rotation of the magnetic tearing modes, including the fast changes that occur during sawtooth and locking events.
DOE
Electromotive Forces; Magnetohydrodynamic Flow; Plasmas (Physics); Temporal Resolution; Toroidal Plasmas; Ion Temperature; High Temperature Plasmas

19980206476 Wisconsin Univ., Madison, WI USA
Fast flow phenomena in the MST reversed-field pinch
DenHartog, D. J., Wisconsin Univ., USA; Almagri, A. F., Wisconsin Univ., USA; Chapman, J. T., Wisconsin Univ., USA; 1997; 7p; In English; 24th; Controlled Fusion and Plasma Physics, 9 - 13 Jun. 1997, Berchtesgaden, Germany; Sponsored by European Physical Society, Switzerland
Contract(s)/Grant(s): DE-FG02-96ER-54345
Report No.(s): DOE/ER/54345-290; CONF-9706131-19; DE97-008723; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We have obtained these key results from the MST RFP: (1) The toroidal velocity fluctuations of the plasma are coherent with the large-scale magnetic tearing modes; during a sawtooth event the scalar product of v(sub (phi)) and B(sub r) is similar to that expected for the MHD dynamo electromotive force. (2) Non-resonant external field errors do not cause magnetic mode locking. (3) Toroidal plasma flow closely tracks the toroidal rotation of the magnetic tearing modes, including the fast changes that occur during sawtooth and locking events. (4) The sawtooth change in mode rotation and plasma flow is not caused by external electromagnetic torque. (5) Plasma flow and mode rotation can be actively controlled, including rotation reversal and unlocking, by modifying E(sub r) with a biased probe or plasma source electrode.
DOE
Electromotive Forces; Active Control; Plasma Electrodes; Plasmas (Physics); Toroidal Plasmas

19980206477 Wisconsin Univ., Dept. of Physics, Madison, WI USA
Improved confinement and (beta) in an RFP with reduced turbulence
Anderson, J., Wisconsin Univ., USA; Chapman, B. E., Wisconsin Univ., USA; Chiang, C. S., Wisconsin Univ., USA; 1997; 7p; In English; 24th; Controlled Fusion and Plasma Physics, 9 - 13 Jun. 1997, Berchtesgaden, Germany; Sponsored by European Physical Society, Switzerland
Contract(s)/Grant(s): DE-FG02-96ER-54345
Report No.(s): DOE/ER/54345-291; CONF-9706131-20; DE97-008724; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Improved confinement has been obtained in the Madison Symmetric Torus (MST) reversed field pinch (RFP) (1) by application of current profile control, (2) spontaneously, subject to constraints on toroidal field-reversal and plasma density, and (3) by application of electrostatic biasing. In all three cases, either or both magnetic and electrostatic fluctuations are reduced. Improved

confinement coinciding with reduced turbulence in the RFP is expected, since magnetic fluctuations have been measured to produce large particle and energy transport in the RFP core (roughly defined interior to the reversal surface), while electrostatic fluctuations produce large particle transport in the edge. (The cause of energy transport in the edge remains unidentified.) Here we briefly describe the important observations for each of these three cases of improved confinement in MST.
DOE
Toroidal Plasmas; Plasma Density; Energy Transfer; Electrostatics; Particle Energy

19980206483 Argonne National Lab., IL USA
The activity of cobalt and silicon in the Co - Si system with special focus on the (alpha) - Co solid solution
Lexa, D., Binghamton Univ., USA; Kematick, R. J., Binghamton Univ., USA; Myers, C. E., Binghamton Univ., USA; 1997; 9p; In English; 9th; High-temperature Materials Chemistry, 19 - 23 May 1997, State College, PA, USA
Contract(s)/Grant(s): W-31-109-ENG-38; NSF DMR 94-08558
Report No.(s): ANL/ES/CP-93123; CONF-9705184; DE97-053311; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The activities of cobalt and silicon at 1463 K have been determined across the whole composition range in the Co - Si system, including the (alpha) - Co solid solution, for which no activity data were previously available. Simple and reactive Knudsen effusion mass spectroscopy employed in this work were shown to successfully overcome problems normally encountered in studying high-temperature solid binary systems, such as slow equilibration and low partial pressures of the components. The composition dependence of the cobalt activities within the (alpha) - Co solid solution phase was used to calculate the self-interaction coefficients of silicon in (alpha) - Co: ln (gamma)(sub Si) = 10.4 (+/-) 0.2 and (epsilon)(sub Si)(sup (Si)) = 18.6 (+/-) 0.8. The regular solution model was shown to be a fairly good description of the (alpha) - Co solid solution, with an energy parameter Z(sub CoSi) of -120 (+/-) 5 kJ(center dot)mol(sup -1). The results compare well with literature data on similar systems, such as Fe - Si and Ni - Si.
DOE
Cobalt; Solid Solutions; Partial Pressure; Silicon

19980206484 Argonne National Lab., IL USA
Materials effects and design implications of disruptions and off-normal events in ITER
Hassanein, A., Argonne National Lab., USA; Federici, G., International Thermonuclear Experimental Reactor Joint Central Team, Germany; Konkashbaev, I., Troitsk Inst. for Innovation, Russia; Zhitlukhin, A., Troitsk Inst. for Innovation, Russia; Litunovsky, V., Efremov (D. V.) Scientific Research Inst., Russia; [1997]; 28p; In English; 4th; Fusion Nuclear Technology, 6 - 11 Apr. 1997, Tokyo, Japan
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/TD/CP-92323; CONF-970404; DE97-053387; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Damage to plasma-facing components (PFCs) and structural materials during abnormal plasma behavior such as hard disruptions, edge-localized modes (ELMs), and vertical displacement events (VDEs) is considered a serious life-limiting concern for these components. The PFCs in the International Thermonuclear Experimental Reactor (ITER), such as the divertor, limiter, and parts of the first wall, will be subjected to high energy deposition during these plasma instabilities. High erosion losses on material surfaces, high temperature rise in structural materials (particularly at the bonding interface), and high heat flux levels and possible burnout of the coolant tubes are critical constraints that severely limit component lifetime and therefore degrade reactor performance, safety, and economics. Recently developed computer models and simulation experiments are being used to evaluate various damage to PFCs during the abnormal events. The design implications of plasma-facing and nearby components are discussed, and recommendations are made to mitigate the effects of these events.
DOE
Damage; Thermonuclear Reactions; Energy Transfer; Magnetohydrodynamic Stability; Plasmas (Physics)

19980206493 Wisconsin Univ., Center for Plasma Theory and Computation, Madison, WI USA
Helical post stellarator, Part 1, Vacuum configuration
Moroz, P. E., Wisconsin Univ., USA; Aug. 1997; 36p; In English
Report No.(s): UW-CPTC-97-15; DE98-000439; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Results on a novel type of stellarator configuration, the Helical Post Stellarator (HPS), are presented. This configuration is different significantly from all previously known stellarators due to its unique geometrical characteristics and unique physical

properties. Among those are: the magnetic field has only one toroidal period (M = 1), the plasma has an extremely low aspect ratio, A approx. 1, and the variation of the magnetic field, B, along field lines features a helical ripple on the inside of the torus. Among the main advantages of a HPS for a fusion program are extremely compact, modular, and simple design compatible with significant rotational transform, large plasma volume, and improved particle transport characteristics.
DOE
Stellarators; Magnetic Fields

19980206494 Wisconsin Univ., Center for Plasma Theory and Computation, Madison, WI USA
Double-helix stellarator
Moroz, P. E., Wisconsin Univ., USA; Sep. 1997; 31p; In English
Report No.(s): UW-CPTC-97-16; DE98-000440; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A new stellarator configuration, the Double-Helix Stellarator (DHS), is introduced. This novel configuration features a double-helix center post as the only helical element of the stellarator coil system. The DHS configuration has many unique characteristics. One of them is the extreme low plasma aspect ratio, A approx. 1-1.2. Other advantages include a high enclosed volume, appreciable rotational transform, and a possibility of extreme-high-beta MHD equilibria. Moreover, the DHS features improved transport characteristics caused by the absence of the magnetic field ripple on the outboard of the torus. Compactness, simplicity and modularity of the coil system add to the DHS advantages for fusion applications.
DOE
Stellarators; Configurations

19980206501 Wisconsin Univ., Madison, WI USA
Self-consistent mean field forces in turbulent plasmas: Current and momentum relaxation
Hegna, C. C., Wisconsin Univ., USA; Aug. 1997; 16p; In English
Contract(s)/Grant(s): DE-FG02-85ER-53212
Report No.(s): DOE/ER/53212-292; DE98-001045; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The properties of turbulent plasmas are described using the two-fluid equations. Under some modest assumptions, global constraints for the turbulent mean field forces that act on the ion and electron fluids are derived. These constraints imply a functional form for the parallel mean field forces in the Ohm's law and the momentum balance equation. These forms suggest that the fluctuations attempt to relax the plasma to a state where both the current and the bulk plasma momentum are aligned along the mean magnetic field with proportionality constants that are global constants. Observations of flow profile evolution during discrete dynamo activity in reversed field pinch experiments are interpreted.
DOE
Collisional Plasmas; Reverse Field Pinch; Turbulent Flow; Flow Equations; Magnetohydrodynamic Flow

19980206502 Los Alamos National Lab., NM USA
Determining the temperature and density distribution from a Z-pinch radiation source
Matuska, W., Los Alamos National Lab., USA; Lee, H., Los Alamos National Lab., USA; [1997]; 23p; In English; 11th; Pulsed Power, 29 Jun. - 2 Jul. 1997, Baltimore, MD, USA; Includes vugraphs
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2960; CONF-9706113; DE98-000996; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

High temperature radiation sources exceeding one hundred eV can be produced via z-pinches using currently available pulsed power. The usual approach to compare the z-pinch simulation and experimental data is to convert the radiation output at the source, whose temperature and density distributions are computed from the 2-D MHD code, into simulated data such as a spectrometer reading. This conversion process involves a radiation transfer calculation through the axially symmetric source, assuming local thermodynamic equilibrium (LTE), and folding the radiation that reaches the detector with the frequency-dependent response function. In this paper the authors propose a different approach by which they can determine the temperature and density distributions of the radiation source directly from the spatially resolved spectral data. This unfolding process is reliable and unambiguous for the ideal case where LTE holds and the source is axially symmetric. In reality, imperfect LTE and axial symmetry will introduce inaccuracies into the unfolded distributions. The authors use a parameter optimization routine to find the temperature and density distributions that best fit the data. They know from their past experience that the radiation source resulting from the implosion of a thin foil does not exhibit good axial symmetry. However, recent experiments carried out at Sandia National Laboratory using

multiple wire arrays were very promising to achieve reasonably good symmetry. For these experiments the method will provide a valuable diagnostic tool.
DOE
Radiation Sources; Emission Spectra; Magnetohydrodynamics; Zeta Pinch; Plasma Density; Plasma Temperature; Plasma Diagnostics

19980206550 Wisconsin Univ., Dept. of Physics, Madison, WI USA
Experimental scaling of fluctuations and confinement with Lundquist number in the RFP
Stoneking, M. R., Wisconsin Univ., USA; Chapman, J. T., Wisconsin Univ., USA; Prager, S. C., Wisconsin Univ., USA; Sarff, J. S., Wisconsin Univ., USA; Sep. 1997; 52p; In English
Contract(s)/Grant(s): DE-FG02-96ER-54345
Report No.(s): DOE/ER/54345-294; DE98-001047; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The scaling of the magnetic and velocity fluctuations with Lundquist number (S) is examined experimentally over a range of values from 7 x 10(sup 4) to 10(sup 6) in a reversed field pinch (RFP) plasma. Magnetic fluctuations do not scale uniquely with the Lundquist number. At high (relative) density, fluctuations scale as (tilde b)(proportional to)S(sup -0.18), and fluctuations are almost independent of S at low relative density, (tilde b)(proportional to)S(sup -0.07); however both exponents fall in the range of theoretical and numerical predictions. At high relative density, the scaling of the energy confinement time follows expectations for transport in a stochastic magnetic field. A confinement scaling law (n(tau)(sub E)(proportional to)(beta)(sup 4/5)T(sup -7/10)A(sup -3/5)I(sub (phi))(sup 2)) is derived assuming the persistent dominance of stochastic magnetic diffusion in the RFP and on the measured scaling of magnetic fluctuations. The peak velocity fluctuations during a sawtooth cycle scale marginally stronger than magnetic fluctuations but weaker than a simple Ohm's law prediction. The sawtooth period is determined by a resistive-Alfvenic hybrid time (T(sub saw)(proportional to)(radical)((tau)(sub R)(tau)(sub Alf))) rather than a purely resistive time.
DOE
Experimentation; Scaling Laws; Reverse Field Pinch; Variations

19980206551 Wisconsin Univ., Dept. of Physics, Madison, WI USA
Alpha effect of Alfven waves and current drive in reversed field pinches
Litwin, C., Wisconsin Univ., USA; Prager, S. C., Wisconsin Univ., USA; Oct. 1997; 7p; In English
Contract(s)/Grant(s): DE-FG02-85ER-53212
Report No.(s): DOE/ER/53212-295; DE98-001046; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Circularly polarized Alfven waves give rise to an (alpha)-dynamo effect that can be exploited to drive parallel current. In a (open quotes)laminar(close quotes) magnetic the effect is weak and does not give rise to significant currents for realistic parameters (e.g., in tokamaks). However, in reversed field pinches (RFPs) in which magnetic field in the plasma core is stochastic, a significant enhancement of the (alpha)-effect occurs. Estimates of this effect show that it may be a realistic method of current generation in the present-day RFP experiments and possibly also in future RFP-based fusion reactors.
DOE
Magnetohydrodynamic Waves; Current Distribution; Plasmas (Physics); Fusion Reactors; Tokamak Devices

19980206552 General Atomics Co., San Diego, CA USA
Comparison of a (del)B drift effect model with measured H-mode power thresholds
Carlstrom, T. N., General Atomics Co., USA; Burrell, K. H., General Atomics Co., USA; Groebner, R. J., General Atomics Co., USA; Sep. 1997; 13p; In English; US/Japan Workshop on H-mode Physics and 6Th H-mode Workshop, 22 - 24 Sep. 1997, Kloster Seeon, Germany
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22696; CONF-9709100-; DE98-001003; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The H-mode power threshold has a weak but positive B(sub T) dependence when the ion (del)B drift is away from the X-point, in contrast to the nearly linear B(sub T) dependence when the ion (del)B drift is toward the X-point. This indicates that geometry plays an important role in the H-mode power threshold scaling. A simple model of the (del)B drift effect failed to predict this behavior, but successfully predicted the sign change of gas puffing and low X-point height on the power threshold. The difference

between the threshold power required for sawtooth and nonsawtooth triggered transitions can be substantial. This effect may contribute to the observed B scaling of the H-mode power threshold.
DOE
Evaluation; Energy Transfer; Plasma Control

19980206553 Los Alamos National Lab., NM USA
Simulations of linear and nonlinear Rayleigh-Taylor instability under high Atwood numbers
Choi, C. K., Purdue Univ., USA; Hoffman, N. M., Los Alamos National Lab., USA; Clover, M. R., Los Alamos National Lab., USA; Powers, W. J., Los Alamos National Lab., USA; [1997]; 10p; In English; Laser Interaction and Related Plasma Phenomena, 13 - 18 Apr. 1997, Monterey, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3027; CONF-970407-; DE98-000999; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Inertial confinement fusion (ICF) implosions, whether real or ideal, are subject to a variety of hydrodynamic instabilities that amplify small departures from spherical symmetry. Asymmetric implosions departing from spherical symmetry can lead to the breakup of the imploding shell or the creation of hydrodynamic turbulence. In an effort to understand the evolution of the asymmetries, perturbation seeds with both velocity and surface displacements have been introduced at the boundary of two different density media to model analytical Rayleigh-Taylor instability growth. Growth of perturbed amplitudes has been studied in linear and late-time nonlinear regimes. Simulated linear growth rates and nonlinear bubble velocities are in good agreement with theoretical values for Atwood numbers that are close to unity (relevant to ICF applications).
DOE
Simulation; Nonlinearity; Linearity; Rayleigh Distribution; Taylor Instability

19980206619 Oak Ridge National Lab., TN USA
Energy confinement scaling and the extrapolation to ITER
[1997]; 18p; In English; Controlled Fusion and Plasma Physics, 9 - 13 Jun. 1997, Berchtesgaden, Germany; Sponsored by European Physical Society, Switzerland
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-9706131-24; DE97-009370; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The fusion performance of ITER is predicted using three different techniques; statistical analysis of the global energy confinement data, a dimensionless physics parameter similarity method and the full 1-D modeling of the plasma profiles. Although the three methods give overlapping predictions for the performance of ITER, the confidence interval of all of the techniques is still quite wide.
DOE
Thermonuclear Reactions; Fusion Reactors; Plasma Control; Statistical Analysis

19980206651 Sandia National Labs., Albuquerque, NM USA
Tritium removal by CO2 laser heating
Skinner, C. H., Princeton Univ., USA; Kugel, H., Princeton Univ., USA; Mueller, D., Princeton Univ., USA; Doyle, B. L., Sandia National Labs., USA; Wampler, W. R., Princeton Univ., USA; [1997]; 6p; In English; 17th; Fusion Engineering, 6 - 10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000; DE-AC02-76CH-03073
Report No.(s): SAND-97-2554C; CONF-971065; DE98-000561; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Efficient techniques for rapid tritium removal will be necessary for ITER to meet its physics and engineering goals. One potential technique is transient surface heating by a scanning CO2 or Nd:YAG laser that would release tritium without the severe engineering difficulties of bulk heating of the vessel. The authors have modeled the heat propagation into a surface layer and find that a multi-kW/cm(exp 2) flux with an exposure time of order 10 ms is suitable to heat a 50 micron co-deposited layer to 1,000--2,000 degrees. Improved wall conditioning may be a significant side benefit. They identify remaining issues that need to be addressed experimentally.
DOE
Carbon Dioxide Lasers; Laser Heating; Tritium; Carbon Dioxide; Laser Beams

19980206653 Los Alamos National Lab., NM USA

Inertial confinement fusion at the Los Alamos National Laboratory

Lindman, E., Los Alamos National Lab., USA; Baker, D., Los Alamos National Lab., USA; Barnes, C., Los Alamos National Lab., USA; Bauer, B., Los Alamos National Lab., USA; Beck, J. B., Los Alamos National Lab., USA; 1997; 26p; In English; 2nd; Current Trends In International Fusion Research, 10 - 14 Mar. 1997, Washington, DC, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2778; CONF-9703109; DE98-000596; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Los Alamos National Laboratory is contributing to the resolution of key issues in the US Inertial-Confinement-Fusion Program and plans to play a strong role in the experimental program at the National Ignition Facility when it is completed.

DOE

Inertial Confinement Fusion; Research Projects

19980206656 Los Alamos National Lab., NM USA

Radiation temperature measurements in laser-heated hohlraums

Cobble, J. A., Los Alamos National Lab., USA; Goldman, S. R., Los Alamos National Lab., USA; Bessarab, A. V., Los Alamos National Lab., USA; Kunin, A. V., All-Russian Scientific Research Inst. of Experimental Physics, Russia; Tokarev, V. A., All-Russian Scientific Research Inst. of Experimental Physics, Russia; [1997]; 8p; In English; 9th; High-temperature Plasma Diagnostics, 2 - 4 Jun. 1997, St. Petersburg, Russian Federation

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2903; CONF-9706154-; DE98-000982; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Two X-ray spectrographs have been used on the Trident laser at LANL to monitor the radiation temperature of small Au hohlraums. The cylindrical targets are smaller than 1 mm. The x radiation produced by (approximately) 400 J of 0.53-(micro)m laser light is detected with a 7-channel VNIIEF soft-X-ray spectrometer. Each channel employs a multi-layer mirror and a filter to limit the channel bandwidth to 1 - 3% of the channel energy. X-rays are detected with calibrated Al X-ray diodes. A second spectrometer is based on a free-standing Au transmission grating for spectral dispersion and a multi-channel diamond photo-conductive device detector. The small hohlraum results are consistent with radiation temperatures exceeding 100 eV. Simple computer modeling shows that late in the plasma discharge, radiation of this temperature is emitted from the target.

DOE

Temperature Measurement; Hohlraums; X Rays; Radiant Heating

19980206705 Los Alamos National Lab., NM USA

Stochastic particle acceleration by plasma waves in AGN jets

Li, Hui, Los Alamos National Lab., USA; Colgate, S. A., Los Alamos National Lab., USA; Miller, J. A., Alabama Univ., USA; 1997; 11p; In English; Relativistic Jets In Agns, 26 - 30 May 1997, Cracow, Poland

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2791; CONF-9705181; DE98-000598; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The free energy stored in the stressed magnetic fields in AGN jets could be dissipated via generating turbulent plasma waves. The authors review several key wave-particle resonant interactions and point out the importance of a broad wave spectrum. Under several idealized assumptions, they show that the transit-time damping process can accelerate electrons to TeV energies in an AGN jet environment, and present a preliminary calculation on the evolution of plasma wave, electron, and photon distributions. The authors especially emphasize several open questions on particle acceleration by waves, and argue that a plausible scenario is to energize electrons out of the thermal background via transit-time damping and further accelerate them by the parallel propagating right-handed waves.

DOE

Particle Acceleration; Plasma Waves; Free Energy; Magnetic Fields; Turbulence; Wave-Particle Interactions; Stochastic Processes

19980206734 Lawrence Livermore National Lab., Livermore, CA USA

Theoretical issues in Spheromak research

Cohen, R. H., Lawrence Livermore National Lab., USA; Hooper, E. B., Lawrence Livermore National Lab., USA; LoDestro, L. L., Lawrence Livermore National Lab., USA; Mattor, N., Lawrence Livermore National Lab., USA; Pearlstein, L. D., Lawrence

Livermore National Lab., USA; Ryutov, D. D., Lawrence Livermore National Lab., USA; Apr. 01, 1997; 72p; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-ID-127002; DE98-050899; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report summarizes the state of theoretical knowledge of several physics issues important to the spheromak. It was prepared as part of the preparation for the Sustained Spheromak Physics Experiment (SSPX), which addresses these goals: energy confinement and the physics which determines it; the physics of transition from a short-pulsed experiment, in which the equilibrium and stability are determined by a conducting wall ('flux conserver') to one in which the equilibrium is supported by external coils. Physics is examined in this report in four important areas. The status of present theoretical understanding is reviewed, physics which needs to be addressed more fully is identified, and tools which are available or require more development are described. Specifically, the topics include: MHD equilibrium and design, review of MHD stability, spheromak dynamo, and edge plasma in spheromaks.

DOE

Spheromaks; Magnetohydrodynamics; Plasmas (Physics); Plasma Equilibrium

19980206760 Naval Research Lab., Washington, DC USA

Advanced Radiation Theory Support Annual Report, 1997 ***Final Report***

May 22, 1998; 143p; In English
Report No.(s): AD-A346024; NRL/MR/6720--98-8144; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report describes the work of the Radiation Hydrodynamics Branch during FY 97 in support of the DSWA PRS program. Critical issues covered are: (1) Long time implosions, power flow, and stability on Decade Quad, (2) Analysis of time resolved and time integrated Z-pinch data, (3) Spectroscopic PRS diagnosis, (4) Radiation magnetohydrodynamics code development and assessment, and (5) Analysis of novel PRS loads.

DTIC

Plasma Diagnostics; Magnetohydrodynamics; Zeta Pinch; Implosions; Hydrodynamics; Flow Stability; Taylor Instability

19980206763 California Univ., Lawrence Livermore Lab., Livermore, CA USA

Sustained Spheromak Physics Experiment, SSPX

Hooper, E. B., California Univ., Lawrence Livermore Lab., USA; May 15, 1997; 23p; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-ID-126278; DE98-050905; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Sustained Spheromak Physics Experiment is proposed for experimental studies of spheromak confinement issues in a controlled way: in steady state relative to the confinement timescale and at low collisionality. Experiments in a flux - conserver will provide data on transport in the presence of resistive modes in shear-stabilized systems and establish operating regimes which pave the way for true steady-state experiments with the equilibrium field supplied by external coils. The proposal is based on analysis of past experiments, including the achievement of T(sub e) = 400 eV in a decaying spheromak in CTX. Electrostatic helicity injection from a coaxial 'gun' into a shaped flux conserver will form and sustain the plasma for several milliseconds. The flux conserver minimizes fluxline intersection with the walls and provides MHD stability. Improvements from previous experiments include modem wall conditioning (especially boronization), a divertor for density and impurity control, and a bias magnetic flux for configurational flexibility. The bias flux will provide innovative experimental opportunities, including testing helicity drive on the large-radius plasma boundary. Diagnostics include Thomson scattering for T(sub e) measurements and ultra-short pulse reflectrometry to measure density and magnetic field profiles and turbulence. We expect to operate at T(sub e) of several hundred eV, allowing improved understanding of energy and current transport due to resistive MHD turbulence during sustained operation. This will provide an exciting advance in spheromak physics and a firm basis for future experiments in the fusion regime.

DOE

Spheromaks; Plasma Control; Plasma Diagnostics; Magnetohydrodynamic Turbulence

19980209646 NASA Johnson Space Center, Houston, TX USA

Characterization of Plasma Discharges in a High-Field Magnetic Tandem Mirror ***Final Report***

Chang-Diaz, Franklin R., NASA Johnson Space Center, USA; Jul. 06, 1998; 6p; In English
Contract(s)/Grant(s): NAG9-759; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

High density magnetized plasma discharges in open-ended geometries, like Tandem Mirrors, have a variety of space applications. Chief among them is the production of variable Specific Impulse (I(sub sp)) and variable thrust in a magnetic nozzle. Our

research group is pursuing the experimental characterization of such discharges in our high-field facility located at the Advanced Space Propulsion Laboratory (ASPL). These studies focus on identifying plasma stability criteria as functions of density, temperature and magnetic field strength. Plasma heating is accomplished by both Electron and Ion Cyclotron Resonance (ECR and ICR) at frequencies of 2-3 Ghz and 1-30 Mhz respectively, for both Hydrogen and Helium. Electron density and temperature has measured by movable Langmuir probes. Macroscopic plasma stability is being investigated in ongoing research.
Author
Plasma Jets; Emission; Magnetic Flux; Magnetic Fields; Magnetic Mirrors; Technology Utilization; Ion Cyclotron Radiation

19980209654 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
Fast Electron Heating of Shock Compressed Solids at High Intensities Relevant to Fast Ignition
Batani, D., Milan Univ., Italy; Bernardinello, A., Milan Univ., Italy; Masella, V., Milan Univ., Italy; Koenig, M., Ecole Polytechnique, France; Benuzzi, A., Ecole Polytechnique, France; Feb. 1998; 22p; In English
Report No.(s): PB98-142813; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
The authors present the first results of fast electron propagation and deposition in a laser compressed plasma. The interaction of a 4 ps, 15 J laser pulse with solid polyethylene targets is used to produce fast electrons on the one side of foil targets and a 2 ns duration laser pulse is used to drive a shock wave into the target from the opposite side. K-alpha emission from Chlorine fluor buried layers is used to measure the electron transport and deposition. The hot electron range in the compressed plastic is found to be approximately twice as large as the range in the uncompressed plastic.
NTIS
Laser Fusion; Electron Transfer; Hot Electrons; Laser Plasmas; Plasma Heating; Shock Waves; Deposition

19980209679 National Inst. for Fusion Science, Nagoya, Japan
Dielectronic Recombination Rate Coefficients to the Excited States of CI from CII
Dubau, J., Observatoire de Paris, France; Kato, T., National Inst. for Fusion Science, Japan; Safronova, U. I., Academy of Sciences (USSR), USSR; Jan. 1998; ISSN 0915-6364; 69p; In English
Report No.(s): NIFS-DATA-44; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only
The dielectronic recombination rate coefficients to the excited states for n = 2 - 6 are calculated including 1s(sup 2)2l(sup 1) 2l(sup 2)2l(sup 3)nl (n = 2 - 6, l less than or equal to (n-1)) states. The values for the excited states higher than n = 6 are extrapolated and the total dielectronic recombination rate coefficients are derived. The rate coefficients to the excited states are fitted to an analytical formula and the fit parameters are given.
Author
Recombination Coefficient; Dielectrics; Excitation; Carbon; Atoms

19980209684 Department of the Navy, Washington, DC USA
Bubble Capture Electrode Configuration
Aaron, Arnold M., Inventor, Department of the Navy, USA; Dickinson, Stuart C., Inventor, Department of the Navy, USA; Nov. 11, 1997; 8p; In English; Supersedes US-Patent-Appl-SN-546032, AD-D017786
Patent Info.: Filed 20 Oct. 1995; US-Patent-Appl-SN-546,032; US-Patent-5,685,966
Report No.(s): AD-D018848; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A bubble capture electrode configuration for an MHD system includes a body portion which forms a main channel and holds an electrically conductive fluid adapted to have a first flow direction. The system includes at least two electrodes wherein one is a cathode and the other is an anode. The electrodes are adjacent the body portion and are adapted to transmit an electric current there between and through the fluid. An electrolysis reaction is produced adjacent at least one electrode, forming gas bubbles. The system also includes magnetic poles for forming a magnetic field, wherein the magnetic field passes through the fluid substantially transverse to the electric current. Accordingly, a force is created for moving the fluid through the main channel. The system further includes a structure for preventing the gas bubbles from entering the main body portion and for preventing interference of the gas bubbles with the electric current flow, for increasing the efficiency of the system and decreasing interference with the electric current transmission through the conductive fluid.
DTIC
Bubbles; Electrical Resistivity; Magnetic Fields; Magnetohydrodynamics; Cathodes; Electrolysis

19980209701 National Inst. for Fusion Science, Nagoya, Japan
Distributed Processing and Network of Data Acquisition and Diagnostics Control for Large Helical Device (LHD)
Nakanishi, H., National Inst. for Fusion Science, Japan; Kojima, M., National Inst. for Fusion Science, Japan; Hidekuma, S.,

National Inst. for Fusion Science, Japan; Nov. 1997; ISSN 0915-6356; 12p; In English
Report No.(s): NIFS-TECH-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The LHD (Large Helical Device) data processing system has been designed in order to deal with the huge amount of diagnostics data of 600 approx. 900 MB per 10-second short-pulse experiment. It prepares the first plasma experiment in March 1998. The recent increase of the data volume obliged to adopt the fully distributed system structure which uses multiple data transfer paths in parallel and separates all of the computer functions into clients and servers. The fundamental element installed for every diagnostic device consists of two kinds of server computers; the data acquisition PC/Windows NT and the real-time diagnostics control VME/VxWorks. to cope with diversified kinds of both device control channels and diagnostics data, the object-oriented method are utilized wholly for the development of this system. It not only reduces the development burden, but also widen the software portability and flexibility. 100 Mbps FDDI-based fast networks will re-integrate the distributed server computers so that they can behave as one virtual macro-machine for users. Network methods applied for the LHD data processing system are completely based on the TCP/IP internet technology, and it provides the same accessibility to the remote collaborators as local participants can operate.
Author
Data Acquisition; Data Processing Equipment; Diagnosis; Distributed Processing

19980209850 Lawrence Livermore National Lab., Livermore, CA USA
Fundamental limits on chemical reduction of NOx by non-thermal plasmas
Penetrante, B. M., Lawrence Livermore National Lab., USA; Hsiao, M. C., Lawrence Livermore National Lab., USA; Merritt, B. T., Lawrence Livermore National Lab., USA; Vogtlin, G. E., Lawrence Livermore National Lab., USA; Jul. 03, 1997; 7p; In English; 2nd; Non-Thermal Plasma Technology for Pollution Control, 11-15 Aug. 1997, Salvador, Brazil
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-128069; CONF-970895; DE98-051060; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The objective of this paper is to establish the fundamental limits on the minimum electrical energy consumption that will be required to implement true chemical reduction of NOx by the plasma alone. The effect of background gas composition particularly the oxygen content on the completion between the reduction and oxidation processes will be discussed. The effect of the electron kinetic energy distribution on the radical production and subsequent chemistry will also be discussed.
DOE
Thermal Plasmas; Electron Energy; Reduction (Chemistry); Nitric Oxide

19980209851 Associazione EURATOM-CNEN Sulla Fusione, Frascati, Italy
Frascati Tokamak Upgrade (FTU): Results and developments
Romanelli, Francesco, Associazione EURATOM-CNEN Sulla Fusione, Italy; May 1997; ISSN 0393-6317; 17p; In English
Report No.(s): ENEA-RT-ERG-FUS-97-04; RT/ERG-FUS-97-04; DE98-712134; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

In the present note the relation is examined between the FTU experimental programme and the most important issues in controlled thermonuclear fusion researches. FTU is a high-density, high magnetic field tokamak devoted to the study of plasma heating and current drive, energy and particle confinement and plasma-wall interaction. The most important FTU results and their relevance for ITER will be discussed.
DOE
Tokamak Devices; Controlled Fusion

19980209864 Sandia National Labs., Albuquerque, NM USA
Numerical simulations of annular wire-array z-pinches in (x,y), (r,theta), and (r,z) geometries
Marder, B. M., Sandia National Labs., USA; Sanford, T. W. L., Sandia National Labs., USA; Allshouse, G. O., Sandia National Labs., USA; Dec. 1997; 25p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2725; DE98-002601; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Total Immersion PIC (TIP) code has been used in several two-dimensional geometries to understand better the measured dynamics of annular, aluminum wire-array z-pinches. The areas investigated include the formation of the plasma sheath from current-induced individual wire explosions, the effects of wire number and symmetry on the implosion dynamics, and the dependence of the Rayleigh-Taylor instability growth on initial sheath thickness. A qualitative change in the dynamics with increasing wire

number was observed, corresponding to a transition between a z-pinch composed of non-merging, self-pinching individual wires, and one characterized by the rapid formation and subsequent implosion of a continuous plasma sheath. A sharp increase in radiated power with increasing wire number has been observed experimentally near this calculated transition. Although two-dimensional codes have correctly simulated observed power pulse durations, there are indications that three dimensional effects are important in understanding the actual mechanism by which these pulse lengths are produced.
DOE
Wire; Zeta Pinch; Computerized Simulation

19980209873 Los Alamos National Lab., NM USA
Nonequilibrium dynamics of the quark-gluon plasma in heavy ion collisions
Mottola, E., Los Alamos National Lab., USA; Cooper, F., Los Alamos National Lab., USA; Habib, S., Los Alamos National Lab., USA; Kluger, Y., Los Alamos National Lab., USA; Paz, J. P., Los Alamos National Lab., USA; [1997]; 11p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2772; DE98-000879; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). We have developed field theory and numerical methods for the general problem of quantum back reaction on classical fields, with applications to a wide variety of physical systems. Our main focus was on particle production processes in the time evolution of the quark-gluon plasma following an ultrarelativistic heavy-ion collision. In particular, we studied in some detail the evolution of a disoriented chiral condensate (DCC) produced in the chiral phase transition of nuclear matter in heavy-ion collision experiments. We have also studied dissipation and decoherence as a result of particle production in time-varying mean fields. Numerical codes previously developed for particle production in strong electric fields in quantum electrodynamics (QED) have been modified for the quantum chromodynamics (QCD) problem. We have made specific predictions for energy-momentum flow and pion production in the central rapidity region of experiments to be performed at the Relativistic Heavy-Ion Collider (RHIC).
DOE
Quarks; Ionic Collisions; Quantum Electrodynamics; Quantum Chromodynamics; Particle Production; Nonequilibrium Plasmas

19980209960 Sandia National Labs., Albuquerque, NM USA
Wire number doubling in plasma-shell regime increases z-accelerator x-ray power
Sanford, T. W. L., Sandia National Labs., USA; Spielman, R. B., Sandia National Labs., USA; Chandler, G. A., Sandia National Labs., USA; Nov. 1997; 18p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2688; DE98-001507; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Doubling the number of tungsten wires from 120 to 240, keeping the mass fixed, increased the radiated x-ray power relative to the electrical power at the insulator stack of the z accelerator by (40 +/- 20)% for 8.75- and 20-mm-radii z-pinch wire arrays. Radiation-magneto-hydrodynamic calculations suggest that the arrays were operating in the 'plasma shell' regime, where the plasmas generated by the individual wires merge prior to the inward implosion of the entire array.
DOE
Hydrodynamics; Metallic Plasmas; Tungsten; Zeta Pinch

19980209963 Wisconsin Univ., Madison, WI USA
Evidence and concepts for nonlocal transport
Callen, J. D., Wisconsin Univ., USA; Kissick, M. W., Wisconsin Univ., USA; Aug. 1997; 38p; In English; Eps Conference on Controlled Fusion and Plasma Physics, 9 - 13 Jun. 1997, Berchtesgaden, Germany
Contract(s)/Grant(s): DE-FG02-92ER-54139
Report No.(s): UW-CPTC-97-12; CONF-9706131; DE98-001651; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Up until a few years ago, most transient transport studies observed primarily diffusive plasma transport responses to fast, localized perturbations. Recently, a number of experiments have, in addition, observed nonlocal electron heat responses. Most remarkably, in cold pulse experiments the abrupt edge cooling via radiative processes can induce both a diffusive cooling response moving in from the edge, and simultaneously a rising electron temperature in the central core of tokamak plasmas, an opposite

response even before the diffusive cooling from the edge reaches the center. These and other nonlocal electron heat transport conundrums from recent experiments are reviewed. Also, models and physical processes being advanced to explain these puzzling phenomena are discussed. The importance of resolving this transport enigma is emphasized.
DOE
Electron Transfer; Plasmas (Physics); Diffusivity; Heat Transfer; Electron Energy; Perturbation

19980209978 Oak Ridge National Lab., TN USA
Edge plasma control by a local island divertor in the Compact Helical System
Komori, A., National Inst. for Fusion Science, Japan; Ohyabu, N., National Inst. for Fusion Science, Japan; Masuzaki, S., National Inst. for Fusion Science, Japan; [1997]; 10p; In English; International Atomic Energy Agency (IAEA) Fusion Energy Conference, 7 - 11 Oct. 1997, Montreal, Canada
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95578; IAEA-CN-64/C1-2; CONF-9710100-; DE98-001927; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

A local island divertor (LID) experiment was performed on the Compact Helical System (CHS) to demonstrate the principle of the LID. It was clearly demonstrated that the particle flow is controlled by adding a resonant perturbation field to the CHS magnetic configuration, and is guided to the back of an m/n = 1/1 island which is created by the perturbation field. The particles recycled there were pumped out with a pumping rate in the range from a few percent to about 10%. As a result, the line averaged core density was reduced by a factor of about 2 in comparison with non-LID discharges at the same gas puffing rate. In addition to the demonstration of these fundamental divertor functions, a modest improvement of energy confinement was observed, which could be attributed to the edge plasma control by the LID.
DOE
Perturbation; Plasma Control; Confinement

19980209985 Oak Ridge National Lab., TN USA
J* optimization of small aspect ratio stellarator/tokamak hybrid devices
Spong, D. A., Oak Ridge National Lab., USA; Hirshman, S. P., Oak Ridge National Lab., USA; Whitson, J. C., Oak Ridge National Lab., USA; 1997; 12p; In English, 17-21 Nov. 1997, Pittsburgh, PA, USA; Sponsored by American Physical Society, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95522; CONF-971103; DE98-001938; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A new class of low aspect ratio toroidal hybrid stellarators is found using more general plasma confinement optimization criterion than quasi-symmetrization. The plasma current profile and shape of the outer magnetic flux surface are used as control variables to achieve near constancy of the longitudinal invariant J* on internal flux surfaces (quasi-omnigeneity), in addition to a number of other desirable physics target properties. We find that a range of compact (small aspect ratio A), high beta(ratio of thermal energy to magnetic field energy), low plasma current devices exist which have significantly improved confinement both for thermal as well as energetic (collisionless) particle components. With reasonable increases in magnetic field and geometric size, such devices can also be scaled to confine 3.5 MeV alpha particle orbits.
DOE
Plasma Control; Stellarators; Tokamak Devices; Aspect Ratio; Alpha Particles

19980209989 Oak Ridge National Lab., TN USA
Shear flow effects on resistive ballooning turbulence
Garcia, L., Universidad Carlos 3 de Madrid, Spain; Carreras, B. A., Oak Ridge National Lab., USA; Lynch, V. E., Oak Ridge National Lab., USA; 1997; 4p; In English; 24th; Controlled Fusion and Plasma Physics, 9-13 Jun. 1997, Berchtesgaden, Germany; Sponsored by European Physical Society, Switzerland
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95622; CONF-9706131; DE98-001944; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Resistive ballooning modes could be responsible for the turbulence and induced transport observed at the edge of present tokamaks. Due to the mode structure, the geometry of the calculation is fully toroidal. The increase in computer capabilities allows now high resolution turbulence calculations. This is very important in the case of ballooning modes since the spectrum is very flat. Two main issues are addressed in this paper: (1) The validity of the mixing length approach for toroidal modes. It is especially important to identify the characteristic spatial and temporal scales in this approach, since these scales would be determinant of

the induced transport. (2) The role and characterization of the Reynolds stress in toroidal geometry. Because of the intrinsic poloidal asymmetry of the ballooning modes, flows with m not equal to 0 are generated. The effect of these flows will be analyzed.
DOE
Ballooning Modes; Tokamak Devices; Magnetohydrodynamic Stability; Shear Flow; Turbulence; Mixing Length Flow Theory

19980209990 Wisconsin Univ., Center for Plasma Theory and Computation, Madison, WI USA
The physics of neoclassical magnetohydrodynamic tearing modes
Hegna, C. C., Wisconsin Univ., USA; Dec. 1997; 25p; In English
Contract(s)/Grant(s): DE-FG02-86ER-53218
Report No.(s): UW-CPTC-97-20; DE98-001964; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Neoclassical effects alter the nonlinear evolution properties of magnetic islands in toroidal plasmas. While the perturbed bootstrap current effects tend to dominate the nonlinear evolution and mode saturation properties in tokamak plasmas, a number of additional effects complicate the picture. A novel aspect of the mode evolution properties is the appearance of a nonlinear threshold width, below which island formation is suppressed. The structure and strength of various closure relations for the ion viscosity and heat fluxes impact the size and scaling of the threshold width. The potential impact of this physics on low aspect ratio tokamaks and stellarator configurations is also discussed.
DOE
Magnetohydrodynamics; Toroidal Plasmas; Tokamak Devices; Magnetic Islands; Tearing Modes (Plasmas)

19980210118 General Atomics Co., San Diego, CA USA
Poloidal pressure gradients, divertor detachment and marfes
Schaffer, M. J., General Atomics Co., USA; Nov. 1997; 7p; In English; 6th; Plasma Edge Theory In Fusion Devices, 15-17 Sep. 1997, Oxford, UK
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22703; CONF-9709115; DE98-001787; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Because the radiation power density from a marfe scales approximately as the square of its plasma pressure, and since increased radiation would aid divertor detachment for high power tokamaks, this paper identifies regions that might permit locally increased plasma pressure in steady state. The magnetic and dynamic (flow) constraints of magneto-hydrodynamics (MHD) are examined for self-consistent locally increased pressure equilibria, in both the magnetically open tokamak scrape-off layer (SOL) and the closed surfaces just inside the last closed flux surface. In most tokamak geometries it is difficult to recycle particles at a sufficient rate to sustain high pressure marfes, but they might be possible near a divertor X-point.
DOE
Pressure Gradients; Diverters; Detachment; Plasma Pressure; Steady State

19980210119 General Atomics Co., San Diego, CA USA
Slow liner fusion
Shaffer, M. J., General Atomics Co., USA; Aug. 1997; 4p; In English; International Atomic Energy Agency Technical Committee Meeting on Innovative Approaches to Fusion Energy, 20-23 Oct. 1997, Pleasanton, CA, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22689; CONF-971079; DE98-001786; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

(open quotes) Slow (close quotes) liner fusion (approximately 10 ms compression time) implosions are nondestructive and make repetitive (approximately 1 Hz) pulsed liner fusion reactors possible. This paper summarizes a General Atomics physics-based fusion reactor study that showed slow liner feasibility, even with conservative open-line axial magnetic field confinement and Bohm radial transport.
DOE
Fusion Reactors; Linings; Feasibility

19980210120 General Atomics Co., San Diego, CA USA
Comparisons of physical and chemical sputtering in high density divertor plasmas with the Monte Carlo Impurity (MCI) transport model
Evans, T. E., General Atomics Co., USA; Loh, Y. S., General Atomics Co., USA; West, W. P., General Atomics Co., USA; Finken-

thal, D. F., General Atomics Co., USA; Nov. 1997; 7p; In English; 6th; Plasma Edge Theory In Fusion Devices, 15-17 Sep. 1997, Oxford, UK
Contract(s)/Grant(s): DE-AC03-89ER-51114; W-7405-eng-48
Report No.(s): GA-A22693; CONF-9709115; DE98-001785; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The MCI transport model was used to compare chemical and physical sputtering for a DIII-D divertor plasma near detachment. With physical sputtering alone the integrated carbon influx was 8.4 x 10(sup 19) neutral/s while physical plus chemical sputtering produced an integrated carbon influx of 1.7 x 10(sup 21) neutrals/s. The average carbon concentration in the computational volume increased from 0.012% with only physical sputtering to 0.182% with both chemical and physical sputtering. This increase in the carbon inventory produced more radiated power which is in better agreement with experimental measurements. DOE

Sputtering; Diverters; Plasmas (Physics); Impurities; Monte Carlo Method

19980210121 General Atomics Co., San Diego, CA USA
Helical-D pinch
Schaffer, M. J., General Atomics Co., USA; Aug. 1997; 4p; In English; International Atomic Energy Agency Technical Committee Meeting on Innovative Approaches to Fusion Energy, 20-23 Oct. 1997, Pleasanton, CA, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22690; CONF-971079; DE98-001784; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A stabilized pinch configuration is described, consisting of a D-shaped plasma cross section wrapped tightly around a guiding axis. The (open quotes) helical-D (close quotes) geometry produces a very large axial (toroidal) transform of magnetic line direction that reverses the pitch of the magnetic lines without the need of azimuthal (poloidal) plasma current. Thus, there is no need of a (open quotes) dynamo (close quotes) process and its associated fluctuations. The resulting configuration has the high magnetic shear and pitch reversal of the reversed field pinch (RFP). (Pitch = P = qR, where R = major radius). A helical-D pinch might demonstrate good confinement at q much less than 1.
DOE

Plasmas (Physics); Plasma Currents

19980210130 General Atomics Co., San Diego, CA USA
Thermal analysis and testing for DIII-D ohmic heating coil repair
Baxi, C. B., General Atomics Co., USA; Anderson, P. M., General Atomics Co., USA; Gootgeld, A. M., General Atomics Co., USA; Nov. 1997; 5p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22677; CONF-971065; DE98-001865; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The DIII-D ohmic heating (OH) coil solenoid consists of two parallel windings of 48 turns each cooled by water. Each winding is made up of four parallel conductors. Desired thermal capacity of the coil is 20 MJ at a repetition rate of 10 min. One of the conductors started leaking water in July 1995. Since then, the coil has been operated at a reduced thermal load using one winding. An experiment followed by an analysis was undertaken to determine if the OH-coil could be operated at full capacity without cooling the leaking segment by relying on conduction heat transfer to the neighboring cooled conductors. The analysis took into consideration the transient energy equations, including the effect of conduction between neighboring conductors. The axial conduction was modeled in the conductor, but was ignored in the coolant. An experiment was performed on the undamaged coil winding to determine the thermal conductance between neighboring conductors. The experiment consisted of passing hot water through adjacent cooling channels of two conductors and cold water through the cooling channels of the remaining two conductors of the same winding. The flow rate, inlet and outlet temperatures from each circuit were measured during the transient. From the experimental data and analysis an average thermal conductance between the conductors was determined to be about 0.1 W/cm(exp 2)-C. Using the experimentally determined value of the thermal conductance, an analysis was performed on a coil winding consisting of one uncooled conductor and three cooled conductors. Results show that it is possible to operate the full OH-coil without cooling the damaged conductor to the desired thermal load of 20 MJ per pulse.
DOE

Thermal Analysis; Thermal Conductivity; Heating; Conductive Heat Transfer; Electric Conductors; Performance Tests

19980210131 General Atomics Co., San Diego, CA USA

Central Thomson scattering upgrade on DIII-D

Nilson, D. G., Lawrence Livermore National Lab., USA; Stallard, B. W., Lawrence Livermore National Lab., USA; Carlstrom, T. N., General Atomics Co., USA; Hsieh, C. L., General Atomics Co., USA; Stockdale, R. E., General Atomics Co., USA; Nov. 1997; 5p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114

Report No.(s): GA-A22722; CONF-971065; DE98-001864; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The existing 36 channel Thomson scattering system on the DIII-D tokamak measures the plasma temperature and density in the core region. However, with the recent interest in core peaked density profiles, coverage needs to be extended into the magnetic axis. This paper addresses the technical issues involved with extending the viewing region from a major radius of 194 cm to 165 cm. At least one of the existing seven core laser beams will be rerouted to probe the plasma horizontally instead of vertically. to do this, a rigid extension of the existing laser/collection optics tower will be built to route the laser to a nearby tangential port. A fiber bundle array from one of the two existing core plasma collection optics sets will be rotated to allow up to 10 of the 36 core channels to view along this new beam path. A new in-vessel absorbing glass laser dump must be developed since there are no appropriate laser beam exit ports. The close proximity of this laser dump to the viewing region presents stray light issues that must be resolved to allow for an accurate density calibration using Rayleigh scattering in argon gas.

DOE

Thomson Scattering; Tokamak Devices; Plasma Temperature; Plasmas (Physics); Radii; Temperature Measurement; Plasma Diagnostics; Plasma Density

19980210132 General Atomics Co., San Diego, CA USA

Fabrication and installation of the DIII-D radiative divertor structures

Hollerbach, M. A., General Atomics Co., USA; Smith, J. P., General Atomics Co., USA; Nov. 1997; 4p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114

Report No.(s): GA-A22724; CONF-971065; DE98-001863; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Phase 1A of the Radiative Divertor Program (RDP) is now installed in the DIII-D tokamak located at General Atomics. This hardware was added to enhance both the Divertor and Advanced Tokamak research elements of the DIII-D program. This installation consists of a divertor baffle enveloping a cryocondensation pump at the upper outer divertor target of DIII-D. The divertor baffle consists of two toroidally continuous Inconel 625 water-cooled rings and a toroidal array of discontinuous radiatively-cooled plates. The water-cooled rings are each comprised of four quadrants, mechanically formed, chem.-milled, and resistance and TIG welded Inconel 625 panels. The supports attaching the panels to the vessel wall are designed to accommodate the differential thermal expansion between the rings and vessel during bake and to react the electromagnetic loads induced during disruptions. They are made from either Inconel 625 or Inconel 718 depending on the stress levels predicted in Finite Element Analysis. Gas seals are designed to limit the leakage from the baffle chamber back to the core plasma to 2,500 (ell)/s and incorporate plasma sprayed alumina to minimize currents flowing through them. The bulk of the water-cooled ring fabrication was performed by a vendor, however, the final machining of penetrations in the conical ring for diagnostic access was performed in-house using a unique machining configuration. This configuration, and the machining of the diagnostic cutouts is described. Graphite tiles were machined from ATJ graphite to form a smooth plasma-facing surface. The installation of all divertor components required only four weeks.

DOE

Fabrication; Installing; Diverters

19980210133 General Atomics Co., San Diego, CA USA

DIII-D ICRF high voltage power supply regulator upgrade

Cary, W. P., General Atomics Co., USA; Burley, B. L., General Atomics Co., USA; Grosnickle, W. H., General Atomics Co., USA; Nov. 1997; 3p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114

Report No.(s): GA-A22712; CONF-971065; DE98-001862; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

For reliable operation and component protection, of the 2 MW 30--120 MHz ICRF Amplifier System on DIII-D, it is desirable for the amplifier to respond to high VSWR conditions as rapidly as possible. This requires a rapid change in power which also means a rapid change in the high voltage power supply current demands. An analysis of the power supply's regulator dynamics was needed to verify its expected operation during such conditions. Based on this information it was found that a new regulator with a larger dynamic range and some anticipation capability would be required. This paper will discuss the system requirements, the as-delivered regulator performance, and the improved performance after installation of the new regulator system. It will also be shown how this improvement has made the amplifier perform at higher power levels more reliably.
DOE
High Voltages; Voltage Regulators; Amplifiers

19980210135 General Atomics Co., San Diego, CA USA
Control of plasma poloidal shape and position in the DIII-D tokamak
Walker, M. L., General Atomics Co., USA; Humphreys, D. A., General Atomics Co., USA; Ferron, J. R., General Atomics Co., USA; Nov. 1997; 7p; In English; 36th; Decision and Control, 10-12 Dec. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22684; CONF-971216; DE98-001836; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Historically, tokamak control design has been a combination of theory driving an initial control design and empirical tuning of controllers to achieve satisfactory performance. This approach was in line with the focus of past experiments on simply obtaining sufficient control to study many of the basic physics issues of plasma behavior. However, in recent years existing experimental devices have required increasingly accurate control. New tokamaks such as ITER or the eventual fusion power plant must achieve and confine burning fusion plasmas, placing unprecedented demands on regulation of plasma shape and position, heat flux, and burn characteristics. Control designs for such tokamaks must also function well during initial device operation with minimal empirical optimization required. All of these design requirements imply a heavy reliance on plasma modeling and simulation. Thus, plasma control design has begun to use increasingly modern and sophisticated control design methods. This paper describes some of the history of plasma control for the DIII-D tokamak as well as the recent effort to implement modern controllers. This effort improves the control so that one may obtain better physics experiments and simultaneously develop the technology for designing controllers for next-generation tokamaks.
DOE
Plasmas (Physics); Plasma Control; Shapes; Tokamak Devices; Position (Location)

19980210136 General Atomics Co., San Diego, CA USA
Comparison of calculated neutral beam shine through with measured shine-through in DIII-D
Chiu, H. K., General Atomics Co., USA; Hong, R., General Atomics Co., USA; Nov. 1997; 4p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22735; CONF-971065; DE98-001835; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A comparison of the calculated shine through of neutral particle beams in the DIII-D plasma to measured values inferred from the target temperature rise is reported. This provides an opportunity to verify the shine through calculations and makes them more reliable in those cases where the shine through can not be measured. The DIII-D centermost neutral beam target tiles are safeguarded against excessive beam shine-through by pyrometry and thermocouple (TC) arrays on the tiles. Shine-through beam power is calculated from the measured temperature changes reported by the target tile TC array. These measurements are performed at the beginning of each operational year at DIII-D. Theoretically, the beam energy deposited into the plasma can be expressed as a function of the change in beam density. Neutral beam energy deposition in plasma (of known density) is inferred by comparing the results of a series of shine-through measurements for the 1997 campaign at DIII-D to the expected shine-through given by theory.
DOE
Neutral Beams; Neutral Particles; Plasmas (Physics); Targets; Neutral Atoms; Beam Injection; Computation

19980210138 General Atomics Co., San Diego, CA USA
Ballooning mode stability for self-consistent pressure and current profiles at the H-mode edge
Miller, R. L., General Atomics Co., USA; Lin-Liu, Y. R., General Atomics Co., USA; Osborne, T. H., General Atomics Co., USA;

Taylor, T. S., General Atomics Co., USA; Nov. 1997; 5p; In English; US/Japan Workshop on H-mode Physics and 6th H-mode Workshop, 22-24 Sep. 1997, Kloster Seeon, Germany
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22711; CONF-9709100; DE98-001788; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The edge pressure gradient (H-mode pedestal) for computed equilibria in which the current density profile is consistent with the bootstrap current may not be limited by the first regime ballooning limit. The transition to second stability is easier for: higher elongation, intermediate triangularity, larger ratio, pedestal at larger radius, narrower pedestal width, higher q(sub 95), and lower collisionality.

DOE

Ballooning Modes; Stability; Pressure Gradients; Current Density

19980210164 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK

Laser Plasma X-ray Contact Microscopy of Living Specimens Using a Chemically Amplified Epoxy Resist: TMR Large-Scale Facilities Access Programme

Cefalas, A. C., National Hellenic Research Foundation, Greece; Argitis, P., National Hellenic Research Foundation, Greece; Kollia, Z., National Hellenic Research Foundation, Greece; Sarantopoulou, E., National Hellenic Research Foundation, Greece; Ford, T. W., National Hellenic Research Foundation, Greece; Jan. 1998; ISSN 1358-6254; 22p; In English
Contract(s)/Grant(s): ERBFMGECT-950053
Report No.(s): PB98-145287; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report on the use of an epoxy novolac chemically amplified photoresist to produce X-ray images of living biological specimens in the water window using laser plasma generated soft X-ray (2.4 - 4.4nm). The photoresist response was a least one order of magnitude 'faster' than the standard PMMA (polymethyl methacrylate) previously used in soft X-ray contact microscopy (SXCM). After chemical development of the exposed resists, atomic force microscopy (AFM) of the relief images obtained of biological specimens clearly showed the flagella of the motile green alga, Chlamydomonas, suggesting a lateral resolution better than 300 nm, whilst the AFT was capable of discriminating height features of 20 nm in depth profiles.

NTIS

Atomic Force Microscopy; Phenol Formaldehyde; Polymethyl Methacrylate; Thermoplastic Resins; X Rays

19980210173 Los Alamos National Lab., NM USA

Design of the cooling systems for the multiplicity and vertex detector

Bernardin, J. D., Los Alamos National Lab., USA; Cunningham, R., Los Alamos National Lab., USA; Nov. 1997; 75p; In English
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-13391; DE98-001884; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The PHENIX experiment at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory is being constructed to investigate a phase of matter termed the quark-gluon plasma. The plasma will be produced through the collision of two heavy ions. The multiplicity and vertex detector (MVD) located in the center of PHENIX will characterize the events, determine the collision point, and act as a central trigger. This report presents the final mechanical designs of the cooling systems for the Multiplicity and Vertex Detector (MVD). In particular, the design procedure and layouts are discussed for two different air cooling systems for the multichip modules and MVD enclosure, and a liquid cooling system for the low dropout voltage regulators. First of all, experimental prototype cooling system test results used to drive the final mechanical designs are summarized and discussed. Next, the cooling system requirements and design calculation for the various subsystem components are presented along with detailed lists of supply vendors, components, and costs. Finally, safety measures incorporated in the final mechanical design and operation procedures for each of the subsystems are detailed.

DOE

Cooling Systems; Heavy Ions; Plasmas (Physics); Mechanical Engineering; Layouts; Air Cooling; Liquid Cooling; Design

19980210176 General Atomics Co., San Diego, CA USA

Restoration of the DIII-D solenoid

Anderson, P. M., General Atomics Co., USA; Robinson, J. I., General Atomics Co., USA; Gonzales, E., General Atomics Co., USA; Rolens, G. W., General Atomics Co., USA; Nov. 1997; 5p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114

Report No.(s): GA-A22686; CONF-971065; DE98-001945; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The DIII-D tokamak has been operated since June 1995 with constrained ohmic heating capability as imposed by the abandonment of half of it's solenoid system due to a cooling water leak. The solenoid is comprised of A and B windings with separate multiple power leads to each. The cooling water leak occurred in the lead of the B winding. This leak occurred in a remote area under the DIII-D vessel and is believed to be caused by magnetic forces developing cyclic bending loads on the conductor. Visual inspection of the lead using flexible bore scopes indicated that the structural fiberglass overwrap intended to band the supply and return leads into a primary-force canceling group had failed allowing individual conductors to become inadequately supported against bending loads. The overwrap failed as a result of poor epoxy encapsulation of the lead which was manufactured in 1978. Inspection of the A lead confirmed no overwrap failure and that the vacuum encapsulation of the A lead was proper and to specification. In order to continue operations, it was decided to abandon the B winding of the solenoid and operate under reduced (5 V-sec) capability. An in-situ repair approach was mandated by the extensive and lengthy effort required to disassemble, repair, and reassemble the tokamak. Access from outside the tokamak was severely limited. A plan to repair the damaged lead was developed and implemented over a 10 month period. This paper describes the repair of the solenoid lead. A VCR video tape of these remote installation efforts has been assembled and will be shown.

DOE

Restoration; Solenoids; Tokamak Devices; Leakage; Installing; Cooling; Heating; Ohmic Dissipation

19980210177 General Atomics Co., San Diego, CA USA

Development of improved methods for remote access of DIII-D data and data analysis

Greene, K. L., General Atomics Co., USA; McHarg, B. B., Jr., General Atomics Co., USA; Nov. 1997; 5p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114

Report No.(s): GA-A22730; CONF-971065; DE98-001946; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The DIII-D tokamak is a national fusion research facility. There is an increasing need to access data from remote sites in order to facilitate data analysis by collaborative researchers at remote locations, both nationally and internationally. In the past, this has usually been done by remotely logging into computers at the DIII-D site. With the advent of faster networking and powerful computers at remote sites, it is becoming possible to access and analyze data from anywhere in the world as if the remote user were actually at the DIII-D site. The general mechanism for accessing DIII-D data has always been via the PTDATA subroutine. Substantial enhancements are being made to that routine to make it more useful in a non-local environment. In particular, a caching mechanism is being built into PTDATA to make network data access more efficient. Studies are also being made of using Distributed File System (DFS) disk storage in a Distributed Computing Environment (DCE). A data server has been created that will migrate, on request, shot data from the DIII-D environment into the DFS environment.

DOE

Tokamak Devices; Data Acquisition; Data Processing; Data Transmission

19980210178 General Atomics Co., San Diego, CA USA

Analysis and testing of the DIII-D ohmic heating coil lead repair clamp

Reis, E. E., General Atomics Co., USA; Anderson, P. M., General Atomics Co., USA; Chin, E., General Atomics Co., USA; Robinson, J. I., General Atomics Co., USA; Nov. 1997; 5p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114

Report No.(s): GA-A22706; CONF-971065; DE98-001947; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

DIII-D has been operating for the last year with limited volt-second capabilities due to structural failure of a conductor lead to one of the ohmic heating (OH) solenoids. The conductor failure was due to poor epoxy impregnation of the overwrap of the lead pack, resulting in copper fatigue and a water leak. A number of structural analyses were performed to assist in determining the failure scenario and to evaluate various repair options. A fatigue stress analysis of the leads with a failed epoxy overwrap indicated crack initiation after 1,000 cycles at the maximum operating conditions. The failure occurred in a very inaccessible area which restricted design repair options to concepts which could be implemented remotely. Several design options were considered for repairing the lead so that it can sustain the loads for 7.5 Vs conditions at full toroidal field. A clamp, along with preloaded banding straps and shim bags, provides a system that guarantees that the stress at the crack location is always compressive and prevents further crack growth in the conductor. Due to the limited space available for the repair, it was necessary to design the

clamp system to operate at the material yield stress. The primary components of the clamp system were verified by load tests prior to installation. The main body of the clamp contains a load cell and potentiometer for monitoring the load-deflection characteristics of the clamp and conductors during plasma operation. Strain gages provides redundant instrumentation. If required, the preload on the conductors can be increased remotely by a special wrench attached to the clamp assembly.
DOE
Clamps; Load Tests; Structural Analysis; Coils; Structural Failure; Stress Analysis; Design Analysis; Ohmic Dissipation

19980210179 General Atomics Co., San Diego, CA USA
Overview of the DIII-D program computer systems
McHarg, B. B., Jr., General Atomics Co., USA; Nov. 1997; 5p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22717; CONF-971065; DE98-001948; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Computer systems pervade every aspect of the DIII-D National Fusion Research program. This includes real-time systems acquiring experimental data from data acquisition hardware; cpu server systems performing short term and long term data analysis; desktop activities such as word processing, spreadsheets, and scientific paper publication; and systems providing mechanisms for remote collaboration. The DIII-D network ties all of these systems together and connects to the ESNET wide area network. This paper will give an overview of these systems, including their purposes and functionality and how they connect to other systems. Computer systems include seven different types of UNIX systems (HP-UX, REALIX, SunOS, Solaris, Digital UNIX, Ultrix, and IRIX), Open VMS systems (both BAX and Alpha), MACintosh, Windows 95, and more recently Windows NT systems. Most of the network internally is ethernet with some use of FDDI. A T3 link connects to ESNET and thus to the Internet. Recent upgrades to the network have notably improved its efficiency, but the demand for bandwidth is ever increasing. by means of software and mechanisms still in development, computer systems at remote sites are playing an increasing role both in accessing and analyzing data and even participating in certain controlling aspects for the experiment. The advent of audio/video over the interest is now presenting a new means for remote sites to participate in the DIII-D program.
DOE
Computers; Real Time Operation; Data Acquisition; Word Processing; Wide Area Networks; Computer Graphics; Data Processing; Numerical Control; UNIX (Operating System)

19980210180 General Atomics Co., San Diego, CA USA
Software development on the DIII-D control and data acquisition computers
Penaflor, B. G., General Atomics Co., USA; McHarg, B. B., Jr., General Atomics Co., USA; Piglowski, D., General Atomics Co., USA; Nov. 1997; 5p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22713; CONF-971065; DE98-001949; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The various software systems developed for the DIII-D tokamak have played a highly visible and important role in tokamak operations and fusion research. Because of the heavy reliance on in-house developed software encompassing all aspects of operating the tokamak, much attention has been given to the careful design, development and maintenance of these software systems. Software systems responsible for tokamak control and monitoring, neutral beam injection, and data acquisition demand the highest level of reliability during plasma operations. These systems made up of hundreds of programs totaling thousands of lines of code have presented a wide variety of software design and development issues ranging from low level hardware communications, database management, and distributed process control, to man machine interfaces. The focus of this paper will be to describe how software is developed and managed for the DIII-D control and data acquisition computers. It will include an overview and status of software systems implemented for tokamak control, neutral beam control, and data acquisition. The issues and challenges faced developing and managing the large amounts of software in support of the dynamic and everchanging needs of the DIII-D experimental program will be addressed.
DOE
Software Engineering; Tokamak Devices; Data Acquisition; Computers; Computer Programming; Data Base Management Systems; Distributed Parameter Systems; Neutral Beams; Computer Programs; Numerical Control

19980210246 Argonne National Lab., IL USA

Dynamic behavior of plasma-facing materials during plasma instabilities in tokamak reactors

Hassanein, A., Argonne National Lab., USA; Konkashbaev, I., Troitsk Inst. for Innovation, Russia; [1997]; 37p; In English; 6thy; Engineering Problems of Thermonuclear Reactors, 25-29 May 1997, St. Petersburg, Russian Federation

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/TD/CP-94009; CONF-9705211; DE97-053930; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Damage to plasma-facing and nearby components due to plasma instabilities remains a major obstacle to a successful tokamak concept. The high energy deposited on facing materials during plasma instabilities can cause severe erosion, plasma contamination, and structural failure of these components. Erosion damage can take various forms such as surface vaporization, spallation, and liquid ejection of metallic materials. Comprehensive thermodynamic and radiation hydrodynamic codes have been developed, integrated, and used to evaluate the extent of various damage to plasma-facing and nearby components. The eroded and splashed materials will be transported and then redeposited elsewhere on other plasma-facing components. Detailed physics of plasma/solid-liquid/vapor interaction in a strong magnetic field have been developed, optimized, and implemented in a self-consistent model. The plasma energy deposited in the evolving divertor debris is quickly and intensely reradiated, which may cause severe erosion and melting of other nearby components. Factors that influence and reduce vapor-shielding efficiency such as vapor diffusion and turbulence are also discussed and evaluated.

DOE

Magnetohydrodynamic Stability; Tokamak Devices; Dynamic Characteristics; Reactor Materials; Damage; Structural Failure

19980210248 Los Alamos National Lab., NM USA

Design considerations for neutron activation and neutron source strength monitors for ITER

Barnes, C. W., Los Alamos National Lab., USA; Jassby, D. L., Princeton Univ., USA; LeMunyan, G., Princeton Univ., USA; Roquemore, A. L., Princeton Univ., USA; Walker, C., International Thermonuclear Experimental Reactor Joint Central Team, Germany; [1997]; 13p; In English; Diagnostics for Experimental Fusion Reactors, 4 - 12 Sep. 1997, Varenna, Italy

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3587; CONF-9709163; DE98-001459; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The International Thermonuclear Experimental Reactor will require highly accurate measurements of fusion power production in time, space, and energy. Spectrometers in the neutron camera could do it all, but experience has taught us that multiple methods with redundancy and complementary uncertainties are needed. Previously, conceptual designs have been presented for time-integrated neutron activation and time-dependent neutron source strength monitors, both of which will be important parts of the integrated suite of neutron diagnostics for this purpose. The primary goals of the neutron activation system are: to maintain a robust relative measure of fusion energy production with stability and wide dynamic range; to enable an accurate absolute calibration of fusion power using neutronic techniques as successfully demonstrated on JET and TFTR; and to provide a flexible system for materials testing. The greatest difficulty is that the irradiation locations need to be close to plasma with a wide field of view. The routing of the pneumatic system is difficult because of minimum radius of curvature requirements and because of the careful need for containment of the tritium and activated air. The neutron source strength system needs to provide real-time source strength vs. time with (approximately)1 ms resolution and wide dynamic range in a robust and reliable manner with the capability to be absolutely calibrated by in-situ neutron sources as done on TFTR, JT-60U, and JET. In this paper a more detailed look at the expected neutron flux field around ITER is folded into a more complete design of the fission chamber system.

DOE

Design Analysis; Neutron Activation Analysis; Neutron Sources; Tokamak Devices; Dynamic Range; Measuring Instruments

19980210255 General Atomics Co., San Diego, CA USA

Multivariable shape control development on the DIII-D tokamak

Walker, M. L., General Atomics Co., USA; Humphreys, D. A., General Atomics Co., USA; Ferron, J. R., General Atomics Co., USA; Nov. 1997; 5p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): DE-AC03-89ER-51114

Report No.(s): GA-A22729; CONF-971065; DE98-001833; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In this paper, the authors describe recent work on plasma shape and position control at DIII-D. This control consists of two equally challenging problems--the problem of identifying what the plasma actually looks like in real time, i.e. measuring the

parameters to be controlled, and the task of determining the feedback algorithm which best controls these plasma parameters in a multiple input-output system. Recent implementation of the EFIT plasma equilibrium reconstruction algorithm in real time code which produces a new equilibrium estimate every 1.5 ms seems to solve the longstanding problem of obtaining sufficiently accurate plasma shape and position estimation. Stabilization of the open-loop unstable vertical motion is also viewed as a solved problem. The primary remaining problem appears to be how best to command the power supplies to achieve a desired shaping control response. They will describe the effort to understand and apply linearized models of plasma evolution to development and implementation of multivariable plasma controllers.
DOE
Shapes; Tokamak Devices; Shape Control; Plasma Control; Plasma Equilibrium; Plasmas (Physics); Multivariable Control; Positioning

19980210256 General Atomics Co., San Diego, CA USA
Recent improvements to the DIII-D neutral beam instrumentation and control system
Kellman, D. H., General Atomics Co., USA; Hong, R., General Atomics Co., USA; Nov. 1997; 5p; In English; 17th; Fusion Engineering, 6-10 Oct. 1997, San Diego, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114
Report No.(s): GA-A22718; CONF-971065; DE98-001834; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The DIII-D neutral beam (NB) instrumentation and control (I and C) system provides for operational control and synchronization of the eight DIII-D neutral beam injection systems, as well as for pertinent data acquisition and safety interlocking. Recently, improvements were made to the I and C system. With the replacement of the NB control computers, new signal interfacing was required to accommodate the elimination of physical operator panels, in favor of graphical user interface control pages on computer terminal screens. The program in the mode control (MC) programmable logic controller (PLC), which serves as a logic-processing interface between the NB control computers and system hardware, was modified to improve the availability of NB heating of DIII-D plasmas in the event that one or more individual beam systems suddenly become unavailable while preparing for a tokamak experimental shot sequences. An upgraded computer platform was adopted for the NB control system operator interface and new graphical user interface pages were developed to more efficiently display system status data. A failure mode of the armor tile infrared thermometers (pyrometers), which serve to terminate beam pulsing if beam shine-through overheats wall thermal shielding inside the DIII-D tokamak, was characterized such that impending failures can be detected and repairs effected to mitigate beam system down-time. The hardware that controls gas flow to the beamline neutralizer cells was upgraded to reduce susceptibility to electromagnetic interference (EMI), and interlocking was provided to terminate beam pulsing in the event of insufficient neutralizer gas flow. Motivation, implementation, and results of these improvements are presented.
DOE
Tokamak Devices; Neutral Beams; Beam Injection; Control Systems Design; Plasmas (Physics)

19980210283 Sandia National Labs., Albuquerque, NM USA
Use of Z-pinch sources for high-pressure shock wave studies
Konrad, C. H., Sandia National Labs., USA; Asay, J. R., Sandia National Labs., USA; Hall, C. A., Sandia National Labs., USA; Jan. 1998; 14p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-98-0047; DE98-002761; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In this paper, we will discuss the use of z-pinch sources for shock wave studies at multi-Mbar pressures. Experimental plans to use the technique for absolute shock Hugoniot measurements are discussed. Recent developments have demonstrated the use of pulsed power techniques for producing intense radiation sources (Z pinches) for driving planar shock waves in samples with spatial dimensions significantly larger than possible with other radiation sources. Initial indications are that using Z pinch sources for producing Planckian radiation sources in secondary hohlraums can be used to drive shock waves in samples with diameters to a few millimeters and thickness approaching one millimeter in thickness. These dimensions provides the opportunity to measure both shock velocity and the particle velocity behind the shock front with accuracy comparable to that obtained with gun launchers. In addition, the peak hohlraum temperatures of nearly 150 eV that are now possible with Z pinch sources result in shock wave pressures approaching 45 Mbar in high impedance materials such as tungsten and 10-15 Mbar in low impedance materials such

as aluminum and plastics. In this paper, we discuss the use of Z pinch sources for making accurate absolute EOS measurements in the megabar pressure range.
DOE
Shock Waves; High Pressure; Millimeter Waves; Radiation Sources; Shock Fronts; Zeta Pinch

19980210360 General Atomics Co., San Diego, CA USA
Experimental constraints on transport from dimensionless parameter scaling studies
Petty, C. C., General Atomics Co., USA; Luce, T. C., General Atomics Co., USA; Baker, D. R., General Atomics Co., USA; Feb. 1998; 27p; In English; Plasma Physics, 17-21 Nov. 1997, Pittsburgh, PA, USA; Sponsored by American Physical Society, USA
Contract(s)/Grant(s): DE-AC03-89ER-51114; W-7405-Eng-48; DE-AC05-96OR-11464
Report No.(s): GA-A22788; CONF-971103; DE98-003184; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The scalings of heat transport with safety factor (q), normalized collisionality (v), plasma beta ((beta)), and relative gyroradius ((rho)*) have been measured on the DIII-D tokamak. The measured (rho)* (beta) and v scalings of heat transport indicate that E x B transport from drive wave turbulence is a plausible basis for anomalous transport. For high confinement (H) mode plasmas where the safety factor was varied at fixed magnetic shear, the effective (or one-fluid) thermal diffusivity was found to scale like (chi)(sub eff) (proportional to) q(sup 2.3(+-)0.64), with the ion and electron fluids having the same q scaling to within the experimental errors except near the plasma edge. The scaling of the thermal confinement time with safety factor was in good agreement with this local transport dependence, (tau)(sub th) (proportional to) q(sup (minus)2.42(+-)0.31); however, when the magnetic shear was allowed to vary to keep q(sub 0) fixed during the (edge) safety factor scan, a weaker global dependence was observed, (tau)(sub th) (proportional to) q(sub 95)(sup (minus)1.43(+-)0.23). This weaker dependence was mainly due to the change in the local value of q between the two types of scans. The combined (rho)*, (beta), v and q scalings of heat transport for H-mode plasmas on DIII-D reproduce the empirical confinement scaling using physical (dimensionless) parameters with the exception of weaker power degradation.
DOE
Turbulence; Tokamak Devices; Thermal Diffusivity; Heat Transfer; Confinement; Plasma Drift; Scaling Laws

19980210385 National Inst. for Fusion Science, Toki, Japan
National Institute for Fusion Science *Annual Report, Apr. 1996 - Mar. 1997*
Kida, S., Editor, National Inst. for Fusion Science, Japan; Namba, C, Editor, National Inst. for Fusion Science, Japan; Tsumori, K., Editor, National Inst. for Fusion Science, Japan; Sep. 1997; ISSN 0917-1185; 404p; In English; Original contains color illustration; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche; US Sales Only; US Sales Only

The report is a summary of the research activities at the National Institute for Fusion Science (NIFS) during April 1996 - March 1997. The major research projects of NIFS are (1) the experimental research in the Large Helical Device (LHD) to study the physics and technologies for the confinement and steady state sustainment of a high temperature fusion relevant plasma, and (2) the theoretical and advanced computer simulation studies on nonlinear and complicated behaviors of high temperature plasmas. These are carried out in collaboration with universities and institutions of domestic as well as international bases. The LHD program is in the final phase of construction (1990 - 1997) of the main device, heating devices and diagnostics. The on-site construction of the device has begun in 1994 at the main experimental hall at Toki. The winding of helical coils, which has started in 1994, finished in June of 1996 with a high mechanical accuracy. Heating devices such as 15 MW NBI using negative ion source, 10 MW ECH system, 3 MW ICRF system, and various diagnostics are being developed and constructed in parallel with the device construction. The other utilities (power supplies, refrigerator, cooling systems etc.) are now in ready. The construction of LHD will be completed in the end of 1997 and the initial operation is planned to begin in April, 1998. The first phase of the experiment will focus on the confinement studies of high temperature plasmas in the range of the average temperature of 2-3 keV, and the average density of JOIOM-3 , and the steady state operation of plasmas will be also demonstrated. The confinement of higher temperature plasmas will be demonstrated in the later upgrading phase, with the increase in the magnetic field strength from 3T to 4T, the installation of a completely closed helical diverter and higher power heating devices. Physics considerations on the NMD, transport, heating, radial electric field, and bootstrap current have been intensively studied for the LHD plasma and the related toroidal plasmas. The importance of the flexibility of LHD to explore confinement physics has been emphasized. Experimental research has been carried out by the use of the CHS. The LID (Local Island Divertor) has been developed successfully and the plasma potential was measured in detail by HIBP in CHS. Theoretical studies are also carried out on physics of high tem-

perature plasmas. Various related processes, for example, the magnetic reconnection mechanism, dynamo processes, double layer along the field line and others, are studied by the use of large scale computer simulation code.
Derived from text
High Temperature Plasmas; Fusion (Melting); Data Acquisition; Computerized Simulation; Nonlinearity; Plasma Control

19980210416 Los Alamos National Lab., NM USA
Calibration issues for neutron diagnostics
Sadler, G. J., Joint European Torus Project, UK; Adams, J. M., AEA Technology, UK; Barnes, C. W., Los Alamos National Lab., USA; [1997]; 9p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3982; DE98-001549; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The performance of diagnostic systems are limited by their weakest constituents, including their calibration issues. Neutron diagnostics are notorious for problems encountered while determining their absolute calibrations, due mainly to the nature of the neutron transport problem. In order to facilitate the determination of an accurate and precise calibration, the diagnostic design should be such as to minimize the scattered neutron flux. ITER will use a comprehensive set of neutron diagnostics--comprising radial and vertical neutron cameras, neutron spectrometers, a neutron activation system and internal and external fission chambers--to provide accurate measurements of fusion power and power densities as a function of time. The calibration of such an important diagnostic system merits careful consideration. Some thoughts have already been given to this subject during the conceptual design phase in relation to the time-integrated neutron activation and time-dependent neutron yield monitors. However, no overall calibration strategy has been worked out so far. This paper represents a first attempt to address this vital issue. Experience gained from present large tokamaks (JET, TFTR and JT60U) and proposals for ITER are reviewed. The need to use a 14-MeV neutron generator as opposed to radioactive sources for in-situ calibration of D-T diagnostics will be stressed. It is clear that the overall absolute determination of fusion power will have to rely on a combination of nuclear measuring techniques, for which the provision of accurate and independent calibrations will constitute an ongoing process as ITER moves from one phase of operation to the next.
DOE
Plasma Diagnostics; Calibrating; Tokamak Devices; Fusion Reactors; Neutron Activation Analysis; Neutrons

19980210437 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A study on the fusion reactor: Study on the physics of tokamak Alfven wave heating
Ryu, Chang Mo, Pohang Univ. of Science and Technology, Korea, Republic of; Bai, You Jung, Pohang Univ. of Science and Technology, Korea, Republic of; Choi, Tae Sung, Pohang Univ. of Science and Technology, Korea, Republic of; Sep. 1996; 62p; In Korean
Report No.(s): KAERI-CM-055/95; DE98-724928; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

As a part of study on the fusion reactor, the Alfven wave heating and the related physics has been studied. Since Alfven waves are one of the basic phenomena of plasmas, and these waves can be excited by alpha particles even during the fusion reaction, their basic characteristics during the heating need to be understood clearly. Based on the cylindrical model, we studied the various properties of Alfven waves such as body waves and Alfven resonance, and by using a computer code the properties of Alfven waves launched by various antenas have been studied for KT-2 tokamak parameters.
DOE
Fusion Reactors; Tokamak Devices; Electromagnetic Radiation

19980210438 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A study on the Fusion Reactor: Development of charge exchange recombination spectroscopy for tokamak diagnostics
Lee, Tong Nyong, Pohang Univ. of Science and Technology, Korea, Republic of; Kim, Dong Eon, Pohang Univ. of Science and Technology, Korea, Republic of; Kim, Dae Sung, Pohang Univ. of Science and Technology, Korea, Republic of; Kim, Seong Ho, Pohang Univ. of Science and Technology, Korea, Republic of; Sep. 1996; 52p; In Korean
Report No.(s): KAERI-CM-056/95; DE98-724929; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

This project has been carried to train people and accumulate the knowledge and techniques related to the measurement of the profiles of ion temperature, toroidal rotation velocity, and fully-stripped ion density in a fusion tokamak plasma by the development of plasma diagnostics using charge exchange recombination (CER) spectroscopy. During the 1 st year, the basic study and

review on the charge exchange process and the conceptual design and review of the diagnostics have been conducted. In addition, the various atomic data centers around the world have been surveyed and atomic data related to CER have been constructed. The results of this project can be used to the construction and tokamak machine installation of a CER plasma diagnostic to a new super-conducting supported by National Fusion Program.
DOE
Fusion Reactors; Product Development; Tokamak Devices; Plasma Diagnostics; Ion Temperature; Charge Exchange

19980210446 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of
A study on the fusion reactor: A study on stability of ballooning and kink modes in tokamaks
Kwon, Oh Jin, Kyungpook National Univ., Korea, Republic of; Seo, Yong Won, Kyungpook National Univ., Korea, Republic of; Park, Myung Hwan, Kyungpook National Univ., Korea, Republic of; Sep. 1996; 71p; In Korean
Report No.(s): KAERI-CM-035/95; DE98-724964; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

We have used the CHEASE ideal MHD code to analyze the ballooning mode stability in tokamak with the boundaries circle, ellipse and D-shape. It has been shown that the (beta) limit due to ballooning mode increases as ellipse becomes more elongated and as the shape is closer to D. The triangularity effects the increase in .beta. more than the elongation. Twice higher (beta) from the circular plasma has been achieved in D-shaped plasma. In most shapes, the Troyon coefficient decreases as the edge q is decreased. However the change of equilibria results in the increase in (beta) In ellipses, higher .beta. can be achieved with more hollow current profile than with less= hollow one. In D-shaped plasma, there is little difference. to increase the efficiency of fusion on plasmas, (beta) should be large. Therefore, more shaped plasmas with hollow q profiles are preferable. High heating power and strong current drive will be needed.
DOE
Fusion Reactors; Tokamak Devices; Stability; Ballooning Modes; Kink Bands; Magnetohydrodynamic Stability

19980210460 Energia Nucleare e Delle Energie Alternative, Dipt. Energia, Rome, Italy
A review of progress towards radiative divertor
Zagorski, Roman, Energia Nucleare e Delle Energie Alternative, Italy; Jul. 1997; ISSN 0393-6317; 38p; In English
Report No.(s): ENEA-RT-ERG-FUS-96-23; DE98-728533; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

A solution of the problem of the power and particle exhaust from the next step tokamaks, will require new techniques which redistribute the power entering the SOL onto much larger surface area than conventional divertor design permits, while maintaining good impurity retention in divertor volume and allowing for efficient helium pumping. Progress made in developing such techniques is discussed. Status of the modelling studies of dynamic gas target divertor and impurity seeded radiating divertors is presented. Recent results of experiments on radiative and gas target divertors are reviewed.
DOE
Procedures; Plasmas (Physics); Divertors (Fusion Reactors); Energy Storage

19980210461 Energia Nucleare e Delle Energie Alternative, Dipt. Energia, Rome, Italy
Proposal of magnetic shear reversal experiments on FTU by Lower Hybrid CO and Counter Current Drive
Barbato, Emilia, Energia Nucleare e Delle Energie Alternative, Italy; Jul. 1997; ISSN 0393-6317; 32p; In English
Report No.(s): ENEA-RT-ERG-FUS-96-25; DE98-728534; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

In this paper magnetic shear reversal experiments on FTU are proposed by Lower Hybrid co-and counter-Current Drive. Low plasma temperatures are suggested to study relaxed states of the current density profile. In this condition LH deposition is controlled by a proper choice of plasma density and q-profile. Both simple arguments and power deposition calculations, based on ray-tracing/Fokker-Planck code, show that, at off axis depositions, useful in the co-CD scheme, are obtained. At high density, centrally peaked deposition, useful in the counter-CD scheme, are achieved. Current density diffusion calculations are performed in the presence of all the current density components, i.e. purely ohmic, purely non inductive and cross term. These calculations show that in the co-Current Drive scheme, about 40 % - 50 % of the total plasma current has to be driven non inductively, in the proper plasma position, in order to realize non-monotonic q-profiles. In the counter-Current -Drive scheme the current fraction can be even lower.
DOE
Experimentation; Transport Theory; Plasma Heating; Fokker-Planck Equation; Q Devices; Tokamak Devices

19980210495 Korean Atomic Energy Research Inst., Korea Nuclear Safety Center, Daeduk, Korea, Republic of

A study on the fusion reactor: Study on the plasma transport in advanced tokamaks

Kim, Chang Bae, Soong Sil Univ., Korea, Republic of; Hong, Kyu Seon, Soong Sil Univ., Korea, Republic of; Choi, Kang Oak, Soong Sil Univ., Korea, Republic of; Sep. 1996; 29p; In Korean

Report No.(s): KAERI-CM-042/95; DE98-724969; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

Upper bound on the heat transport is considered with varying (eta)(sub i) and the curvature of the q profile. Nonlinear variational principle is adopted to= maximize the heat transport under the conditions of energy balance and the parallel energy balance. As a model, fluid plasma is assumed in the slab geometry. Resulting Lagrange equations are solved on the computer. Critical value of (eta)(sub i) energy stability is obtained and eigen states for higher (eta)(sub i)'s are found upon considering only the critical mode. Upper bound is found to be smaller when the curvature of q profile id of the same sign as the magnetic shear than the opposite case. As future studies, study on the bifurcation of the modes and, thus, inclusion of more modes are suggested. For more sophisticated model, there seems to be no untoward problems in applying the same method and, after such calculation is done, useful bounds with direct implications to real experiments will be predicted. Lower bound may be interesting, as well, and the work is in progress.

DOE

Fusion Reactors; Tokamak Devices; Heat Transfer; Magnetohydrodynamic Stability; Calculus of Variations; Euler-Lagrange Equation

19980210578 Texas Univ., Austin, TX USA

On the theory of internal kink oscillations

Breizman, B. N., Texas Univ., USA; Candy, J., Texas Univ., USA; Berk, H. L., Texas Univ., USA; Porcelli, F., Texas Univ., USA; Dec. 1997; 22p; In English

Contract(s)/Grant(s): DE-FG03-96ER-54346

Report No.(s): DOE/ER/54346-802; IFSR-802; DE98-001978; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In this paper the authors derive a time evolution equation for internal kink oscillations which is valid for both stable and unstable plasma regimes, and incorporates the nonlinear response of an energetic particle population. A linear analysis reveals a parallel between (i) the time evolution of the spatial derivative of the internal kink radial displacement and (ii) the time evolution of the perturbed particle distribution function in the field of an electrostatic wave (Landau problem). They show that diamagnetic drift effects make the asymptotic decay of internal kink perturbations in a stable plasma algebraic rather than exponential. However, under certain conditions the stable root of the dispersion relation can dominate the response of the on-axis displacement for a significant period of time. The form of the evolution equation naturally allows one to include a nonlinear, fully toroidal treatment of energetic particles into the theory of internal kink oscillations.

DOE

Dispersions; Landau Damping; Mathematical Models; Time Dependence; Integral Equations; Electrostatic Waves

19980210589 Argonne National Lab., IL USA

Thermomechanical analysis of the ITER breeding blanket

Majumdar, S., Argonne National Lab., USA; Gruhn, H., Argonne National Lab., USA; Gohar, Y., Max-Planck-Inst. fuer Plasmaphysik, Germany; Giegerich, M., Max-Planck-Inst. fuer Plasmaphysik, Germany; Mar. 1997; 12p; In English; 4th; Fusion Nuclear Technology, 6-11 Apr. 1997, Tokyo, Japan

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): ANL/ET/CP-92936; CONF-970404-9; DE97-007077; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Thermomechanical performance of the ITER breeding blanket is an important design issue because it requires first, that the thermal expansion mismatch between the blanket structure and the blankets internals (such as, beryllium multiplier and tritium breeders) can be accommodated without creating high stresses, and second, that the thermomechanical deformation of various interfaces within the blanket does not create high resistance to heat flow and consequent unacceptably high temperatures in the blanket materials. Thermomechanical analysis of a single beryllium block sandwiched between two stainless steel plates was carried out using the finite element code ABAQUS to illustrate the importance of elastic deformation on the temperature distribu-

tions. Such an analysis for the whole ITER blanket needs to be conducted in the future. Uncertainties in the thermomechanical contact analysis can be reduced by bonding the beryllium blocks to the stainless steel plates by a thin soft interfacial layer.
DOE
Thermal Expansion; Temperature Distribution; Thermodynamics; Tokamak Devices; Fusion Reactors; Metal Plates

19980210696 Lawrence Livermore National Lab., Livermore, CA USA
Observation of the saturation of Langmuir waves driven by ponderomotive force in a large scale plasma
Kirkwood, R., Lawrence Livermore National Lab., USA; Afeyan, B. B., Lawrence Livermore National Lab., USA; Moody, J. D., Lawrence Livermore National Lab., USA; MacGowan, B. J., Lawrence Livermore National Lab., USA; Glenzer, S. H., Lawrence Livermore National Lab., USA; Kruer, W. L., Lawrence Livermore National Lab., USA; Estabrook, K. G., Lawrence Livermore National Lab., USA; Wharton, K. B., Lawrence Livermore National Lab., USA; Williams, E. A., Lawrence Livermore National Lab., USA; Berger, R. L., Lawrence Livermore National Lab., USA; Montgomery, D. S., Los Alamos National Lab., USA; Jun. 22, 1997; 16p; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-ID-128007; DE98-051047; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We report the observation of amplification of a probe laser beam (I le 1x10(exp 14) W/cm(exp 2)) in a large scale approximately 1 mm plasma by interaction with a pumping laser beam (I = 2x10(exp 15) W/cm(exp 2)) and a stimulated Langmuir wave. When the plasma density is adjusted to allow the Langmuir wave dispersion to match the difference frequency and wave number of the two beams, amplification factors as high as times 2.5 result. Interpretation of this amplification as scattering of pump beam energy by the Langmuir wave that is produced by the ponderomotive force of the two beams, allows the dependence of Langmuir wave amplitude on ponderomotive force to be measured. It is found that the Langmuir wave amplitude saturates at a level that depends on ion wave damping, and is generally consistent with secondary ion wave instabilities limiting its growth.
DOE
Wave Dispersion; Ponderomotive Forces; Plasmas (Physics); Laser Beams; Plasma Waves; Saturation

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SOLID-STATE PHYSICS

Includes superconductivity. For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

19980206333 Los Alamos National Lab., NM USA
Impression creep behavior of atmospheric plasma sprayed and hot pressed MoSi2/Si3N4
Hollis, K. J., Los Alamos National Lab., USA; Butt, D. P., Los Alamos National Lab., USA; Castro, R. G., Los Alamos National Lab., USA; 1997; 12p; In English; 10th; 17th; National Thermal Spray Conference In Conjunction with Materials Week, 15 - 19 Sep. 1997, Indianapolis, IN, Indianapolis, IN, USA, USA; Sponsored by American Society for Metals, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1666; CONF-970929; DE97-008889; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The use of MoSi2 as a high temperature oxidation resistant structural material is hindered by its poor elevated temperature creep resistance. The addition of second phase Si3N4 holds promise for improving the creep properties of MoSi2 without decreasing oxidation resistance. The high temperature impression creep behavior of atmospheric plasma sprayed (APS) and hot pressed (HP) MoSi2/Si3N4 composites was investigated. Values for steady state creep rates, creep activation energies, and creep stress exponents were measured. Grain boundary sliding and splat sliding were found to be the dominant creep mechanisms for the APS samples while grain boundary sliding and plastic deformation were found to be the dominant creep mechanisms for the HP samples.
DOE
Activation Energy; Creep Strength; Plasmas (Physics); Plastic Deformation; Steady State Creep; Silicon Nitrides; Oxidation Resistance; Molybdenum Compounds

19980206530 Los Alamos National Lab., NM USA
Nonlinearity in structural and electronic materials
Bishop, A. R., Los Alamos National Lab., USA; Beardmore, K. M., Los Alamos National Lab., USA; Ben-Naim, E., Los Alamos National Lab., USA; [1997]; 15p; In English

Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3069; DE98-001214; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The project strengthens a nonlinear technology base relevant to a variety of problems arising in condensed matter and materials science, and applies this technology to those problems. In this way the controlled synthesis of, and experiments on, novel electronic and structural materials provide an important focus for nonlinear science, while nonlinear techniques help advance the understanding of the scientific principles underlying the control of microstructure and dynamics in complex materials. This research is primarily focused on four topics: (1) materials microstructure: growth and evolution, and porous media; (2) textures in elastic/martensitic materials; (3) electro- and photo-active polymers; and (4) ultrafast photophysics in complex electronic materials. Accomplishments included the following: organization of a ”Nonlinear Materials” seminar series and international conferences including ”Fracture, Friction and Deformation,” ”Nonequilibrium Phase Transitions,” and ”Landscape Paradigms in Physics and Biology”; invited talks at international conference on ”Synthetic Metals,” ”Quantum Phase Transitions,” ”1996 CECAM Euroconference,” and the 1995 Fall Meeting of the Materials Research Society; large-scale simulations and microscopic modeling of nonlinear coherent energy storage at crack tips and sliding interfaces; large-scale simulation and microscopic elasticity theory for precursor microstructure and dynamics at solid-solid diffusionless phase transformations; large-scale simulation of self-assembling organic thin films on inorganic substrates; analysis and simulation of smoothing of rough atomic surfaces; and modeling and analysis of flux pattern formation in equilibrium and nonequilibrium Josephson junction arrays and layered superconductors.

DOE

Research and Development; Superconductors (Materials); Technology Assessment; Microstructure; Nonlinearity; Josephson Junctions

19980206544 Los Alamos National Lab., NM USA

LO phonons in La(1.85)SR(0 .15)CuO4

Egami, T., Pennsylvania Univ., USA; Petrov, Y., Pennsylvania Univ., USA; McQueeney, R. J., Los Alamos National Lab., USA; Petrov, Y., Pennsylvania Univ., USA; Yethiraj, M., Oak Ridge National Lab., USA; Shirane, G., Brookhaven National Lab., USA; Endoh, Y., Tohoku Univ., Japan; [1997]; 8p; In English; Neutron Scattering, 17 - 21 Aug. 1997, Toronto, Canada
Contract(s)/Grant(s): W-7405-ENG-36; NSF DMR-96-28134
Report No.(s): LA-UR-97-3047; CONF-970814-; DE98-001167; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Dispersion of the highest energy LO phonons in La(1.85)SR(0.15) CuO4 was studied by neutron inelastic scattering. At T = 10 K the dispersion along (h, 0, 0) is anomalous forming dispersion branches with a discontinuity at h = 1/4. A possible relation of this anomaly to the spin-charge stripes with be discussed.

DOE

Phonons; Copper Oxides; Anomalies; Inelastic Scattering; Neutron Scattering

19980206545 Los Alamos National Lab., Manuel Lujan Jr. Neutron Scattering Center, NM USA

Localized excitations in UPdSn

Nakotte, H., Los Alamos National Lab., USA; Robinson, R. A., Los Alamos National Lab., USA; Swan, T., Los Alamos National Lab., USA; Kelley, T., Los Alamos National Lab., USA; Bull, M., London Univ., UK; McEwen, K. A., London Univ., UK; Ecclestone, R. A., Rutherford Appleton Lab., UK; Brueck, E., Amsterdam Univ., Netherlands; [1997]; 10p; In English; Neutron Scattering, 17 - 21 Aug. 1997, Toronto, Canada
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3049; CONF-970814-; DE98-001166; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors have measured the inelastic neutron-scattering response of UPdSn at various temperatures using the HET and PHAROS spectrometers at the ISIS and MLNSC facilities, respectively. UPdSn shows some quasielastic scattering, which may be attributed to the hybridization of the 5f electrons with the conduction electrons. Furthermore, they find a clear excitation around 40 meV above 40 K in addition to the phonon contribution. While this excitation may be indicative of crystal fields in UPdSn, its strong temperature dependence seems to contradict a simple crystal-field picture. Below T(sub N), the unusual temperature dependence may be attributed to magnetically-driven distortions (and subsequent changes in the local surrounding of the U ions),

but there is some evidence that other additional mechanism(s) may contribute above T(sub N). Some possible mechanisms will be discussed.
DOE
Inelastic Scattering; Neutron Scattering; Magnetic Measurement; Spectrometers

19980206547 Los Alamos National Lab., NM USA
Four decades in the megagauss world
Fowler, C. M., Los Alamos National Lab., USA; [1997]; 18p; In English; RHMF '97: Research In High Magnetic Fields Symposium, 4 - 6 Aug. 1997, Sydney, Australia
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2621; CONF-9708108-; DE98-001153; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper contains a short history of the generation of megagauss magnetic fields obtained by explosive flux compression at Los Alamos over the last four decades, a brief description of the high field systems most commonly used for solid state research, and a survey of selected physics experiments performed using these systems as high magnetic field sources.
DOE
Magnetic Fields; Histories; Laboratory Equipment; Magnetic Compression; Research Management; Semiconductors (Materials)

19980206573 Sandia National Labs., Albuquerque, NM USA
Modeling, synthesis and characterization of LiMn2O4 spinels
Doughty, D. H., Sandia National Labs., USA; Ingersoll, D., Sandia National Labs., USA; Cygan, R. T., Sandia National Labs., USA; Westrich, H. R., Sandia National Labs., USA; Rodriguez, M. A., Sandia National Labs., USA; Boyle, T. J., Sandia National Labs., USA; Voigt, J. A., Sandia National Labs., USA; Johnson, B. J., Minnesota Mining and Mfg. Co., USA; [1997]; 3p; In English; Advanced Non-aqueous Battery Research and Development Workshop, 15 - 17 Oct. 1997, Hunt Valley, MD, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2628C; CONF-971087-; DE98-001174; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors report on an integrated program to understand the fundamentals of LiMn2O4 performance as a cathode for lithium ion rechargeable batteries. Specifically, this program is designed to address the effects of doping on the crystal chemistry, lattice constants, and electrochemical performance. The work is being expanded to include studies on LiCoO2 and LiNiO2.
DOE
Models; Synthesis (Chemistry); Spinel; Lithium Oxides; Manganese Oxides; Molecular Structure

19980206591 Argonne National Lab., IL USA
Crystal structure of (Li(0.5)K(0.5))2CO3 by neutron powder diffraction analysis
Idemoto, Yasushi, Argonne National Lab., USA; Richardson, J. W., Jr., Argonne National Lab., USA; Loong, C. K., Argonne National Lab., USA; Koura, Nobuyuki, Science Univ. of Tokyo, Japan; Kohara, Shinji, Science Univ. of Tokyo, Japan; [1997]; 14p; In English
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/IPNS/PP-89800; DE97-008116; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The crystal structure of (Li(0.5)K(0.5))2CO3 was determined by neutron powder diffraction. A final weighted R-factor of 4.54% was obtained for the refinement of 2,373 reflections by the Rietveld method from a sample synthesized using (7)Li2CO3 and K2CO3 (99.9% pure). Slight distortion of the CO3(2-) units in the monoclinic cell was observed; the O(1)-C-O(2) angle and C-O(3) length are larger than those for the other C-O bonds and O-C-O angles. These local-structure characteristics can be explained by the difference in the ionic size of Li(+) and K(+), and the different electrostatic interactions between the cations and CO3(2-) units. (Li(0.5)K(0.5))2CO3 is important as a material for molten carbonate fuel cells.
DOE
Neutron Diffraction; Crystal Structure; Lithium Compounds; Potassium Compounds; Carbon Compounds; Molten Carbonate Fuel Cells

19980206703 Michigan Univ., Dept. of Electrical Engineering and Computer Science, Ann Arbor, MI USA
Epitaxia1 Growth and Characterization of Si(1-x)Ge(x) Materials and Devices ***Final Report, 15 Oct. 1994 - 14 Oct 1997***
Bhattacharya, Pallab, Michigan Univ., USA; Dec. 1997; 38p; In English
Contract(s)/Grant(s): F49620-95-1-0013
Report No.(s): AD-A341167; AFRL-SR-BL-TR-98-0313; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this project were the understanding of heteroepitaxial growth of SiGe/Si, dislocation control for highly mismatched layers, and the application of such heterostructure to high speed microelectronics and optoelectronics. A new technique of dislocation control, using a low temperature Si buffer layer, has been identified. SiGe/Si heterostructure FETs have been fabricated, using this technique. Heterostructure bipolar transistors have been utilized to realize the first SiGe based integrated photoreceivers. The electro-optic coefficients in SiGe/Si quantum wells have also been measured. Modulators, whose operation principle is based on the small conduction band offset, in this heterostructure, has been demonstrated theoretically and experimentally, for the first time. Theoretical work, involving a charge control study of the interfacial effects in p-MOSFETs.
DTIC
Silicon; Germanium; Optoelectronic Devices; Epitaxy; Field Effect Transistors

19980209716 Lawrence Livermore National Lab., Materials Science and Technology Div., Livermore, CA USA
Periodic boundary conditions for three dimensional dislocation dynamics
Huang, H., Lawrence Livermore National Lab., USA; delaRubia, Diaz, Lawrence Livermore National Lab., USA; Jan. 1997; 12p; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-ID-126219; DE98-051040; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The boundary conditions in three dimensional Dislocation Dynamics (DD) simulations have always been a matter of concern. Two types of boundary conditions, quasi-free-surface and reflection boundaries are currently being used by groups in Grenoble, France and Pullman, Washington. In this paper, we present a mathematical transformation that enables simulations of dislocation evolution processes in single crystals using periodic boundary conditions (PBCs). The idea is graphically demonstrated with transformation matrices given for BCC crystal systems. Extension to other crystal structures is also discussed. Comparing to the existing boundary conditions, the new approach (1) balances the dislocation flux in and out of a computational cell; and (2) does not require artificial termination of dislocations in the bulk.
DOE
Boundary Conditions; Transformations (Mathematics); Dislocations (Materials); Crystal Structure; Single Crystals

19980209731 North Carolina State Univ., Raleigh, NC USA
Defects and Impurities in 4H- and 6H-SiC Homoepitaxial Layers: Identification, Origin, Effect on Properties of Ohmic Contacts and Insulating Layers and Reduction ***Quarterly Report, 1 Jan - 31 Mar. 1998***
Davis, R. F., North Carolina State Univ., USA; Aboelfotoh, M. O., North Carolina State Univ., USA; Baliga, B. J., North Carolina State Univ., USA; Nemanich, R. J., North Carolina State Univ., USA; Mar. 1998; 17p; In English
Contract(s)/Grant(s): N00014-95-1-1080
Report No.(s): AD-A345803; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A hot wall chemical vapor deposition system has been constructed to deposit thin films of 4H- and 6H-SiC and AlN. The design incorporates a separate load lock from which the growth chamber and a RHEED chamber are attached. Operation awaits the completion of the laboratory upfitting to address the safety requirements necessary to use silane. Characteristics of high voltage, planar, PN junction diodes fabricated on 4H-SiC using field plate as an edge termination are reported for the first time. The diodes were formed by nitrogen implantation into p-type epitaxial layers and aluminum implantation into p-type epitaxial layers at 1000 C, using a deposited and patterned SiO2 layer as the mask.
DTIC
Defects; Impurities; Silicon Dioxide; Epitaxy; Surface Layers; Insulation; Thin Films

19980209821 Department of the Navy, Washington, DC USA
Process for Forming Epitaxial BaF2 on GaAs
Santiago, Francisco, Inventor, Department of the Navy, USA; Chu, Tak Kin, Inventor, Department of the Navy, USA; Stumborg, Michael, Inventor, Department of the Navy, USA; Nov. 25, 1997; 5p; In English
Patent Info.: Filed 31 May 1935; US-Patent-Appl-SN-454983; US-Patent-5,690,737
Report No.(s): AD-D018822; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A process for growing single crystal epitaxial BaF2 layers on gallium arsenide substrates by slowly reacting Ba, BaCl2, BaI2, BaBr2, BaF2.BaCl2, BaF2.BaBr2, BaF2.BaI2, BaCl2.BaBr2, Ba3(GaF6)2, BAH2, or BaO2 vapor with a clean, hot GaAs substrate at 500 to 700 C. in high vacuum until a uniform, thin (2 A) layer of reaction product is formed and then vapor depositing BaF2 onto the reaction layer at room temperature to 400 C. to form the single crystal, epitaxial BaF2 layer.
DTIC
Gallium Arsenides; Semiconductor Devices; Barium Compounds; Technologies; Epitaxy; Crystal Growth

19980209833 Osaka Univ., Dept. of Electrical Engineering, Osaka, Japan
Electron Traps in AlInAs Treated with O2 Plasma
Yamamura, Ikuhiro, Osaka Univ., Japan; Matsuda, Koichiro, Horiba Ltd., Japan; Sugino, Takashi, Osaka Univ., Japan; Shirafuji, Junji, Osaka Univ., Japan; Technology Reports of the Osaka University; Apr. 15, 1994; ISSN 0030-6177; Volume 44, Nos. 2163-2182, pp. 35-41; In English
Report No.(s): Rept-2167; Copyright; Avail: Issuing Activity (Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan), Hardcopy, Microfiche

N-AlInAs treated with oxygen plasma has been characterized in terms of Schottky barrier junction characteristics and plasma induced traps. The apparent barrier height including effect of a thin oxide layer approaches 0.90 eV for Au/n-AlInAs Schottky junctions with increasing plasma treatment time. On the contrary, the true barrier height decreases to 0.25 eV from 0.46 eV for the virgin sample and the ideality factor degrades with increasing plasma treatment time. From isothermal capacitance transient spectroscopy (ICTS) measurement, two electron traps, E1(Ec-0.47eV) and E2(Ec-0.69eV), are detected in untreated AlInAs. An Additional two electron traps, EO1(Ec 0.44eV) and EO2(Ec-0.52eV) are introduced by oxygen plasma treatment.
Author
Traps; Indium Aluminum Arsenides; Semiconductors (Materials); Oxygen Plasma; Schottky Diodes

19980209847 Sandia National Labs., Livermore, CA USA
Cl(-) adsorption on an Al2O3 surface in an electrolyte
Wilson, W. D., Sandia National Labs., USA; Schaldach, C. M., California Univ., USA; Nov. 1997; 17p; In English; 191st, 4-9 May 1997, Montreal, Canada
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-8471; CONF-970517; DE98-051309; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Adsorption of ions on mineral surfaces is important to a number of technologies, including soil-surface geochemical cycling, corrosion, waste isolation and environmental restoration. The initiation of pitting of aluminum in water vapor and chlorine environments has been associated with the adsorption of chloride ions on the surface of oxidized aluminum. The authors present a method for calculating the minimum energy configurations of atomic and molecular species adsorbing on defected solid surfaces in the presence of an electrolyte. The method couples a quantum region containing the adsorbing atom or molecule and neighboring lattice atoms to a continuum which may contain a real charge. A molecular surface surrounds the quantum zone, discretized into boundary elements facilitating the coupling of the Schroedinger and Poisson equations. The interfacial polarization created by the electrons in this zone, (from the Poisson equation using Green's functions) is incorporated into the Hamiltonian providing a reaction field for the next iteration quantum calculation. Lattice defects induce single and double layers of charge at the interface, treated as additional background charges in the Hamiltonian. The authors find that these polarization effects can reduce the binding energy of the Cl(-) and that a charged defect can displace the minimum and well depth of an adsorbing Cl(-).
DOE
Aluminum Oxides; Adsorption; Chlorine; Metal Surfaces; Electrolytes; Pitting; Corrosion

19980209882 NASA Marshall Space Flight Center, Huntsville, AL USA
Characterization of Cadmium-Zinc Telluride Crystals Grown by 'Contactless' PVT Using Synchrotron White Beam Topography
Palosz, W., NASA Marshall Space Flight Center, USA; Gillies, D., NASA Marshall Space Flight Center, USA; Grasza, K., Polish Academy of Sciences, Poland; Chung, H., State Univ. of New York, USA; Raghothamachar, B., State Univ. of New York, USA; Dudley, M., State Univ. of New York, USA; Journal of Crystal Growth; 1997; ISSN 0022-0248; Volume 182, pp. 37-44; In English
Report No.(s): NASA/TM-97-207869; NAS 1.15:207869; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Crystals of Cd(1-x)Zn(x)Te grown by Physical Vapor Transport (PVT) using self-seeding 'contactless' techniques were characterized using synchrotron radiation (reflection, transmission, and Laue back-reflection X-ray topography). Crystals of low (x = 0.04) and high (up to x approx. = 0.4) ZnTe content were investigated. Twins and defects such as dislocations, precipitates, and

slip bands were identified. Extensive inhomogeneous strains present in some samples were found to be generated by interaction (sticking) with the pedestal and by composition gradients in the crystals. Large (up to about 5 mm) oval strain fields were observed around some Te precipitates. Low angle grain boundaries were found only in higher ZnTe content (x greater than or equal to 0.2) samples.
Author
Crystal Growth; Cadmium Tellurides; Zinc Tellurides; Topography; Crystal Defects; Edge Dislocations; Characterization; Laue Method

19980209958 Sandia National Labs., Albuquerque, NM USA
Model-based predictions of solid state intermetallic compound layer growth in hybrid microelectronic circuits
Vianco, P. T., Sandia National Labs., USA; Erickson, K. L., Sandia National Labs., USA; Hopkins, P. L., Sandia National Labs., USA; [1997]; 13p; In English; Life Cycle Systems Engineering, 4-5 Nov. 1997, Huntsville, AL, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3049C; CONF-971193; DE98-001488; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A mathematical model was developed to quantitatively describe the intermetallic compound (IMC) layer growth that takes place between a Sn-based solder and a noble metal thick film conductor material used in hybrid microcircuit (HMC) assemblies. The model combined the reaction kinetics of the solder/substrate interaction, as determined from ancillary isothermal aging experiments, with a 2-D finite element mesh that took account of the porous morphology of the thick film coating. The effect of the porous morphology on the IMC layer growth when compared to the traditional 1-D computations was significant. The previous 1-D calculations under-predicted the nominal IMC layer thickness relative to the 2-D case. The 2-D model showed greater substrate consumption by IMC growth and lesser solder consumption that was determined with the 1-D computation. The new 2-D model allows the design engineer to better predict circuit aging and hence, the reliability of HMC hardware that is placed in the field.
DOE
Aging (Materials); Computation; Computational Grids; Conductors; Finite Element Method; Hybrid Circuits; Intermetallics; Isothermal Processes; Metal Films; Morphology

19980209965 Sandia National Labs., Albuquerque, NM USA
Theoretical investigation of extended defects in group-III nitrides
Wright, A. F., Sandia National Labs., USA; [1997]; 9p; In English; 1997 Fall Meeting of the Materials Research Society, 1 - 5 Dec. 1997, Boston, MA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3142C; CONF-971201; DE98-001702; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The authors have investigated two types of extended defects commonly found in AlN, GaN and InN films using density-functional techniques. First, basal-plane stacking faults have been studied for all three compounds. Stacking-fault energies were found to be largest in AlN and smallest in GaN consistent with density-functional results for their wurtzite/zinc-blende energy differences. In addition, the 4H and 6H structures were found to have lower energies than zinc blende for all three compounds. Secondly, the authors have investigated the electronic structure and formation energy for an edge dislocation in AlN. The full-core dislocation structure was found to have a filled electronic level approximately 0.55 eV above the valence-band edge and an empty level 1.4 eV below the conduction-band edge. An open-core structure was found to have filled and empty electronic levels closer to the middle of the energy gap. Formation energies for these two geometries suggest that the full-core structure would be expected to form in p-type material whereas both are expected in n-type material.
DOE
Atomic Structure; Energy of Formation; Edge Dislocations; Wurtzite; Crystal Defects; Electron Energy

19980209970 Oak Ridge National Lab., TN USA
Direct structure determination by atomic-resolution incoherent STEM imaging
Nellist, P. D., Cambridge Univ., UK; Xin, Y., Oak Ridge National Lab., USA; Pennycook, S. J., Oak Ridge National Lab., USA; Nov. 1997; 4p; In English, 2-5 Sep. 1997, Cambridge, UK
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95489; CONF-970911; DE98-001838; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Use of a large, annular dark-field (ADF) detector in a scanning transmission electron microscope is shown to give images that can allow direct structure determination, being a convolution between the illuminating probe intensity and an object function localized at the atomic column positions. The ADF image is also shown to resolve crystal spacings more than twice smaller than the phase contrast point resolution limit of the microscope used, with sub-angstrom structural information being retrieved. ADF image of several semiconductor materials are studied.
DOE
Imaging Techniques; Phase Contrast; Scanning Electron Microscopy; Semiconductors (Materials)

19980209973 Oak Ridge National Lab., TN USA
Ion beam synthesis of CdS, ZnS, and PbS compound semiconductor nanocrystals
White, C. W., Oak Ridge National Lab., USA; Budai, J. D., Oak Ridge National Lab., USA; Meldrum, A. L., Oak Ridge National Lab., USA; Dec. 1997; 5p; In English, 1-5 Dec. 1997, Boston, MA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95414; CONF-971201; DE98-001841; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Sequential ion implantation followed by thermal annealing has been used to form encapsulated CdS, ZnS, and PbS nanocrystals in SiO(sub 2) and Al(sub 2)O(sub 3) matrices. In SiO(sub 2), nanoparticles are nearly spherical and randomly oriented, and ZnS and PbS nanocrystals exhibit a bimodal size distribution. In Al(sub 2)O(sub 3), nanoparticles are faceted and coherent with the matrix. Initial photoluminescence (PL) results are presented.
DOE
Annealing; Ion Beams; Ion Implantation; Nanocrystals; Photoluminescence; Semiconductors (Materials)

19980209976 Oak Ridge National Lab., TN USA
Direct observations of atomic structures of defects in GaN by high-resolution Z-contrast STEM
Xin, Y., Illinois Univ., USA; Pennycook, S. J., Oak Ridge National Lab., USA; Browning, N. D., Illinois Univ., USA; Sivananthan, S., Illinois Univ., USA; Nellist, P. D., Cambridge Univ., UK; Faurie, J. P., Illinois Univ., USA; Gibart, P., Centre National de la Recherche Scientifique, France; Dec. 1997; 6p; In English; 1997 Fall Meeting of the Materials Research Society, 1 - 5 Dec. 1997, Boston, MA, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95879; CONF-971201; DE98-001847; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

GaN/(0001) Sapphire grown by low pressure MOVPE is studied by high resolution Z-contrast imaging using STEM. First direct observation of the threading dislocation with edge character shows the atomic core structure, which appears to have a similar configuration to the (l brace)10-10(r brace) surface. The surfaces of the nanopipe walls are on (l brace)10-10(r brace) with the terminating layer between the atoms with one bond per pair. In addition, the high resolution Z contrast image of the prismatic stacking fault confirms the results by conventional HRTEM.
DOE
Atomic Structure; High Resolution; Sapphire; Imaging Techniques; Low Pressure

19980209982 Oak Ridge National Lab., TN USA
Temperature-induced phase transitions during ion-beam irradiation of the perovskite-structure oxides
Meldrum, A., Oak Ridge National Lab., USA; Boatner, L. A., Oak Ridge National Lab., USA; Ewing, R. C., Michigan Univ., USA; 1997; 6p; In English; 1997 Fall Meeting of the Materials Research Society, 1 - 5 Dec. 1997, Boston, MA, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95551; CONF-971201; DE98-001935; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Several perovskite-structure oxide compounds, including CaTiO3, SRTiO3, BaTiO3, KNbO3, and KTaO3 were irradiated by 800 keV Kr(+) ions in order to investigate and compare their response to heavy-ion irradiation. The critical amorphization temperature T(sub c), above which amorphization temperature T(sub c), above which amorphization could not be induced, was found to increase in the order SRTiO3 (yields) CaTiO3 (yields) BaTiO3 (yields) KNbO3 (yields) KTaO3. No single physical parameter explains the observed sequence, although T(sub c) correlates well with the melting temperatures. The well-known temperature-driven phase transformations in these materials did not have a significant effect on the dose required for amorphization.

Domain boundaries were observed in the pristine samples; however, after only a low dose, the boundaries became poorly defined and, with increasing dose, eventually disappeared. Dislocation loops were observed to aggregate at the domain boundaries.
DOE
Critical Temperature; Ion Irradiation; Phase Transformations; Ion Beams; Barium Titanates

19980209983 Oak Ridge National Lab., TN USA
Structure, energy, and electronic properties of the (Sigma) = 13 (510) tilt grain boundary structure in Si
Morris, J. R., Ames Lab., USA; Lu, Z. Y., Ames Lab., USA; Xiang, J. B., Ames Lab., USA; 1997; 6p; In English; 1997 Fall Meeting of the Materials Research Society, 1 - 5 Dec. 1997, Boston, MA, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95715; CONF-971201; DE98-001936; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

We have examined a variety of structures for the (510) symmetric tilt boundary in Si, using first-principles calculations. These calculations show that the observed structure in Si is the lowest energy structure. This structure is more complicated than what is necessary to preserve four-fold coordination. We compare the results to classical and tight-binding models, in order to test these empirical problems.
DOE
Attitude (Inclination); Grain Boundaries

19980209986 Oak Ridge National Lab., TN USA
Excitations and possible bound states in the S = 1/2 alternating chain compound (VO)2P2O7
Tennant, D. A., Oak Ridge National Lab., USA; Nagler, S. E., Oak Ridge National Lab., USA; Sales, B. C., Oak Ridge National Lab., USA; Jul. 30, 1997; 13p; In English; Neutron Scattering, 17-21 Aug. 1997, Toronto, Canada
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95532; CONF-970814; DE98-001939; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Magnetic excitations in an array of (VO)2P2O7 single crystals have been measured using inelastic neutron scattering. Until now, (VO)2P2O7 has been thought of as a two-leg antiferromagnetic Heisenberg spin ladder with chains running in the a-direction. The present results show unequivocally that (VO)2P2O7 is best described as an alternating spin-chain directed along the crystallographic b-direction. In addition to the expected magnon with magnetic zone-center energy gap Delta = 3.1 meV, a second excitation is observed at an energy just below 2(Delta). The higher mode may be a triplet two-magnon bound state. Numerical results in support of bound modes are presented.
DOE
Quantum Mechanics; Vanadium Compounds; Phosphorus Compounds; Single Crystals; Excitation; Antiferromagnetism

19980209987 Oak Ridge National Lab., TN USA
Neutron scattering studies of the magnetic fluctuations in YBa2Cu3O(7-delta)
Mook, H. A., Oak Ridge National Lab., USA; Dai, P., Oak Ridge National Lab., USA; Hunt, R. D., Oak Ridge National Lab., USA; Dogan, F., Washington Univ., USA; Nov. 05, 1997; 9p; In English; Spectroscopies of Novel Superconductors, 14-18 Sep. 1997, Falmouth, MA, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95529; CONF-970959; DE98-001940; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Neutron scattering measurements have been made on the spin fluctuations in YBa2Cu3O(7-delta) for different oxygen doping levels. Incommensurability is clearly observed for oxygen concentrations of 6.6 and 6.7 and is suggested for the 6.93. Measurements of the resonance for the 6.6 concentration show that it exists in a broadened and less intense form at temperatures much higher than Tc.
DOE
YBCO Superconductors; Neutron Scattering; Magnetic Variations

19980209988 Oak Ridge National Lab., TN USA
Characterization of fullerness and fullerene derivatives by small-angle neutron scattering and transmission measurements
Melnichenko, Y. B., Oak Ridge National Lab., USA; Wignall, G. D., Oak Ridge National Lab., USA; Affholter, K. A., Oak Ridge

National Lab., USA; 1997; 11p; In English; 191st, 4-9 May 1997, Montreal, Canada; Sponsored by Electrochemical Society, Inc., USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95494; CONF-970517; DE98-001941; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Small-angle neutron scattering (SANS) has been shown to be an appropriate technique for the structural characterization of fullerenes in solvents with strong SANS contrast (e.g. CS2) and we have extended initial studies of C60 to include C70 and C84 moieties. Deuterated solvents (e.g. toluene-d(sub 8)) have a high scattering length density (SLD), which is close to that of C60, so there is virtually no SANS contrast with the solvent. Hence, these particles are practically ”invisible” in such media, though the negative scattering length of hydrogen means that SLD of H(sup 1)-containing materials is much lower, so they have strong contrast with toluene-d(sub 8). Thus, SANS makes it possible to study the size and shapes of modified buckyballs and this paper describes the first results on cyclohexane-substituted fullerenes.
DOE
Neutron Scattering; Molecular Structure; Fullerenes; Cyclohexane

19980209992 Sandia National Labs., Albuquerque, NM USA
In-situ optical photoreflectance during MOCVD
Breiland, W. G., Sandia National Labs., USA; Hammons, B. E., Sandia National Labs., USA; Hou, H. Q., Sandia National Labs., USA; Mei, X. B., Sandia National Labs., USA; Jan. 1998; 9p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3077; DE98-002600; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report summarizes the development of in situ optical photoreflectance as a tool for measuring impurity concentrations in compound semiconductors. The authors have successfully explored the use of photoreflectance as an in situ tool for measuring n-type doping levels in metal-organic chemical vapor deposition (MOCVD) grown GaAs materials. The technique measures phase and frequency shifts in Franz-Keldysh oscillations measured on uniformly doped thin films. Doping concentrations from 5 x 10(exp 16) to 1 x 10(exp 18) can be measured at temperatures below 130 C. A method has been developed to include photoreflectance as the last step in the pre-growth in situ calibration procedure for MOCVD thin film structures. This combined capability now enables one to rapidly and accurately determine growth rates, chemical composition, and doping levels necessary to generate a recipe to fabricate complex optoelectronic compound semiconductor devices.
DOE
Metalorganic Chemical Vapor Deposition; Optoelectronic Devices; Gallium Arsenides; Impurities; Doped Crystals; Fabrication

19980209997 Argonne National Lab., IL USA
Why we still don’t know the symmetry of the order parameter in high temperature superconductors
Klemm, R. A., Argonne National Lab., USA; Mar. 1997; 14p; In English; International Workshop on High-temperature Superconductivity: Ten Years After Its Discovery, 16-21 Dec. 1996, Jaipur, India
Contract(s)/Grant(s): W-31109-eng-38
Report No.(s): ANL/MSD/CP-92965; CONF-961233; DE97-008661; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

One of the most elusive topics in the study of high temperature superconductors (HTCS) is the orbital symmetry of the superconducting order parameter (Delta). The low temperature T behavior observed in many experiments suggests that (Delta) might exhibit line nodes, as expected for d(sub x)(sub -y)2 orbital symmetry. However, such behavior also arises from intrinsic proximity coupling and surface states, etc. The paramagnetic Meissner effect, once cited as indirect evidence for a d-wave (Delta), was recently observed in Nb. Some phase-sensitive Josephson junction experiments gave strong evidence for a substantial isotropic, or s-wave, component to (Delta), whereas others supported the above d-wave form. However, such experiments are intrinsically unreliable in experimental geometries with sample corners, or with meandering grain boundary junctions and stoichiometry inhomogeneities. Finally, the pseudogap observed recently in underdoped HTCS could arise from a charge-density wave.
DOE
Symmetry; Superconductivity; High Temperature Superconductors; Copper Oxides

19980210021 Oak Ridge National Lab., TN USA
First-principles simulations and Z-contrast imaging of impurities at (001) tilt grain boundaries in MgO
Yan, Y., Oak Ridge National Lab., USA; Chisholm, M. F., Oak Ridge National Lab., USA; Pennycook, S. J., Oak Ridge National

Lab., USA; Duscher, G., Oak Ridge National Lab., USA; Maiti, A., Molecular Simulations, Inc., USA; Pantelides, S. T., Oak Ridge National Lab., USA; Dec. 1997; 6p; In English, 1-5 Dec. 1997, Boston, MA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): ORNL/CP-95887; CONF-971201; DE98-001845; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

First-principles density-functional calculations were used to study the effects of CA impurities on the (Sigma) = 5 (310) <001 tilt grain boundaries in MgO. An equilibrium structure and two metastable structures of the grain boundaries in pure MgO have been established. The calculations further demonstrated that Ca impurities segregate at particular sites in the metastable grain boundary and induce a structural transformation. This result is consistent with atomic resolution Z-contrast imaging. The calculations also found that the impurities at the grain boundaries do not induce states in the band gap. The mechanism of the transformation is also discussed.
DOE
Attitude (Inclination); Grain Boundaries; Imaging Techniques; Magnesium Oxides; Metastable State

19980210097 Sandia National Labs., Livermore, CA USA
Material inhomogeneities in Cd(1- x)Zn(x)Te and their effects on large volume gamma-ray detectors
VanScyoc, J. M., Sandia National Labs., USA; Lund, J. C., Sandia National Labs., USA; Morse, D. H., Sandia National Labs., USA; [1997]; 15p; In English; 2nd; Science, 3-6 Nov. 1997, Orcas Island, WA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-8503C; CONF-971191; DE97-053782; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Cadmium zinc telluride (Cd(1-x)Zn(x)Te or CZT) has shown great promise as a material for room-temperature x-ray and gamma-ray detectors. In particular, polycrystalline material grown by the High Pressure Bridgman method with nominal Zn fraction (x) from 0.1 to 0.2 has been used to fabricate high resolution gamma-ray spectrometers with resolution approaching that of cooled high-purity Ge. For increased sensitivity, large areas (greater 1 sq cm) are required, and for good sensitivity to high energy gamma photons, thick detectors (on the order of 1 cm) are required. Thus there has been a push for the development of CZT detectors with a volume greater than 1 cu cm. However, nonuniformities in the material over this scale degrade the performance of the detectors. Variations in the zinc fraction, and thus the bandgap, and changes in the impurity distributions, both of which arise from the selective segregation of elements during crystal growth, result in spectral distortions. In this work several materials characterization techniques were combined with detector evaluations to determine the materials properties limiting detector performance. Materials measurements were performed on detectors found to have differing performance. Measurements conducted include infrared transmission (IR), particle induced x-ray emission (PIXE), photoluminescence (PL), and triaxial x-ray diffraction (TAXRD). to varying degrees, these measurements reveal that poor-performance detectors exhibit higher nonuniformities than spectrometer-grade detectors. This is reasonable, as regions of CZT material with different properties will give different localized spectral responses, which combine to result in a degraded spectrum for the total device.
DOE
Cadmium Tellurides; Zinc Tellurides; Gamma Ray Spectrometers; Polycrystals; X Ray Detectors; Fabrication; Semiconductor Devices

19980210098 Sandia National Labs., Livermore, CA USA
Material properties of large-volume cadmium zinc telluride crystals and their relationship to nuclear detector performance
James, R. B., Sandia National Labs., USA; Lund, J., Sandia National Labs., USA; Yoon, H., Sandia National Labs., USA; [1997]; 9p; In English; Physics and Chemistry of II-Vi Materials, 21-23 Oct. 1997, Santa Barbara, CA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-8615C; CONF-9710129; DE97-053783; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The material showing the greatest promise today for production of large-volume gamma-ray spectrometers operable at room temperature is cadmium zinc telluride (CZT). Unfortunately, because of deficiencies in the quality of the present material, high-resolution CZT spectrometers have thus far been limited to relatively small dimensions, which makes them inefficient at detecting high photon energies and ineffective for weak radiation signals except in near proximity. to exploit CZT fully, it will be necessary to make substantial improvements in the material quality. Improving the material involves advances in the purity, crystallinity, and control of the electrical compensation mechanism. Sandia National Laboratories, California, in close collaboration with US

industry and academia, has initiated efforts to develop a detailed understanding of the underlying material problems limiting the performance of large volume gamma-ray spectrometers and to overcome them through appropriate corrections therein. A variety of analytical and numerical techniques are employed to quantify impurities, compositional and stoichiometric variations, crystallinity, strain, bulk and surface defect states, carrier mobilities and lifetimes, electric field distributions, and contact chemistry. Data from these measurements are correlated with spatial maps of the gamma-ray and alpha particle spectroscopic response to determine improvements in the material purification, crystal growth, detector fabrication, and surface passivation procedures. The results of several analytical techniques will be discussed. The intended accomplishment of this work is to develop a low-cost, high-efficiency CZT spectrometer with an active volume of 5 cu cm) and energy resolution of 1--2% (at 662 keV), which would give the US a new field capability for screening radioactive substances.
DOE
Cadmium Tellurides; Zinc Tellurides; Gamma Ray Spectrometers; Crystal Growth; Semiconductor Devices; Fabrication

19980210103 Sandia National Labs., Albuquerque, NM USA
Detecting and characterizing ferroelectric domain boundaries using nonphase-matched second harmonic generation
Gehr, R. J., Sandia National Labs., USA; Alford, W. J., Sandia National Labs., USA; Smith, A. V., Sandia National Labs., USA; 1998; 4p; In English; Advanced Solid-State Lasers and Radiative Processes and Dephasing In Semiconductors, 2-4 Feb. 1998, Coeur d'Alene, ID, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2461C; CONF-980204; DE98-000381; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We demonstrate that tilted planar ferroelectric domain boundaries create tilted second harmonic beams in nonphase-matched second harmonic generation, and that the tilt of the boundary can be deduced from the harmonic direction.
DOE
Ferroelectric Materials; Harmonic Generations; Boundaries; Detection

19980210125 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Ultrafast x-ray diffraction of laser-irradiated crystals
Heimann, P. A., California Univ., Lawrence Berkeley Lab., USA; Larsson, J., California Univ., USA; Chang, Z., Michigan Univ., USA; Sep. 1997; 8p; In English; 10th; Synchrotron Radiation Instrumentation, 17-20 Jun. 1997, Ithaca, NY, USA
Contract(s)/Grant(s): DE-AC03-76SF-00098
Report No.(s): LBNL-40925; CONF-9706157; LSBL-417; DE98-001382; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An apparatus has been developed for measuring time-dependent x-ray diffraction. X-ray pulses from an Advanced Light Source bend magnet are diffracted by a sagittally-focusing Si(111) crystal and then by a sample crystal, presently InSb(111). Laser pulses with 100 fs duration and a repetition rate of 1 KHz irradiate the sample inducing a phase transition. Two types of detectors are being employed: an x-ray streak camera and an avalanche photodiode. The streak camera is driven by a photoconductive switch and has a 2 ps temporal resolution determined by trigger jitter. The avalanche photodiode has high quantum efficiency and sufficient time resolution to detect single x-ray pulses in ALS two bunch or camshaft operation. A beamline is under construction dedicated for time resolved and micro-diffraction experiments. In the new beamline a toroidal mirror collects 3 mrad horizontally and makes a 1:1 image of the bend magnet source in the x-ray hutch. A laser induced phase transition has been observed in InSb occurring within 70 ps.
DOE
Crystals; Product Development; Fabrication; Time Dependence; Electromagnetic Measurement; X Ray Diffraction

19980210163 Rutherford Appleton Lab., ISIS Facility, Chilton, UK
Diffraction and Absorption of X-rays by 3d Transition Ions: The 1s yields 3d Process
Lovesey, S. W., Rutherford Appleton Lab., UK; Jan. 1998; ISSN 1358-6254; 24p; In English
Report No.(s): PB98-142946; RAL-TR-98-010; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The resonant scattering-length for K shell absorption and an E2 transition is calculated for 3d transition ions, on the basis of an atomic model. It is applied to the evaluation of the intensity of X-rays Bragg reflected from a magnetic salt, e.g. NiO, and the circular dichroic signal in the attenuation coefficient. The information which can be extracted from these quantities relates to the orbital properties of the 3d valence shell. An exception is the s-state ion 3d(sup 5), for which the leading-order effect is zero. For

the 3d(sup 5) ion it shown that, inclusion of core polarization in the calculation leads to a weak effect which contains the spin magnetic-moment.
NTIS
Attenuation Coefficients; Magnetic Moments; X Ray Diffraction; Bragg Angle

19980210294 California Univ., Irvine, CA USA
Ground Based Program for the Physical Analysis of Macromolecular Crystal Growth ***Final Report, Jul. 1997 - Jul. 1998***
Malkin, Alexander J., California Univ., USA; 1998; 6p; In English
Contract(s)/Grant(s): NAG8-1164; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the past year we have focused on application of in situ Atomic Force Microscopy (AFM) for studies of the growth mechanisms and kinetics of crystallization for different macromolecular systems. Mechanisms of macrostep formation and their decay, which are important in understanding of defect formation, were studied on the surfaces of thaumatin, catalase, canavalin and lysozyme crystals. Experiments revealed that step bunching on crystalline surfaces occurred either due to two- or three-dimensional nucleation on the terraces of vicinal slopes or as a result of uneven step generation by complex dislocation sources. No step bunching arising from interaction of individual steps in the course of the experiment was observed. The molecular structure of the growth steps for thaumatin and lipase crystals were deduced. It was further shown that growth step advance occurs by incorporation of single protein molecules. In singular directions growth steps move by one-dimensional nucleation on step edges followed by lateral growth. One-dimensional nuclei have different sizes, less then a single unit cell, varying for different directions of step movement. There is no roughness due to thermal fluctuations, and each protein molecule which incorporated into the step remained. Growth kinetics for catalase crystals was investigated over wide supersaturation ranges. Strong directional kinetic anisotropy in the tangential step growth rates in different directions was seen. The influence of impurities on growth kinetics and cessation of macromolecular crystals was studied. Thus, for catalase, in addition to pronounced impurity effects on the kinetics of crystallization, we were also able to directly observe adsorption of some impurities. At low supersaturation we repeatedly observed filaments which formed from impurity molecules sedimenting on the surfaces. Similar filaments were observed on the surfaces of thaumatin, canavalin and STMV crystals as well, but the frequency was low compared with catalase crystallization. Cessation of growth of xylanase and lysozyme crystals was also observed and appeared to be a consequence of the formation of dense impurity adsorption layers. Attachment: ”An in situ AFM investigation of catalase crystallization”, ”Atomic force microscopy studies of living cells: visualization of motility, division, aggregation, transformation, and apoptosis”, AFM studies on mechanisms of nucleation and growth of macromolecular crystals”, and ”In situ atomic force microscopy studies of surface morphology, growth kinetics, defect structure and dissolution in macromolecular crystallization”.
Derived from text
Molecular Structure; Crystal Growth; Atomic Force Microscopy; Crystallization; Surface Defects; Surface Roughness

19980210312 Argonne National Lab., IL USA
Growth and luminescence of porous silicon: X-ray and photoluminescence measurements
You, H., Argonne National Lab., USA; Tanzer, J. A., Argonne National Lab., USA; Nagy, Z., Argonne National Lab., USA; Gaburro, Z., Illinois Univ., USA; Babic, D., Illinois Univ., USA; 1997; 10p; In English; 191st, 4-9 May 1997, Montreal, Canada; Sponsored by Electrochemical Society, Inc., USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/MSD/CP-93901; CONF-970517; DE97-053713; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The authors have shown in their previous studies that applications of x-ray scattering techniques in a transmission geometry open an avenue for in situ structural investigation of silicon/solution, in general, semiconductor/solution interfaces. In these studies, the surface morphological evolution was deduced from x-ray reflectivity measurements and the pore-pore pair-distribution function was obtained from diffuse scattering measurements. The combination of these two techniques provided a complete phenomenological description of the pore formation and growth based on the most fundamental Langevin equation of interface-evolution phenomena, known as Edward-Wilkinson model. In essence, the high-current-density condition, where the surface etching occurs via surface oxidation of silicon and dissolution of the surface oxide, inhibits short-wave length fluctuations and the low-current-density condition, where the surface etching occurs via direct dissolution of H2SiF6 formed at the interface, amplifies fluctuations with length scales of space-charge width. These two conditions are found to be consistent with the sign inversion of coefficient for the curvature dependent term of the Langevin equation. In this study extending the previous studies,

the authors will show that the luminescence and the two conditions under which the porous silicon (PS) produced are directly related, based on x-ray and photoluminescence (PL) measurements.
DOE
Crystal Growth; Porous Silicon; Photoluminescence; X Ray Scattering; Langevin Formula

19980210413 Los Alamos National Lab., NM USA
Numerical simulations of disordered superconductors
Bedell, K. S., Los Alamos National Lab., USA; Gubernatis, J. E., Los Alamos National Lab., USA; Scalettar, R. T., Los Alamos National Lab., USA; Zimanyi, G. T., California Univ., USA; [1997]; 8p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3252; DE98-001511; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The authors carried out Monte Carlo studies of the critical behavior of superfluid He-4 in aerogel. They found the superfluid density exponent increases in the presence of fractal disorder with a value roughly consistent with experimental results. They also addressed the localization of flux lines caused by splayed columnar pins. Using a Sine-Gordon-type of renormalization group study they obtained an analytic form for the critical temperature. They also determined the critical temperature from I-V characteristics obtained from a molecular dynamics simulation. The combined studies enabled one to construct the phase diagram as a function of interaction strength, temperature, and disorder. They also employed the recently developed mapping between boson world-lines and the flux motion to use quantum Monte Carlo simulations to analyze localization in the presence of disorder. From measurements of the transverse flux line wandering, they determined the critical ratio of columnar to point disorder strength needed to localize the bosons.
DOE
Monte Carlo Method; Aerogels; Order-Disorder Transformations; Phase Diagrams; Superfluidity; Renormalization Group Methods; Helium Isotopes

19980210498 Energia Nucleare e Delle Energie Alternative, Dipt. Energia, Rome, Italy
State of the art and prospective of large scale applications of YBCO thick films grown on metallic substrates *Possibilita' applicative a larga scala dei film spessi di YBCO su substrati metallici: Stato dell'arte e prospettive*
Boffa, Vincenzo, Energia Nucleare e Delle Energie Alternative, Italy; Sep. 1997; ISSN 0393-6317; 25p; In Italian
Report No.(s): ENEA-RT-ERG-FUS-97-08; DE98-728618; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

In the framework of the high temperature superconducting materials, YBa2Cu3O7 (YBCO) shows very interesting intrinsic superconducting transport properties at temperature higher than the liquid nitrogen temperature. These properties are very important in large scale applications: transport of energy, magnets, transformers, etc. Unfortunately the potential of this material cannot be achieved today, since it is very difficult to manufacture YBCO based tapes or cables. In the last years several groups have tried to overcome the problems with new fabrication techniques. In the present report the state of the art and the prospective in the field of YBCO film fabrication on metallic substrates are presented.
DOE
YBCO Superconductors; Thick Films; Substrates; Superconductors (Materials); Superconducting Films; Yttrium Oxides

19980210539 Fermi National Accelerator Lab., Batavia, IL USA
Spectroscopy of B(s) and D(s) mesons
MacKenzie, P. B., Fermi National Accelerator Lab., USA; Ryan, S. M., Fermi National Accelerator Lab., USA; Simone, J. N., Fermi National Accelerator Lab., USA; Jan. 1998; 8p; In English; 15th; Lattice Field Theory, 22-26 Jul. 1997, Edinburgh, UK
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/399-T; CONF-970709; DE98-051884; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We study B(sub s) and D(sub s) spectroscopy in quenched lattice QCD using the Fermilab approach to heavy quarks. We obtain results at four lattice spacings, a, using O(a)-improved Wilson quarks. We compare and contrast the various methods for heavy quarks on the lattice, discussing which methods work best for different physical systems and the ease with which calculations may be performed.
DOE
Spectroscopy; Mesons; Quantum Chromodynamics

19980210565 Argonne National Lab., IL USA

Neutron powder diffraction study of sulfated zirconia catalysts

Li, X., Louisville Univ., USA; Lager, G. A., Louisville Univ., USA; Loong, C. K., Argonne National Lab., USA; Jul. 01, 1997; 9p; In English; Neutron Scattering, 17-21 Aug. 1997, Toronto, Canada

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/IPNS/CP-93088; CONF-970814; DE97-054130; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In situ neutron powder diffraction method was used to investigate the crystal structures, phase abundance, and thermal stability of sulfated zirconia catalysts prepared by impregnation of hydrous zirconium oxide gels with 0.5 M H2SO4 solutions. The sample studied was precipitated at pH = 10 and dried for 5 h at 493 K, and then calcined at 853 K for 3 h. Diffraction data were collected in the temperature range 295-1273 K in an Ar atmosphere and analyzed using the Rietveld method. Only the metastable tetragonal phase was observed below 673 K. Above this temperature, the sample consisted of a mixture of tetragonal (T) and monoclinic (M) phases in the proportions (T:M wt%) 85:15 (1073 K) and 61:39 (1273 K). Surface modification by sulfation was found to retard the onset of the tetragonal-to-monoclinic transformation relative to pure zirconia. The decrease in peak-broadening at the higher temperatures reflects both an increase in crystallite size and a decrease in microstrain.

DOE

Neutron Diffraction; Catalysts; Zirconium Oxides; Gels; Powder (Particles)

19980210569 Brookhaven National Lab., Upton, NY USA

The SPRITE and POS-SPRITE user report: An extensible calculation of particle, positron and electron implantation in solids

Ritley, K. A., Illinois Univ., USA; Ghosh, V. J., Brookhaven National Lab., USA; Lynn, K. G., Brookhaven National Lab., USA; McKewown, M., Brookhaven National Lab., USA; Welch, D. O., Brookhaven National Lab., USA; Oct. 20, 1997; 79p; In English

Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-64884; DE98-001564; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

SPRITE (Simulation of Particle Reemission, Implantation and Transmission--Extensible) is a FORTRAN computer program designed to model the transport of a stream of energetic particles as they scatter through a solid or multilayer. SPRITE is intended to be a user-friendly and easily-extensible engine for performing basic transport calculations, and SPRITE incorporates such physics as is required to simulate the transport process, but specifically omits the details of the scattering mechanisms. PSPRITE is a FORTRAN computer program, built around the SPRITE transport engine and incorporating physical information necessary for modeling the implantation and thermalization of a stream of positrons or electrons with a solid. This document is intended to be the primary source of information and the only operations manual for SPRITE and the POS-SPRITE family of programs. This information includes the mode of operation of SPRITE, the format of the required and optional file types, as well as information about the output and results of the calculation. Information about installing and running these programs on a variety of computer systems will not be addressed in this report. Such information is rapidly expanding as these programs are adapted to run on different platforms, and thus the user can expect such information to be contained with the source code distribution set. Detailed information about the calculations of the structure of the POS-SPRITE programs are provided in this report, but detailed benchmark comparisons between the output of these calculations and experimental data are an active topic of research, and they refer the reader to the published literature for this information.

DOE

Applications Programs (Computers); Energetic Particles; Transport Properties; Positrons; Electrons; Implantation; Solids

19980210590 Sandia National Labs., Albuquerque, NM USA

Pressure dependence of the bandgap energy and the conduction-band mass for an n-type InGaAs/GaAs strained single-quantum-well

Jones, E. D., Sandia National Labs., USA; Tozer, S. T., National High Magnetic Field Lab., USA; Schmiedel, T., National High Magnetic Field Lab., USA; Jul. 07, 1997; 13p; In English; 8th; Modulated Semiconductor Structures, 14-18 Jul. 1997, Santa Barbara, CA, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-0701C; CONF-970782-1; DE97-007799; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We report the measurement of the pressure dependence for the bandgap energy E(sub g) and conduction-band mass m(sub c) for an 80(angstrom)-wide n-type In(0.20)Ga(0.80)As/GaAs single strained quantum well at 4.2K for pressures between 0 and 35 kbar and fields up to 30 tesla.
DOE
Pressure Dependence; Gallium Arsenides; Energy Gaps (Solid State); N-Type Semiconductors

19980210707 Lawrence Livermore National Lab., Livermore, CA USA
Crystal growth and roughening of solid D2
Kozioziemski, B. J., Lawrence Livermore National Lab., USA; Collins, G. W., Lawrence Livermore National Lab., USA; Bernat, T. P., Lawrence Livermore National Lab., USA; Mar. 26, 1997; 8p; In English; 11th; Target Fabrication Specialist Meeting, 8-12 Sep. 1996, Orcas Island, WA, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-125121; CONF-9609225; DE97-053406; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Near the triple point, growth shapes of vapor deposited hexagonal close packed D2 crystals reveal two crystal orientations contain facets which persist up to the melt. This observation is in contrast with previous experiments on rare gas solids and H2 where the highest T(sub r) measured is 0.8 T(tp).
DOE
Deuterium; Crystal Growth; Vapor Deposition; Flat Surfaces; Rare Gases

19980210754 Brookhaven National Lab., Upton, NY USA
Investigation of epitaxial silicon layers as a material for radiation hardened silicon detectors
Li, Z., Brookhaven National Lab., USA; Eremin, V., Academy of Sciences (USSR), USSR; Ilyashenko, I., Academy of Sciences (USSR), USSR; Ivanov, A., Academy of Sciences (USSR), USSR; Nov. 1997; 5p; In English; Nuclear Science Symposium, 11 - 13 Nov. 1997, Albuquerque, NM, USA
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-64973; CONF-971147; DE98-001637; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Epitaxial grown thick layers greater than 100 mu m of high resistivity silicon (Epi-Si) have been investigated as a possible candidate of radiation hardened material for detectors for high-energy physics. As grown Epi-Si layers contain high concentration (up to 2(center dot)10(exp 12) cm(exp -3)) of deep levels compared with that in standard high resistivity bulk Si. After irradiation of test diodes by protons (E(sub p) = 24 GeV) with a fluence of 1.5(center dot)10(exp 11) cm(exp -2), no additional radiation induced deep traps have been detected. A reasonable explanation is that there is a sink of primary radiation induced defects, in epitaxial layers. The 'sinking' process, however, becomes non-effective at high radiation fluences (10(exp 14) cm(exp -2)) due to saturation of epitaxial defects by high concentration of radiation induced ones. As a result, at neutron fluence of 1(center dot)10(exp 14)cm(exp -2) the deep level spectrum corresponds to well-known spectrum of radiation induced defects in high resistivity bulk Si. The net effective concentration in the space charge region equals to 3(center dot)10(exp 12) cm(exp -3) after 3 months of room temperature storage and reveals similar annealing behavior for epitaxial as compared to bulk silicon.
DOE
Silicon; Radiation Detectors; Liquid Phase Epitaxy

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THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

19980206480 Los Alamos National Lab., NM USA
Remarks on bounds for quantum codes
Ashikhmin, A., Los Alamos National Lab., USA; 1997; 9p; In English; 5th; Quantum on Computation Workshop, 7 - 18 Jul. 1997, Torino, Italy
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2513; CONF-9707104; DE97-009105; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We present some results that show that bounds from classical coding theory still work in many cases of quantum coding theory.
DOE
Coding; Quantum Theory

19980206716 Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Frascati, Frascati, Italy
Consistency of orthodox gravity
Bellucci, S., Istituto Nazionale di Fisica Nucleare, Italy; Shiekh, A., International Centre for Theoretical Physics, Italy; Jan. 1997; 11p; In English
Report No.(s): INFN-P-LNF-97-003; DE98-712224; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

A recent proposal for quantizing gravity is investigated for self consistency. The existence of a fixed-point all-order solution is found, corresponding to a consistent quantum gravity. A criterion to unify couplings is suggested, by invoking an application of their argument to more complex systems.
DOE
Gravitation; Lagrangian Function; Field Mode Theory; Quantum Theory

19980210580 Florida Univ., Inst. for Fundamental Theory, Gainesville, FL USA
The equivalence principle of quantum mechanics: Uniqueness theorem
Faraggi, A. E., Florida Univ., USA; Matone, M., Padua Univ., Italy; Oct. 28, 1997; 15p; In English
Contract(s)/Grant(s): DE-FG05-86ER-40272
Report No.(s): DOE/ER/40272-290; UFIFT-HEP-97-33; DFPD-97/TH/33; HEP-TH-9711028; DE98-001992; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Recently the authors showed that the postulated diffeomorphic equivalence of states implies quantum mechanics. This approach takes the canonical variables to be dependent by the relation p = (partial derivative)(sub q)S(sub 0) and exploits a basic GL(2,C)-symmetry which underlies the canonical formalism. In particular, they looked for the special transformations leading to the free system with vanishing energy. Furthermore, they saw that while on the one hand the equivalence principle cannot be consistently implemented in classical mechanics, on the other it naturally led to the quantum analogue of the Hamilton-Jacobi equation, thus implying the Schroedinger equation. In this letter they show that actually the principle uniquely leads to this solution. The authors also express the canonical and Schroedinger equations by means of the brackets recently introduced in the framework of N = 2 SYM. These brackets are the analogue of the Poisson brackets with the canonical variables taken as dependent.
DOE
Equivalence; Quantum Mechanics; Hamilton-Jacobi Equation

19980210581 Florida Univ., Inst. for Fundamental Theory, Gainesville, FL USA
A guide to flat direction analysis in anomalous U(1) models
Irges, N., Florida Univ., USA; Lavignac, S., Florida Univ., USA; Dec. 1997; 16p; In English
Contract(s)/Grant(s): DE-FG05-86ER-40272
Report No.(s): DOE/ER/40272-291; UFIFT-HEP-97-34; DE98-001993; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The authors suggest a systematic procedure to study D- and F-flat directions in a large class of models with an anomalous U(1). This class of models is characterized by the existence of a vacuum that breaks all Abelian gauge symmetries connecting the observable sector to the hidden sector. They show that, under some conditions, there is no other stable vacuum that breaks these symmetries. As a consequence, the model yields definite (order of magnitude) predictions for low-energy mass hierarchies. Then they study generic flat directions and identify the ones that may lead to undesirable vacua. They give necessary conditions for those to be lifted, and show that supersymmetry breaking only slightly affects the conclusions from the flat direction analysis.
DOE
Manuals; Supersymmetry; Gauge Invariance; String Theory

19980210604 Florida Univ., Inst. for Fundamental Theory, Gainesville, FL USA
On the anomalous U(1) in free fermionic superstring models
Cleaver, G. B., Pennsylvania Univ., USA; Faraggi, A. E., Florida Univ., USA; Nov. 1997; 23p; In English
Contract(s)/Grant(s): DE-FG05-86ER-40272
Report No.(s): DOE/ER/40272-288; UFIFT-HEP-97-28; UPR-0773-T; HEP-TH-9711339; DE98-001990; No Copyright; Avail:

Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The realistic free fermionic models have had an intriguing success in explaining different properties of the observed particle spectrum. In this paper the authors discuss in some detail the anomalous U(1) symmetry which exists in these models. They study the properties of the anomalous U(1) in both the more realistic NAHE-based free fermionic models and those in a general NAHE class. Appearance of an anomalous U(1) in the more realistic NAHE models is shown to be an effect of reduction of world-sheet supersymmetry from (2,2) to (2,0). They show, however, that in more general (2,1) and (2,0) models, all U(1) can remain anomaly-free under certain conditions. Several phenomenological issues related to the anomalous U(1) are discussed. In particular, they note that in some examples the anomalous U(1) arises from the breaking E(sub 6) (yields) SO(10) (times) U(1)(sub A), resulting in U(1)(sub A) being family universal.

DOE

Models; Anomalies; Fermions; Grand Unified Theory; Supersymmetry

19980210722 Fermi National Accelerator Lab., Batavia, IL USA

Supersymmetry at the Tevatron?

Lammel, S., Fermi National Accelerator Lab., USA; Feb. 1998; 42p; In English; 13th; Thermophysical Properties, 22-27 Jun. 1997, Boulder, CO, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-98/055-E; CONF-970629; DE98-052298; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

These lectures contain an introduction to the search for supersymmetry at hadron colliders. The Tevatron is one of high-energy physics most sophisticated tools. The high center-of-mass energy of its proton-antiproton collisions makes it an ideal place to search for physics beyond the Standard Model, such as supersymmetry. Two experiments, CDF and D0, completed a long data taking period in summer of 1995, yielding over 100 pb(sup -1) of proton-antiproton interactions. The data recorded by the experiments are still being analyzed. The lectures outline the strategies in the search for supersymmetry at the Tevatron and examine the major analyses in detail. Results obtained by the two experiments are included where available.

DOE

Supersymmetry; Collisions; Particle Accelerators; Hadrons; Experiment Design

19980210723 Fermi National Accelerator Lab., Batavia, IL USA

Towards a string formulation of vortex dynamics

Elsebeth Schroeder, Bayreuth Univ., Germany; Ola Toernkvist, Fermi National Accelerator Lab., USA; Jan. 1998; 7p; In English; Solitons, Their Properties, Dynamics, Interactions, and Applications, 20-26 Jul. 1997, Kingston, Canada

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/391-A; CONF-9707150; DE98-052296; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We derive an exact equation of motion for a non-relativistic vortex in two- and three-dimensional models with a complex field. The velocity is given in terms of gradients of the complex field at the vortex position. We discuss the problem of reducing the field dynamics to a closed dynamical system with non-locally interacting strings as the fundamental degrees of freedom.

DOE

Equations of Motion; Vortices; String Theory

19980210802 Lawrence Livermore National Lab., Livermore, CA USA

STATTHERM: a statistical thermodynamics program for calculating thermochemical information

Marinov, N. M., Lawrence Livermore National Lab., USA; Mar. 1997; 37p; In English

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-ID-126775; DE98-052018; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A statistical thermodynamics program is presented which computes the thermochemical properties of a polyatomic molecule using statistical thermodynamic formulas. Thermodynamic data for substances involving C, H,O,N, and Cl elements are fitted into NASA polynomial form for use in combustion research or research where thermodynamical information is important.

DOE

Thermochemical Properties; Thermodynamics; Polyatomic Molecules; Computer Programs; Statistical Analysis

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19980206508 Naval Postgraduate School, Monterey, CA USA
Development of Spreadsheet Models for Forecasting Manpower Stocks and Flows
Earl, Michael G., Naval Postgraduate School, USA; Mar. 1998; 117p; In English
Report No.(s): AD-A344928; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The computerized manpower planning models developed in this thesis were designed to be used by students taking the Manpower Personnel Models course, OS4701, in the Manpower Systems Analysis Curriculum at the Naval Postgraduate School. The purpose of the course is to introduce students to some of the basic manpower modeling concepts and these models are the prime instruments toward achieving that goal. The models constructed using Microsoft Excel (Trademark) include a Markov Chain Model, a One Grade Vacancy model, a Multigrade Vacancy model with Non-Instantaneous Filling of Vacancies, and a Vacancy model with Instantaneous Filling of Vacancies. The models are designed to be run on personal computers with a Microsoft Windows 95 (Trademark) operating system. User's manuals and example problems are included for each model in the appendices.
DTIC
Computer Programs; Manpower; Computer Graphics; Management Methods; Models

19980209745 Royal Aeronautical Society, London, UK
Decision Support Analysis: Proceedings
1998; 72p; In English; Decision Support Analysis, 16 Jun. 1998, London, UK; Also announced as 19980209746 through 19980209753; ISBN 1-85768-059-6; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

Topics considered include: what is decision support; decision support and organization culture; managing organizational complexity; case study of decision support in technology management; modeling complex strategic conflicts; industry's future needs for decision support; future trends in decision support; and future thinking for decision analysis.
CASI
Decision Theory; Support Systems

19980209746 Brunel Univ., Dept. of Information Systems and Computing, Uxbridge, UK
What is Decision Support?
Paul, Ray J., Brunel Univ., UK; Decision Support Analysis: Proceedings; 1998; 4p; In English; Also announced as 19980209745; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

This paper looks at a variety of decision support approaches, including optimization, application package development, problem understanding, and problem investigation.
Author
Computer Programs; Decision Support Systems

19980209747 Fairtlough (Gerard), London, UK
Decision Support and Organization Culture
Fairtlough, Gerard, Fairtlough (Gerard), UK; 1998; 4p; In English; Also announced as 19980209745; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

Decision analysis can sometimes lead to a recommendation based on the facts of the situation which, however, does not work in practice. This is because the culture of the organization makes that particular decision hard to implement. The paper proposes that decision analysis has to take account, in an explicit fashion, the culture of the organization concerned. It suggests that a good way of doing this is to explore the mental models presently shared by members of the organization, and any new mental models that the decision may require.
Author
Decision Theory; Evaluation; Examination

19980209748 Defence and Evaluation Research Agency, Fareham, UK
Managing Organisational Complexity: Case Studies in Military Use of Decision Support Analysis
Richardson, Kurt A., Defence and Evaluation Research Agency, UK; Bartley, Richard, Defence and Evaluation Research Agency,

UK; 1998; 13p; In English; Also announced as 19980209745; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

As the connectivity of the business environment increases, as a result of rapid technological development, strategic decision making becomes more intricate. In making decisions, a diverse range of factors, both tangible and intangible, need to be considered. Some of these factors will be interdependent, creating a complicated intertwined net of causes and effects. Coping with the complexity of this 'problem space' provides considerable challenges for the decision-maker. Soft decision support tools provide a structured and, generally, transparent way of managing the complexity inherent in the current business environment. The key to understanding complex system behaviour, and managing the inescapable uncertainty associated with such organizational problems, is exploration of the possibility space. This paper will present a selection of soft systems tools that may be used to facilitate the decision making process, identifying both their strengths and shortcomings. In addition, three case studies demonstrating the application of these tools are reported.

Author

Management Methods; Decision Making; Computer Programs

19980209749 PA Consulting Group, London, UK

Case Study of Decision Support in Technology Management

Bowns, Steven, PA Consulting Group, UK; 1998; 32p; In English; Also announced as 19980209745; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

Uncertainty is an important feature in technology management. Softer judgement based tools are much more useful in uncertainty than quantitative models. These softer tools must be structured and applied carefully, as processes. Portfolio tools are central. They can show effective combinations of judgmental and quantitative factors, but they can be weak when used in isolation. A powerful integration between the parts of a toolset can add significant value for the client.

Derived from text

Decision Support Systems; Decision Making; Management Planning; Management Analysis

19980209750 Bath Univ., School of Management, Bath, UK

Modelling Complex Strategic Conflicts: A State-Based Transition-Centred Approach

Powell, John H., Bath Univ., UK; 1998; 11p; In English; Also announced as 19980209745; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

The strategic interactions between organisations have characteristics which make them particularly difficult to model and predict. As a result senior executives engaged in mergers and acquisitions or in major project planning and negotiation are generally poorly supported in their decision making. The conventional management and economics methods, including the extensive literature on game theory is either too general in its representation or is too specific and abstract in its embodiment. Strategic conflict/co-operation is characterised by a high degree of arbitrariness on the parts of participants, by defective and often deceptive communication and by its dynamic and complex nature. Frequently there are many players involved and the game is rarely zero sum. A framework is presented which allows the planning of such complex situations and, in particular, the prediction of the possible trajectories of the conflict, i.e. the possible directions in which a situation can develop. This two layered structure allows both generalized strategic planning using an essentially scenario-based approach and a more detailed planning method, known as Powergraph which allows the prediction of more specific situations. Both the general and the specific modelling approaches allow the identification of specific management action plans by which the situation can be manipulated in the interest of declared participants. The overall method has been applied extensively in practice and a digest of these applications is provided.

Author

Management Methods; Project Planning; Decision Making; Models

19980209751 British Airways, Heathrow, UK

Industry's Future Needs for Decision Support

Rapley, Keith, British Airways, UK; 1998; 4p; In English; Also announced as 19980209745; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

This paper argues that there are a wealth of ways in which decision support systems will help industry cope both with an increasing rate of pace of change and increasing uncertainty in the business environment.

Author

Decision Support Systems; Decision Making

19980209752 Brunel Univ., Dept. of Information Systems and Computing, Uxbridge, UK

Future Trends in Decision Support

Paul, Ray J., Brunel Univ., UK; 1998; 3p; In English; Also announced as 19980209745; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

This paper looks at the potential impact of the World Wide Web on Decision Support.

Author

World Wide Web; Decision Support Systems

19980209753 HVR Consulting Services Ltd., Alton, UK

Futures Thinking for Decision Analysis

Coyle, Geoff, HVR Consulting Services Ltd., UK; Decision Support Analysis: Proceedings; 1998; 13p; In English; Also announced as 19980209745; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); US Sales Only, Hardcopy, Microfiche

The theme of the paper is that, as decisions often have long-lasting effects, it would be imprudent not to attempt to 'model' the future. Being able to do so might enable one to make more robust, or future proof, choices. Several types of methodology for futures studies are reviewed. Most attention is given to scenario techniques. It is suggested that their advantage is the deployment of human imagination in a useful way. The classical scenario techniques have weaknesses and it is proposed that a variant called Field Anomaly Relaxation (FAR) may offer significant advantages. The FAR method is explained and illustrated by a case study. It is shown how FAR can add to multiple scenarios and an example is given of their ability to support robust, future proof, decisions.

Author

Decision Theory; Decision Making

19980210088 Argonne National Lab., IL USA

Performance evaluation for conflict resolution transaction management approach

Lee, J. C., Argonne National Lab., USA; Henschen, L. J., Northwestern Univ., USA; 1997; 20p; In English; 10th; Parallel and Distributed Computing, 1 - 3 Oct. 1997, New Orleans, LA, USA

Contract(s)/Grant(s): W-31-109-ENG-38

Report No.(s): ANL/DIS/CP-92960; CONF-971047-1; DE97-052986; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors continue their previous study on the conflict resolution approach to transaction management. They compare both time and space performance of their approach with those of other transaction management models. They use mathematical abstraction and calculation for the comparison.

DOE

Performance Tests; Data Bases; Data Processing; Mathematical Models

19980210388 Physics and Electronics Lab. TNO, The Hague, Netherlands

The Use of the Concept of "Direct" and "Indirect" in the Business Management of 760 Verzorgingscommando ***Het gebruik van de begrippen 'direct' en 'indirect' in de bedrifsvoering van 760 Verzoergingscommando***

vonBergh, C. J. W., Physics and Electronics Lab. TNO, Netherlands; Stoop, M. M., Physics and Electronics Lab. TNO, Netherlands; Oct. 1997; 47p; In Dutch

Contract(s)/Grant(s): A96KL767

Report No.(s): TNO-FEL-97-A175; TD76-0133; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., PO Box 96864, 2509 JG The Hague, The Netherlands); US Sales Only, Hardcopy, Microfiche

This report describes the results of an assignment for 760 Verzorgingscommando (Royal Netherlands Army). The reason was the ongoing, discussion about the use of the concepts of 'direct' and 'indirect' in the management of the organization. Concepts have been defined, reckoned with different areas of application in management. For a specific area, the determination of the number of personnel required, a method has been developed and tested in a case study.

Author

Management Methods; Personnel; Labor

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.

19980206479 Los Alamos National Lab., NM USA
Activities at Los Alamos for the optical model segment of the RIPL CRP
Young, P. G., Los Alamos National Lab., USA; May 10, 1997; 12p; In English; 3rd; Development of Reference Input Parameter Library for Nuclear Model Calculations of Nuclear Data, 26 - 29 May 1997, Trieste, Italy
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2450; CONF-9705179-; DE97-008838; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report discusses activity at Los Alamos on the nuclear optical model. In particular, the following topics are discussed: format of the optical model parameter library; contents of the library; validation of the optical model library; and conclusions and recommendations.
DOE
Nuclear Models; Optical Properties; Data Collection Platforms

19980206535 Sandia National Labs., Albuquerque, NM USA
Salvaging transient data with overloads and zero offsets
Smallwood, D. O., Sandia National Labs., USA; Cap, J. S., Sandia National Labs., USA; Oct. 21, 1997; 10p; In English; 68th; Shock and Vibration Symposium, 3 Nov. 1997, Baltimore, MD, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-1482C; CONF-971164-; DE98-001191; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors are sometimes presented with data with serious flaws, like overloads, zero shifts, and impulse noise, including much of the available pyrotechnic data. Obviously, these data should not be used if at all possible. However, they are sometimes forced to use these data as the only data available. Methods to salvage these data are discussed. Using the methods requires judgment, and the results must be accepted with the understanding that the answers are credible, not necessarily correct. None of the methods will recover information lost due to overloads or non-linearities of the data system. The best that can be accomplished is the recovery of data, after the data system has recovered from the overload. Several correction methods are discussed: high pass filtering of the data, correction with two forms of an exponential function, and a correction with the form t exp((minus)(alpha)t). Examples showing the results of the methods will be given using flawed pyrotechnic data.
DOE
Data Systems; Exponential Functions; Pyrotechnics; Chemical Explosions

19980206646 Los Alamos National Lab., NM USA
Physical Review Online Archives (PROLA)
Thomas, T., Los Alamos National Lab., USA; Davies, J., Los Alamos National Lab., USA; Kilman, D., Los Alamos National Lab., USA; Laroche, F., Los Alamos National Lab., USA; May 1997; 20p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2710; DE98-000884; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In cooperation with the American Physical Society, the Computer Research and Applications Group (CIC-3 -- see Section 13 for an acronym glossary) at Los Alamos National Laboratory has developed and deployed a journal archive system called, The Physical Review OnLine Archive (PROLA). It is intended to be a complete, full service on-line archive of the existing issues of the journal Physical Review from its inception to the advent of a full-service electronic version. The fundamental goals of PROLA are to provide screen-viewable and printable images of every article, full-text and fielded search capability, good browsing features, direct article retrieval tools, and hyperlinking to all references, errata, and comments. The research focus is on transitioning large volumes of paper journals to a modern electronic environment.
DOE
Documents; Information Dissemination; Information Systems

19980206752 Secure Computing Technology Corp., Roseville, MN USA

High Assurance Secure X.500 ***Final Report, May 1996 - Dec. 1997***

Murphy, Cornelia, Secure Computing Technology Corp., USA; OBrien, Dick, Secure Computing Technology Corp., USA; Thomsen, Don, Secure Computing Technology Corp., USA; Apr. 1998; 14p; In English

Contract(s)/Grant(s): F30602-96-C-0065; AF Proj. 7820

Report No.(s): AD-A345832; AFRL-IF-RS-TR-1998-55; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final report for the High Assurance Secure (HAS) X.500 program. It summarizes progress made on development of a high assurance, Multilevel Secure X.500 network directory server. The program was to develop an important enabling technology for building secure integrated network applications. Upon completion, the HAS X.500 system would have lowered operational costs and increased productivity by providing a high assurance networked database management system (DBMS) on the Secure Network Server LOCK 6 platform allowing connectivity between databases on networks at different classification levels and sharing of directory information between levels. The program consisted of four major components: (1) porting a trusted DBMS to a high assurance platform, porting an X.500 Directory Server Agent to a high assurance platform, developing a relational directory information base, and coordinating and (2) sharing progress with the security community. A majority of the DBMS port was completed prior to a redirection of the Defense Message System program which prompted an early termination for this program.

DTIC

Security; Networks; Productivity; Operating Costs; Defense Program; Data Base Management Systems; Data Processing

19980206757 Naval Postgraduate School, Monterey, CA USA

The Impact of Information Technology on Organizations: Implications for Organizational Integration and the Management of Information Technology

Burlingame, Stanley G., Naval Postgraduate School, USA; Mar. 1998; 97p; In English

Report No.(s): AD-A345908; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The goal of this thesis is two-fold. First, the paper explores and discusses how Information Technology (IT) is used as an integrative mechanism in organizations. Second, the paper suggests why organizations have experienced increased IT management requirements. The paper examines how Internet technology is used by companies to integrate operations. Supporting case studies of Wal-Mart and Calyx & Corolla are examined to determine the effectiveness of using IT as an integrative tool. Next, this research discusses how a buying versus building strategy has led to increased demands on IT management. Supporting case studies of SAP (Systems, Applications and Products) and British Petroleum are reviewed to determine if IT management will increase. This research concluded that IT is used as an integrative tool in organizations. Companies are using Internet technology to electronically link to other companies to form virtual organizations. In addition, IT is used as an effective means of collaborating and sharing information and knowledge in order to make decisions and innovate faster. Finally, although companies have achieved clear benefits of using IT for integration, there also have been negative repercussions. Using IT and adopting a buying strategy results in greater IT management requirements.

DTIC

Information Management; Information Systems; Internets; Information Resources Management

19980206761 Office of the Chief of Naval Operations, Director Test and Evaluation and Technology Requirements, Washington, DC USA

The 1997 Science and Technology Requirements Guidance (STRG)

Jul. 1997; 123p; In English

Report No.(s): AD-A346031; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Department of the Navy Science and Technology Requirements Guidance - the STRG - is published each year by the Director, Test and Evaluation and Technology Requirements (CNO-N09l) to provide guidance to the Office of Naval Research for the development of the Navy's science and technology investment plan. The Round Tables convened as part of this process are used by N09l as a forum to enhance and encourage communications between OPNAV, the Fleet and the technical community. Round Table I for 1997 was designed to build on the success of the 1996 STRG, with the goal of refining and improving the focus of the document to provide a sound basis for long range science and technology investment planning. Requirements priorities for each of the functional area chapters were established using a groupware voting system. Priorities are grouped into three broad tiers in each chapter. These priorities are guides to the Office of Naval Research (ONR) for developing the science and technology investment strategy. Final decisions for future funding priorities will be made on the basis of the existing investment strategy,

leveraged investments of other services and agencies, and the state of the art in available science and technology capabilities. Overarching concerns of the 1997 Round Table I were the issues of
DTIC
Research and Development; Technological Forecasting; Documentation

19980210023 Argonne National Lab., IL USA
Optimization environments and the NEOS server
Gropp, W., Argonne National Lab., USA; More, J. J., Argonne National Lab., USA; Mar. 1997; 16p; In English; 3rd; International Workshop on Short Term Experiments Under Strongly Reduced Gravity Conditions, 8-11 Jul. 1996, Bremen, Germany
Contract(s)/Grant(s): W-31109-eng-38
Report No.(s): ANL/MCS-P-654-0397; CONF-9607197-1; DE97-053059; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The authors are interested in the development of problem-solving environments that simplify the formulation of optimization problems, and the access to computational resources. Once the problem has been formulated, the first step in solving an optimization problem in a typical computational environment is to identify and obtain the appropriate piece of optimization software. Once the software has been installed and tested in the local environment, the user must read the documentation and write code to define the optimization problem in the manner required by the software. Typically, FORTRAN or C code must be written to define the problem, compute function values and derivatives, and specify sparsity patterns. Finally, the user must debug, compile, link, and execute the code. The Network-Enabled Optimization System (NEOS) is an Internet-based service for optimization providing information, software, and problem-solving services for optimization. The main components of NEOS are the NEOS Guide and the NEOS Server. The current version of the NEOS Server is described in Section 2. The authors emphasize nonlinear optimization problems, but NEOS does handle linear and nonlinearly constrained optimization problems, and solvers for optimization problems subject to integer variables are being added. In Section 4 the authors begin to explore possible extensions to the NEOS Server by discussing the addition of solvers for global optimization problems. Section 5 discusses how a remote procedure call (RPC) interface to NEOS addresses some of the limitations of NEOS in the areas of security and usability. The detailed implementation of such an interface raises a number of questions, such as exactly how the RPC is implemented, what security or authentication approaches are used, and what techniques are used to improve the efficiency of the communication. They outline some of the issues in network computing that arise from the emerging style of computing used by NEOS.
DOE
Applications Programs (Computers); Computer Information Security; Optimization; Linear Programming; Information Dissemination; Distributed Processing; Data Processing

19980210275 Argonne National Lab., IL USA
A layered architecture for critical database design
Chisholm, G. H., Argonne National Lab., USA; Swietlik, C. E., Argonne National Lab., USA; 1997; 12p; In English; Afcea-dod Database Colloquium ’97, 8 - 10 Sep. 1997, San Diego, CA, USA
Contract(s)/Grant(s): W-31-109-ENG-38
Report No.(s): ANL/DIS/CP-94400; CONF-9709167; DE97-054216; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Integrity, security, and safety are desired properties of database systems destined for use in critical applications. These properties are desirable because they determine a system’s credibility. However, demonstrating that a system does, in fact, preserve these properties when implemented is a difficult task. The difficulty depends on the complexity of the associated design. The authors explore architectural paradigms that have been demonstrated to reduce system complexity and, thus, reduce the cost associated with certifying that the above properties are present in the final implementation. The approach is based on the tenet that the design is divided into multiple layers. The critical functions and data make up the bottom layer, where the requirements for integrity, security, and safety are most rigid. Certification is dependent on the use of formal methods to specify and analyze the system. Appropriate formal methods are required to support certification that multiple properties are present in the final implementation. These methods must assure a rigid mapping from the top-level specification down through the implementation details. Application of a layered architecture reduces the scope of the design that must be formally specified and analyzed. This paper describes a generic, layered architecture and a formal model for specification and analysis of complex systems that require rigid integrity security, and safety properties.
DOE
Complex Systems; Data Bases; Cost Reduction

19980210297 Department of the Navy, Washington, DC USA

Compression of Hyperdata With Orasis Multisegment Pattern Sets (CHOMPS)

Antoniades, John A., Inventor, Department of the Navy, USA; Baumback, Mark M., Inventor, Department of the Navy, USA; Bowles, Jeffrey H., Inventor, Department of the Navy, USA; Grossman, John M., Inventor, Department of the Navy, USA; Haas, Daniel G., Inventor, Department of the Navy, USA; Mar. 06, 1998; 40p; In English

Patent Info.: Filed 6 Mar. 1998; US-Patent-Appl-SN-035909

Report No.(s): AD-D018893; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The Compression of Hyperdata with ORASIS Multisegment Pattern Sets, (CHOMPS), system is a collection of algorithms designed to optimize the efficiency of multispectral data processing systems. The CHOMPS system employs two types of algorithms, Focus searching algorithms and Compression Packaging algorithms. The Focus algorithms employed by CHOMPS reduce the computational burden of the prescreening process by reducing the number of comparisons necessary to determine whether or not data is redundant, by selecting only those exemplars which are likely to result in the exclusion of the incoming sensor data for the prescreener comparisons. The Compression Packaging algorithms employed by CHOMPS, compress the volume of the data necessary to describe what the sensor samples. In the preferred embodiment these algorithms employ the Prescreener, the Demixer Pipeline and the Adaptive Learning Module Pipeline to construct a compressed data set. The compression is realized by constructing the data set from the exemplars defined in the prescreening operation and expressing those exemplars in wavespace with the necessary scene mapping data, or further processing the exemplars through the adaptive learning pipeline and expressing the exemplars in terms of endmembers, to facilitate the efficient storage, download and the later reconstruction of the complete data set with minimal deterioration of signal information.

DTIC

Data Compression; Signal Processing; Algorithms; Data Processing Equipment

19980210367 Fermi National Accelerator Lab., Batavia, IL USA

The Fermilab physics class library

Fischler, M., Rice Univ., USA; Brown, W., Rice Univ., USA; Gaines, I., Rice Univ., USA; Kennedy, R.D., Rice Univ., USA; Marraffino, J., Rice Univ., USA; Michelotti, L., Rice Univ., USA; Sexton-Kennedy, E., Rice Univ., USA; Yoh, J., Rice Univ., USA; Adams, D., Rice Univ., USA; Paterno, M., Rochester Univ., USA; Feb. 1997; 6p; In English; Computing In High Energy Physics, 7-12 Apr. 1997, Berlin, Germany

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/040; CONF-970410; DE97-052735; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Fermilab Physics Class Library Task Force has been formed to supply classes and utilities, primarily in support of efforts by CDF and D0 toward using C++. A collection of libraries and tools will be assembled via development by the task force, collaboration with other HEP developers, and acquisition of existing modules. The main emphasis is on a kit of resources which physics coders can incorporate into their programs, with confidence in robustness and correct behavior. The task force is drawn from CDF, D0 and the FNAL Computing and Beams Divisions. Modules-containers, linear algebra, histograms, etc.-have been assigned priority, based on immediate Run II coding activity, and will be available at times ranging from now to late May.

DOE

Subroutine Libraries (Computers); Coding; Conferences

19980210486 Army War Coll., Carlisle Barracks, PA USA

Information: An Independent Element of National Power

Sasser, Walter I., Army War Coll., USA; May 13, 1998; 43p; In English

Report No.(s): AD-A346385; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper posits that information is the only independent element of power. As such the traditional elements of power, diplomatic, economic and military, are derived from the informational element of power. to support this thesis, the paper reviews current views of information, message, means, and matter. With this understanding, it considers the evolution and purpose of the national security apparatus. This paper then turns to a review of the elements of power. It concludes by restating the thesis ”information is the only independent element of power” and offers national policy makers recommendations to address the misapplication of information.

DTIC

Information Theory; Security

19980210488 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Unclassified Publications of Lincoln Laboratory, Volume 23, *1 Jan. - 31 Dec. 1997*

Means, Patricia A., Massachusetts Inst. of Tech., USA; Seidel, Robert C., Massachusetts Inst. of Tech., USA; Dec. 31, 1997; 56p; In English

Contract(s)/Grant(s): F19628-95-C-0002

Report No.(s): AD-A346370; ESC-TR-97-104-VOL-23; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This current report, Volume 23 of Unclassified Publications of Lincoln Laboratory, lists reports published from 1 January to 31 December 1997, as well as updated information on earlier publications.

DTIC

Bibliographies; Documents

19980210517 NASA Langley Research Center, Hampton, VA USA

NASA Thesaurus Supplement, Supplement 1

Jul. 1998; 15p; In English

Report No.(s): NASA/SP-1998-7501/SUPPL1; NAS 1.21:7501/SUPPL1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The three-part cumulative NASA Thesaurus Supplement to the 1998 edition of the NASA Thesaurus includes the following: (1) Hierarchical Listing; (2) Rotated Term Display; and (3) Changes. The semiannual supplement gives complete hierarchies for new terms. Definitions are included in Part 1 and uppercase/lowercase forms are provided in both Parts 1 and 2.

Derived from text

Hierarchies; Thesauri; Supplements

19980210593 Los Alamos National Lab., NM USA

Semantic representations for collaborative, distributed scientific information systems

Kantor, M., Los Alamos National Lab., USA; Joslyn, C., Los Alamos National Lab., USA; Kantor, M., Los Alamos National Lab., USA; [1997]; 8p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2398; DE97-008603; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

It is vital for Los Alamos to respond to the challenge presented by the ongoing revolution in Information Science and Technology. Distributed Information Systems (DIS) are having a profound affect not only in science, but in society in general. In view of their increasing role in the management of scientific information, in national security and intelligence, and certainly as objects of scientific inquiry themselves, these DIS need to be designed and studied from a scientific perspective. The technological developments over the last ten years, the Internet and the World-Wide Web (www) in particular, have been breakthroughs, allowing for the construction of non-linear, hypertextually based, DIS. and yet most of these DIS are still constructed by hand, and have the properties and architectures of the prior paradigm based on books and libraries, with strictly hierarchical categorization designed with many hours of human effort. Our broader vision is based on an organismal model where DIS are adaptable and evolutionary, scalable, highly connected, high dimensional, resilient, and admitting to many complementary views and orderings. The key development necessary to support this view is the representation of semantic information in DIS. We propose a set of software developments and experiments which will both construct novel DIS with explicit semantic representations, and measure the semantic properties of existing DIS. For DIS design, we propose an architecture called Semantic Webs, where a binary multigraph representation relates a number of nodes according to a variety of semantic categories, each partially ordered. The ontological relations among the semantic categories allows a dynamic among them, and thus for the DIS to be self-modifying and adaptive, suggesting new links as a form of inference. These structures will be implemented as Java add-ons in existing browsers. Semantic categories will be represented as hypertext links, with type indicated by anchor color.

DOE

Information Systems; Research and Development; Technologies; Design Analysis; Distributed Processing; Data Processing

19980210651 Hollandse Signaalapparaten N.V., Applied Systems Research Dept., Hengelo, Netherlands

TA10: Advanced Information Processing for Multisensory Systems. IEPG Cooperative Technological Programs: Technological Area 10

deLeeuw, Charles, Hollandse Signaalapparaten N.V., Netherlands; Chalmeton, Vincent, Thomson-CSF, France; Multi-Sensor Systems and Data Fusion for Telecommunications, Remote Sensing and Radar; Apr. 1998; 12p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Real-time interpretation of large amounts of battlefield information by both operator and system is increasingly difficult due to steadily growing complexity, and integration of systems. Therefore data fusion, i.e. combining data from several sources in order to obtain a global and coherent view on the battlefield, both at sensor level (multi sensor data fusion) and at abstract, strategic information level (information fusion), becomes more important. In this paper we will describe the different concepts used for the multi sensor data fusion processes, and the distributed asynchronous software architecture chosen. Furthermore, the interaction between Data Fusion, Situation Assessment and Sensor/Platform Management will be explained in order to Sensors/Platforms illustrate the applied technologies for advanced information processing for multisensory systems. In the paper some of the first results from this on-going project will be presented.
Author (revised)
Real Time Operation; Warfare; Information Systems; Data Flow Analysis

19980210652 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Lancashire, UK
Aircraft Sensor Data Fusion: An Improved Process and the Impact of ESM Enhancements
Noonan, C. A., British Aerospace Public Ltd. Co., UK; Pywell, M., British Aerospace Public Ltd. Co., UK; Multi-Sensor Systems and Data Fusion for Telecommunications, Remote Sensing and Radar; Apr. 1998; 10p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

British Aerospace Military Aircraft and Aerostructures (BAe MA&A) has conducted various studies on the topic of Data Fusion. This paper highlights developments which, it is thought, offer a significant step towards optimum situation awareness. It examines sensor data quality, the fusion process and method function. The paper also examines the key issues affecting quality of track data fed into the fusion process by Electronic Support Measures systems (ESM), the prime threat identity data. Emitter recognition and location issues are discussed and potential routes are proposed to attain the necessary performance increases to support optimum situation However, lack of adherence to a known plan is not a conclusive awareness.
Author
Multisensor Fusion; Emitters; Remote Sensing; Aircraft Production

19980210656 Royal Military Academy, Signal and Image Centre, Brussels, Belgium
Data Fusion for Long Range Target Acquisition
Verlinde, Patrick, Royal Military Academy, Belgium; Borghys, Dirk, Royal Military Academy, Belgium; Perneel, Christiaan, Royal Military Academy, Belgium; Acheroy, Marc, Royal Military Academy, Belgium; Apr. 1998; 10p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

An approach to the long range automatic detection of vehicles, using multi-sensor image sequences is presented. The algorithm we use was tested on a database of six sequences, acquired under diverse operational conditions. The vehicles in the sequences can be either moving or stationary. The sensors are stationary, but can perform a pan/tilt operation. The presented paradigm uses data fusion methods at four different levels (feature level, sensor level, temporal level and decision level) and consists of two parts. The first part detects targets in individual images using a semi-supervised approach. For each type of sensor a training image is chosen. On this training image the target position is indicated. Textural features are calculated at each pixel of this image. Feature level fusion is used to combine the different features in order to find an optimal discrimination between target and non-target pixels for this training image. Because the features are closely linked to the physical properties of the sensors, the same combination of features also gives good results on the test images, which are formed of the remainder of the database sequences. by applying feature level fusion, a new image is create in which the local maxima correspond to probable target positions. These images coming from the different sensors are then combined in a multi-sensor image using sensor fusion. The local maxima in this multi-sensor image are detected using morphological operators. Any available prior knowledge about possible target size and aspect ratio is incorporated using a fusion (also called score or measurement level fusion), medium region growing procedure around the local maxima. A variation to this approach, that will also be developed in this paper, combines the previous feature and sensor level fusion, by extracting the features in each sensor as before but using the from all sensors in what is sometimes called a <super feature vector>>. Tracking is used in both cases to reduce the false alarm rate.
Author
Multisensor Applications; Warfare; Target Acquisition; Multisensor Fusion; Morphology

19980210663 Forschungsinstitut fuer Informationsverarbeitung und Mustererkennung, Ettlingen, Germany
Multisensor Data Fusion for Automatic Recognition of High Value Surface Targets
Bers, K.-H., Forschungsinstitut fuer Informationsverarbeitung und Mustererkennung, Germany; Essen, H., Forschungsinstitut fuer Hochfrequenzphysik, Germany; Jaeger, K., Forschungsinstitut fuer Informationsverarbeitung und Mustererkennung, Germany; Schimpf, H., Forschungsinstitut fuer Hochfrequenzphysik, Germany; Apr. 1998; 8p; In English; Also announced as

19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper describes a system for surveillance and target recognition for autonomous stand-off weapons based on the interpretation of multisensor data in combining the individual sensor channels to optimize the system performance by intelligent fusion techniques. to meet this demand, we propose a model-based method for the automatic recognition of high value fixed or relocatable surface targets like bridges, airfields, industrial installations and command posts. A production net is used to represent the knowledge about target structures. The analysis is carried out by a knowledge based classification system. Starting with primitive objects extracted separately from each individual sensor channel (low-level-processing), more complex parts are composed step by step until the target object is recognized (high-level-processing). The radar preprocessing comprises a thresholding prescreener and a subsequent feature based discrimination stage, the features making use of polarimetric and geometric properties, and of scattering center statistics. The IR-preprocessing is more related to geometric and structural features like line elements, corners and circles. to enhance the detection probability, in the low level stage a high false alarm rate is accepted as regards the primitive objects. The reduction of the false alarm rate is done in the high level stage by the spatial fusion of 2D- or 3D-structures and by using additional context information of the target environment. The purpose of this paper is to address the state of the algorithms for automatic recognition of high value surface targets. For this, sensor data have been interpreted which were recorded with an imaging infrared sensor and a coherent, polarimetric, high range resolution radar. to enable the spatial fusion process, the raw sensor data were registered together with inertial data of the aircraft. The efficiency of the analysis system is demonstrated by an example involving the detection of command posts. The results show the suitability of the method for future autonomous stand-off weapon systems like drones and missiles with imaging sensors.

Author

Multisensor Fusion; Multisensor Applications; Autonomy; Target Recognition; Surveillance; Weapon Systems; Infrared Detectors; Detection

19980210674 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

Use of Contextual Information in Multiple Sensor Tracking ***Utilisation d'Informations Contextuelles dans des Algorithmes de Pistage Multicapteur***

Nimier, Vincent, Office National d'Etudes et de Recherches Aerospatiales, France; Apr. 1998; 13p; In French; Also announced as 19980210650; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this article we propose a method which allows one to combine symbolic data with numerical data. In order to do this, we propose a process of estimation controlled by a context analysis level. The application anticipated is the merging of data and the algorithms which are inserted in the multiple sensor systems. These algorithms must be designed so that the system will function in a nominal way under all conditions. In order to achieve this, the system must be capable of adjusting, so that at any moment the evaluation will take into account the context in question. The result will be to make available, in certain contexts, the measurements coming from the sensors in nominal condition of functioning and of reducing the importance of the ones which are aberrational in light of certain criteria which are established in advance by an expert.

Author

Numerical Analysis; On-Line Systems

19980210675 MATRA Systemes and Information, Direction des Filieres Technologiques, Val de Reuil, France

SAGESSE: A Model of Data Representation for the Merging of Symbolic Data ***SAGESSE: Un Modele de Representation de Donneespour la Fusion de Donnees Symboliques***

Pollet, Yann, MATRA Systemes and Information, France; Robidou, Sebastien, MATRA Systemes and Information, France; Apr. 1998; 11p; In French; Also announced as 19980210650; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A system of symbolic data merging has the goal of developing and processing at any moment the most complete, exact and coherent possible image of an external world during its evolution, called the situation, from uncertain, incomplete and imprecise input data. The modeling of a situation requires representation of the concept of imprecision on the characteristics of the perceived objects, the idea of doubt as to the existence of an object, but also the representation of the hypothetical information used during the reasoning. We present in this report a formal approach which allows one to integrate in a unified way these different ideas in a single representational model, providing them with a precise semantic base. We then describe the application for this approach and the pilot implementation which was carried out under the international program DFD (Data Fusion Demonstrator).

Author

Data Conversion Routines; Data Integration; Data Systems

19980210676 Liege Univ., Lab. SURFACES, Belgium

Adaptive Intensity Matching Filters: A New Tool for Multi-Resolution Data Fusion

deBethune, S., Liege Univ., Belgium; Muller, F., Liege Univ., Belgium; Binard, M., Liege Univ., Belgium; Multi-Sensor Systems and Data Fusion for Telecommunications, Remote Sensing and Radar; Apr. 1998; 15p; In English; Also announced as 19980210650

Contract(s)/Grant(s): OSTC-T3/12/47; OSTC-IN-CH-005; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Many different multiresolution fusion methods have been proposed in the literature. An important actual aim in this field of research is to produce colour composites of multiresolution data preserving both the essential spatial information of the high resolution image and the spectral information content of the low resolution channels, so as to produce pseudo high resolution spectral channels which can be further processed for improved classification or other information extraction purposes. The best integration results in this regard have been obtained by the HPF algorithm and by a new fusion method based on multiresolution analysis of the images using the wavelet transform. A new methodology based on adaptive intensity matching filters using local image statistics to spectrally adjust high resolution images to the radiometry of low resolution channels is described in this paper. The algorithm tends to equalize the mean (LMM algorithm) or the mean and the variance (LMVM algorithm) of the high resolution image with those of the low resolution channels, on a pixel by pixel basis, from the values measured within a local window around each pixel position. The INR (Intensity Normalised Ratio) transform, as defined in this paper, is a fast alternative to the RGB-IHS-RGB transform, and allows an efficient implementation of the intensity matching fusion method, generalised to images with more than three channels. These algorithms are applied to a 1024 x 1024 window extract of a high resolution (5m) KOSMOS KVR 1000 panchromatic image to be fused with a registered low resolution (20 m) SPOT XS image, obtained over the city of Liege (Belgium). The results obtained for varying filtering window sizes are compared with the HPF filter and the wavelet transform applied to the same set of images.

Author

Adaptive Filters; Multisensor Fusion; Image Resolution; High Resolution

19980210677 Defence Research Establishment Valcartier, Decision Support Technology Section, Val Belair, Quebec Canada

The Fusion of Organic and Non-Organic Identity Information Sources Using Evidential Reasoning

Bosse, Eloi, Defence Research Establishment Valcartier, Canada; Roy, Jean, Defence Research Establishment Valcartier, Canada; Paradis, Stephane, Defence Research Establishment Valcartier, Canada; Apr. 1998; 12p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The aim of this paper is to explore the problem of identity data fusion in the context of naval warfare where commanders and their staff require access to a wide range of information to carry out their duties. With the increasing use of the remote sources and the increasing use of information that has already been fused, there is a requirement to define an identity data fusion function that can handle organic and non-organic, local and remote types of information characterized by different accuracy and timeliness. This paper is a step towards the definition of an architecture that can perform the fusion of organic and non-organic identity data through the use of statistical analysis rooted in the Dempster-Shafer theory of evidence. The goal is to offer the decision maker a quantitative analysis based on statistical methodology that can enhance his/her decision making process regarding the identity of detected objects.

Author

Organic Materials; Quantitative Analysis; Multisensor Fusion

19980210678 Office National d'Etudes et de Recherches Aerospatiales, Complexe Scientifique de Rangueil, Toulouse, France

Pixel Fusion for Roads Detection and Classification

Fabre, S., Office National d'Etudes et de Recherches Aerospatiales, France; Briottet, X., Office National d'Etudes et de Recherches Aerospatiales, France; Marthon, P., Ecole Nationale Superieure d'Electronique d'Informatique et d'Hydraulique, France; Appriou, A., Office National d'Etudes et de Recherches Aerospatiales, France; Apr. 1998; 9p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The opportunity to process several images being acquired simultaneously over the same landscape in different spectral hands provides a better perception of the scene using data fusion methods. This new method classifying the image in two types (target and background) using the radiometric properties of the surface, is particularly powerful for the detection of non resolved objects. The fusion method is defined by using the normal probability density hypothesis to estimate the of each initial image The classification is done hy using a threshold where analytic expression depends on the type of the a priori knowledge. The method is then applied on an image acquired with the hyperspectral scanner sensor: AVIRIS. The chosen target is a non resolved road in one

dimension. Different criteria are used to evaluate the performance of the method: statistical properties, good classification percentage, false alarm and non detection errors. We analyze the a priori probability uncertainty on the image obtained after fusion.
Author
Pixels; Multisensor Fusion; Airborne Equipment; Image Classification

19980210679 Physics and Electronics Lab. TNO, The Hague, Netherlands
Sensor Synergetics: The Design Philosophy of the Sensor Fusion Demonstrator and Testbed (SFD) at TNO-FEL
vanderWal, A. J., Physics and Electronics Lab. TNO, Netherlands; Apr. 1998; 26p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Although the potential of sensor and data fusion as a way to improve situation awareness nowadays is widely regarded as a valuable tool by the military R&D community, there is still little quantitative evidence available that supports the acclaimed benefits of generic fusion methodologies and thus justifies their application. It is therefore legitimate to ask how much value sensor fusion adds to the observation process. In case studies this question is seldom addressed and it is therefore tempting to ask, whether the acclaimed advantages of sensor fusion are 'hype' or real. In this paper we will try to identify in what situation the application of sensor fusion techniques may be beneficial and which sensor fusion techniques seem to be among the most promising. The starting point of our discussion is the observation that the added value of fusion of similar sensors must originate from a nonlinear combination of sensor data streams. This observation naturally gives rise to the application of novel nonlinear models, e.g. from the area of softcomputing, viz. fuzzy logic, neural networks and evolutionary programming. In addition a trend in research can be observed to apply fusion techniques almost exclusively to 'high-level' fusion (i.e. levels 2 and 3 of the JDL data fusion process model), implicitly considering fusion on the sensor level to be much less of a challenge. Motivated by the fact that high quality primary data are of paramount importance to the success of all subsequent signal processing stages, we argue against this view in this paper. In contrast to the classical data fusion approach, at TNO-FEL it was decided to start up a sensor fusion approach, in which an integrated approach towards sensor optimization, sensor management, and early fusion is pursued. Only in this way one may hope to attain the goal of sensor fusion, viz. an improved situation assessment. Concentrating on the primary information sources, i.e. the sensors, and using their synergy at the earliest stages of signal processing, inevitably forces one to invest in state-of-the art data-acquisition and real-time (pre)processing facilities. This will be illustrated by discussing some of the design issues of the FEL sensor fusion demonstrator (SFD) testbed. The SFD project has been started up by the end of 1996 and initial concepts have meanwhile been defined. The hardware and software concepts of this testbed will be described as well as the functionality that we hope to implement.
Author
Multisensor Fusion; Imaging Techniques; Signal Processing; Terrain Analysis; Information Systems; Data Acquisition

19980210680 Defence Evaluation Research Agency, Malvern, UK
The NEMESIS Identification Data Fusion Demonstrator
Griffith, P. N., Defence Evaluation Research Agency, UK; Hooper, L. A., Defence Evaluation Research Agency, UK; Everitt, W. M., Defence Evaluation Research Agency, UK; Apr. 1998; 7p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The NEMESIS programme at DERA Malvern was instituted to investigate aspects of multi-sensor, single node data fusion applied to the task of air target identification (ID) in the military environment. In recent years, a reduction of force numbers combined with the introduction of more capable weapon systems, such as precision guided weapons and beyond visual range missiles has made the requirement for accurate, timely, reliable and robust target identification a high priority for air defence forces. After much research during the last 25 years into ID technologies and techniques, it is generally conceded that no single identification technology or system can now nor will, in the foreseeable future, satisfy all the operational capabilities and performance requirements needed from air target identification systems. The enforced use of several identification sensors and sources implies the need for the fusion of the ID data derived from these different sensors and sources. Studies have indicated that automated ID fusion is likely to provide accuracy, consistency, timeliness and manpower benefits. The NEMESIS programme, sponsored by the UK MoD, has investigated the application of a dedicated NATO air target ID data fusion algorithm, NATO STANAG 4162, to a multi-sensor, single node SHOrt Range Air Defence (SHORAD) demonstrator system. This paper describes the demonstrator package, the sensors, the fusion process and the results.
Author
Multisensor Applications; Multisensor Fusion; Weapon Systems; Missiles

19980210683 Environmental Research Inst. of Michigan, Ann Arbor, MI USA

Imagery and Signals Intelligence Data Fusion: Issues and Methods

Waltz, Edward L., Environmental Research Inst. of Michigan, USA; Hart, Jerry, BTG, Inc., USA; Apr. 1998; 11p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Imagery and Signals Intelligence (IMINT and SIGINT) data sources and processing have traditionally followed independent channels, with cross use of the information being achieved only by manual human interaction between users at the end of their respective channels. The characteristics of each of these sources are quite different, making automatic correlation of the data a challenging task, but the rewards of correlated data hold the promise for more accurate and robust surveillance than now available from either independent source. IMINT, for example, is characterized by a low revisit rate, high spatial fidelity and broad spatial context, while SIGINT provides a high revisit rate, low spatial fidelity and a broad temporal context. This paper describes the specific issues that face designers who seek to automatically fuse imagery and signal data - and the methods used to overcome the obstacles posed by the fundamental differences in the data types. Four areas of IMINT-SIGINT fusion are addressed: 1) fusion for cross-cueing and sensor management, 2) fusion for improved target geolocation, 3) fusion for increased target detection and identification confidence, and, 4) fusion for improved visualization of the battlefield. The paper provides examples illustrating future solutions using terrain data, UAV imaging sensors, and real-time-in-cockpit (RTIC) techniques illustrated by ERIM-developed technologies. The integration of these capabilities into joint intelligence systems is illustrated by BTG-developed technologies. The paper addresses two of the specific topics listed in the AGARD call for papers: 1) Applications of multiple sensors and data fusion in - target recognition and surveillance, 2) Sensor data networks across imaging and non-imaging sensors.
Author

Imaging Techniques; Data Processing; Imagery; Multisensor Fusion; Surveillance; Target Acquisition; Target Recognition

19980210685 Defence Evaluation Research Agency, Command Systems Dept., Malvern, UK

The NATO Data Fusion Demonstrator Project

Skinner, J. M., Defence Evaluation Research Agency, UK; Apr. 1998; 8p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper defines data fusion in the context of the land battle and the military intelligence cycle, it describes the NATO Data Fusion Demonstrator concept and the key aspects of the current design and concludes with a description and evaluation of the results achieved to-date.
Author

Multisensor Fusion; Imaging Techniques; Remote Sensing; Signal Processing

19980210688 Office National d'Etudes et de Recherches Aerospatiales, Ingenieur de Recherche, Paris, France

Combining of Information and Physical Network for the Sol-Air Multi-Sensor System ***Fusion d'Informations et Reseaux Physiques pour les Systemes Multi-Senseurs Sol-Air***

Nahum, C., Office National d'Etudes et de Recherches Aerospatiales, France; Apr. 1998; 8p; In French; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The work conducted for the Computation of the Arienne Group of Defense Coordination of DRET (Defense Research and Technology) presents a methodology for the configuration, evaluation and improvement of the sol-air multi-sensor systems of the SACP type. They are being solidified by the Development of ROSACE (Research for the Optimization of Systems, Anti-aeriens Evaluation Concept) are described. The first part of the document presents the ROSACE logic. The second part is dedicated to the problem of achieving basic information of the multi-sensor system. In particular, the conditions of compatibility between the algorithmic logic and the physical communication system are studied.
Author

Information Systems; Multisensor Applications; Networks

19980210690 Institute for Human Factors TNO, Soesterberg, Netherlands

Fusion of Visible and Thermal Imagery Improves Situational Awareness

Toet, A., Institute for Human Factors TNO, Netherlands; IJspeert, J. K., Institute for Human Factors TNO, Netherlands; Waxman, A. M., Massachusetts Inst. of Tech., USA; Aguilar, M., Massachusetts Inst. of Tech., USA; Apr. 1998; 12p; In English; Also announced as 19980210650; Original contains color illustrations

Contract(s)/Grant(s): F19628-95-C-0002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A new colour image fusion scheme is applied to visible and thermal images of military relevant scenarios. An observer experiment is performed to test if the increased amount of detail in the fused images can improve the accuracy of observers performing a detection and localisation task. The results show that observers can localise a target in a scene (1) with a significantly higher

accuracy, and (2) with a greater amount of confidence when they perform with fused images (either gray or colour fused), compared to the individual image modalities (visible and thermal).
Author
Thermal Mapping; Image Converters; Image Resolution; Imagery

19980210769 NASA Langley Research Center, Hampton, VA USA
Buckets: Aggregative, Intelligent Agents for Publishing
Nelson, Michael L., NASA Langley Research Center, USA; Maly, Kurt, Old Dominion Univ., USA; Shen, Stewart N. T., Old Dominion Univ., USA; Zubair, Mohammad, Old Dominion Univ., USA; May 1998; 12p; In English
Report No.(s): NASA/TM-1998-208419; L-17753; NAS 1.15:208419; ODUTR-97-41; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Buckets are an aggregative, intelligent construct for publishing in digital libraries. The goal of research projects is to produce information. This information is often instantiated in several forms, differentiated by semantic types (report, software, video, datasets, etc.). A given semantic type can be further differentiated by syntactic representations as well (PostScript version, PDF version, Word version, etc.). Although the information was created together and subtle relationships can exist between them, different semantic instantiations are generally segregated along currently obsolete media boundaries. Reports are placed in report archives, software might go into a software archive, but most of the data and supporting materials are likely to be kept in informal personal archives or discarded altogether. Buckets provide an archive-independent container construct in which all related semantic and syntactic data types and objects can be logically grouped together, archived, and manipulated as a single object. Furthermore, buckets are active archival objects and can communicate with each other, people, or arbitrary network services.
Author
Subroutine Libraries (Computers); Architecture (Computers); Semantics; Data Storage; Documents; Software Development Tools

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LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

19980209700 Leicester Univ., UK
A Large Area MCP Detector for X-Ray Imaging
Lees, J. E., Leicester Univ., UK; Pearson, J. F., Leicester Univ., UK; Nuclear Instruments and Methods in Physics Research. Section A: Accelerators, Spectrometers, Detectors and Associated Equipment; 1997; ISSN 0168-9002; Volume 384, pp. 410-424; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We report on the X-ray performance of an imaging detector utilizing a pair of 100 mm by 100 mm square microchannel plates. Gain and spatial uniformity are described, as are the imaging characteristics of the detector which uses a large format resistive anode readout. We also report on the uniformity of the quantum efficiency of the detector coated with a CsI photocathode. Background noise count rates are compared for 100 mm by 100 mm square microchannel plates manufactured from ”standard” and radioisotope free glasses. Application of the large area detector to non-astronomy research, including imaging of ”Lobster-Eye” type lenses and beta autoradiography are discussed.
Author
Microchannel Plates; Imaging Techniques; X Ray Imagery

88
SPACE SCIENCES (GENERAL)

19980206462 NASA Marshall Space Flight Center, Huntsville, AL USA
Life and Microgravity Spacelab (LMS) ***Final Report***
Downey, James Patton, Compiler, NASA Marshall Space Flight Center, USA; Feb. 1998; 624p; In English; Life and Microgravity Spacelab (LMS) One Year Science Review Meeting, 20-21 Aug. 1997, Montreal, Canada; Sponsored by Canadian Space Agency, Canada; Also announced as 19980206463 through 19980206470

Report No.(s): NASA/CP-1998-206960; M-854; NAS 1.55:206960; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This document reports the results and analyses presented at the Life and Microgravity Spacelab One Year Science Review meeting. The science conference was held in Montreal, Canada, on August 20-21, 1997, and was hosted by the Canadian Space Agency. The LMS payload flew on the Space Shuttle Columbia (STS-78) from June 20 - July 7, 1996. The LMS investigations were performed in a pressurized Spacelab module and the Shuttle middeck. Forty scientific experiments were performed in fields such as fluid physics, solidification of metals, alloys, and semiconductors, the growth of protein crystals, and animal, human, and plant life sciences. The results demonstrate the range of quality science that can be conducted utilizing orbital laboratories in microgravity.

Author

Conferences; Microgravity; Gravitational Effects; Spaceborne Experiments; Manned Space Flight; Space Processing; Life Sciences; Materials Science; Physiological Responses; Space Shuttles; Space Transportation System; Laboratories; Space Laboratories

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ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

19980209678 Oxford Univ., Nuclear and Astrophysics Lab., Oxford UK

Long-Term X-Ray Variability in GX 354-0

Kong, A. K. H., Oxford Univ., UK; Charles, P. A., Oxford Univ., UK; Kuulkers, E., Oxford Univ., UK; 1998; 12p; In English

Report No.(s): OUAST/98/10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

We report for the first time the detection of long-term X-ray variability in the bright bulge source GX 354-0 (=4U 1728-34) observed with the All Sky Monitor (ASM) on board the Rossi X-Ray Timing Explorer (RXTE). The 2-year RXTE ASM database reveals significant power at approx. 72 days. Similar behaviour was seen in the 6-year Ariel 5 ASM database, but at a period of approx. 63 days. The timescales and light curves resemble the approx. 78 days modulation seen in Cyg X-2 and we therefore interpret this modulation in GX 354-0 as a super-orbital effect.

Author

X Ray Timing Explorer; Variability; Cygnus Constellation; Ariel 5 Satellite

19980210380 Fermi National Accelerator Lab., Batavia, IL USA

QSO color selection in the SDSS

Newberg, H. J., Fermi National Accelerator Lab., USA; Yanny, B., Fermi National Accelerator Lab., USA; Jan. 1998; 4p; In English; IAU Symposium 179 on New Horizons from Multi-wavelength Sky, 26-30 Aug. 1997, Baltimore, MD, USA

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-98/036-A; CONF-9708149; DE98-051892; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Sloan Digital Sky Survey (SDSS) will image 10,000 square degrees in the north galactic cap in five filters. We hope to identify and obtain spectra for about 100,000 quasars brighter than 20th magnitude in this area. The selection will be primarily on the basis of point spread function and colors, but we will also identify quasars from a catalog of FIRST radio sources. The selection areas in color space must be determined during the testing period prior to the official start of the survey. This task may determine the length of the test period. In anticipation of this becoming the critical path, we have written a body of software that will allow us to quickly analyze a set of multicolor data and make a first cut at the selection limits.

DOE

Quasars; Color; Sky Surveys (Astronomy)

19980210476 Iowa State Univ. of Science and Technology, Physics and Astronomy Dept., Ames, IA USA

[Results of the EGRET Detector Program] ***Final Report***

Carter-Lewis, D. A., Iowa State Univ. of Science and Technology, USA; Jun. 1998; 7p; In English

Contract(s)/Grant(s): NAG5-3819; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This NASA grant has funded studies of cosmic objects observed by both the EGRET detector aboard the Compton Gamma-ray Observatory and Whipple Gamma-ray imaging telescope. The former has sensitivity up to a few GeV and latter has sensitivity starting at about 200 GeV extending up to beyond 10 TeV. Thus these instruments probe some of the most energetic phenomena

in the universe. This program has been in place for several years and led to important results referred to below. The Whipple Observatory Imaging Cherenkov Telescope consists of a 10-meter reflector with a nanosecond photomultiplier-tube camera at the focal plane. During the time period covered by this grant, it had either 109 pixels or 151 pixels on a 1/4 degree hexagonal pattern. As a TeV gamma ray enters the atmosphere, it produces an electron/positron pair initiating an extensive air shower. Cherenkov light from the electrons and positrons in the shower form an image of the shower at the phototube camera. The shape and intensity of this image is used to distinguish gamma-ray initiated showers from cosmic-ray (largely proton and alpha-particle) background showers and to derive an energy estimate for the primary gamma-ray. The Whipple Observatory gamma-ray collaboration pioneered this imaging technique which normally rejects over 99 percent of the cosmic-ray background while keeping over 70 percent of the gamma-ray signal. One of its key features is 2 large collection area which can exceed 50,000 meters. This grant covered primarily correlated observations of Markarian 421 and observations of the Cygnus region. The former resulted in a multiwavelength campaign showing correlations in several wavebands. The TeV data showed dramatic variability with the emission characterized by day-scale flickering and with now well defined steady component.
Derived from text
Cosmic Rays; Observatories; Imaging Techniques; Alpha Particles; Cameras; Correlation

19980210477 California Univ., Space Sciences Lab., Berkeley, CA USA
Far Infrared All-Sky Survey ***Final Report, 1 Jul. 1990 - 31 Jan. 1997***
Richards, Paul L., California Univ., USA; Jul. 09, 1998; 8p; In English
Contract(s)/Grant(s): NAGw-2121; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Precise measurements of the angular power spectrum of the Cosmic Microwave Background (CMB) anisotropy will revolutionize cosmology. These measurements will discriminate between competing cosmological models and, if the standard inflationary scenario is correct, will determine each of the fundamental cosmological parameters with high precision. The astrophysics community has recognized this potential: the orbital experiments MAP and PLANCK, have been approved to measure CMB anisotropy. Balloon-borne experiments can realize much of this potential before these missions are launched. Additionally, properly designed balloon-borne experiments can complement MAP in frequency and angular resolution and can give the first realistic test of the instrumentation proposed for the high frequency instrument on PLANCK. The MAXIMA experiment is part of the MAXIMA/BOOMERANG collaboration which is doing balloon observations of the angular power spectrum of the Cosmic Microwave Background from l = 10 to l = 800. These experiments are designed to use the benefits of both North American and Antarctic long-duration ballooning to full advantage. We have developed several new technologies that together allow the power spectrum to be measured with unprecedented combination of angular resolution, beam throw, sensitivity, sky coverage and control of systematic effects. These technologies are the basis for the high frequency instrument for the PLANCK mission. Our measurements will strongly discriminate between models of the origin and evolution of structure in the universe and, for many models, will determine the value of the basic cosmological parameters to high precision.
Author
Far Infrared Radiation; Electromagnetic Measurement; Background Radiation; Microwaves; Angular Resolution

19980210629 Pennsylvania State Univ., University Park, PA USA
Research in X-ray Astronomy ***Final Report, Period ending 30 Jun. 1997***
1997; 9p; In English
Contract(s)/Grant(s): NAG5-100
Report No.(s): NASA/CR-1997-208225; NAS 1.26:208225; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This research grant supported an active sounding rocket program at Penn State University over a period of over 10 years. During this period, the grant supported at least 8 graduate students in Astronomy & Astrophysics for at least a portion of their research. During the same period, our group was involved in seven sounding rocket flights, launched from White Sands, New Mexico, and from Woomera, Australia. Most of these rocket flights, and most of the work supported by this grant, involved the use of X-ray CCD cameras. The first X-ray CCD camera ever flown in space was our sounding rocket observation of SN1987A (flight 36.030 in 1987). Subsequent flights utilized improved CCD detectors, culminating in the'state-of-the-art EEV detector developed for our CUBIC mission, which was flown on 36.093 last May. Data from the last three flights, which observed the diffuse X-ray background with CCDS, include detection of the OVII He(alpha) line in the high latitude diffuse background and detection of the Mg XI He(alpha) line in the North Polar Spur. These results have been reported at meetings of the American Astronomical Society and the SPIE. The analysis of flights 36.092 and 36.106 is part of Jeff Mendenhall's PhD thesis and will be published in the Astrophysical Journal next year. The 36.093 data are currently being analyzed by PhD student Laura Cawley. From 1990 to 1996 this grant supported our development and launch of the CUBIC instrument on the SAC-B satellite, which was designed to measure the spectrum of the soft X-ray diffuse background with moderate energy resolution and high S/N ratio. Unfor-

tunately, this mission terminated shortly after launch due to a failure of the Pegasus XL launch vehicle. This work resulted in publication of 4 papers in the SPIE Proceedings and four others in refereed journals, in addition to several other conference proceedings and contributed papers. In addition to the CCD flights described above, this grant has supported preliminary development of a new sounding rocket payload utilizing a replicated Ni mirror that is being developed at PSU in collaboration with MSFC. Initial testing of the coating technology has produced promising results.
Derived from text
X Ray Astronomy; Research and Development; Sounding Rockets; Rocket Flight; Detection

19980210697 Lawrence Livermore National Lab., Livermore, CA USA
Binary neutron star GRB model
Wilson, J. R., Lawrence Livermore National Lab., USA; Salmonson, J. D., Notre Dame Univ., USA; Mathews, G. J., Notre Dame Univ., USA; Nov. 11, 1997; 8p; In English; 4th; Gamma Ray Bursts Symposium, 15-20 Sep. 1997, Huntsville, AL, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-129080; CONF-9709153; DE98-051383; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In this paper we present the preliminary results of a model for the production of gamma-ray bursts (GRBs) through the compressional heating of binary neutron stars near their last stable orbit prior to merger. Recent numerical studies of the general relativistic (GR) hydrodynamics in three spatial dimensions of close neutron star binaries (NSBs) have uncovered evidence for the compression and heating of the individual neutron stars (NSs) prior to merger. This effect will have significant effect on the production of gravitational waves, neutrinos and, ultimately, energetic photons. The study of the production of these photons in close NSBs and, in particular, its correspondence to observed GRBs is the subject of this paper. The gamma-rays arise as follows. Compressional heating causes the neutron stars to emit neutrino pairs which, in turn, annihilate to produce a hot electron-positron pair plasma. This pair- photon plasma expands rapidly until it becomes optically thin, at which point the photons are released. We show that this process can indeed satisfy three basic requirements of a model for cosmological gamma-ray bursts: 1) sufficient gamma-ray energy release greater than 10(exp 51) ergs to produce observed fluxes, 2 a time-scale of the primary burst duration consistent with that of a 'classical' GRB approximately 10 seconds, 3 peak of photon number spectrum matches that of 'classical' GRB approximately 300 keV.
DOE
Binary Stars; Neutron Stars; Neutrinos; Gamma Ray Bursts

19980210768 Instituto de Estudos Avancados, Sao Jose dos Campos, Brazil
A Star Sensor for the Fine Pointing of the MASCO Telescope ***Um Sensor Estelar Para o Apontamento Fino do Telescopio MASCO***
Cabeza, Jorge Mejia, Instituto de Estudos Avancados, Brazil; Sep. 1997; 104p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6682-TDI/627; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

In this work, it is described the development of the SUE stellar sensor, an instrument based on a CCD camera and capable of determining the pointing coordinates with an error smaller than 0.5 arcminute. This instrument is part of the attitude control system of the MASCO telescope. It acquires an image of the sky every second, recognizes the most brilliant stars in the image, creates with them a "constellation", and searches for this pattern in a catalog of the observed region. In its basic configuration, the stellar sensor is able to detect stars up to magnitude 3.2. The searching algorithm is based on the analysis of the geometrical configuration of the "constellation" and considers the distances and angles between the stars and their relative brightness as well. The stellar sensor, consisting in a CCD camera coupled to a telephoto lens, digitizes the images at 512 x 4OO pixels resolution. Two configurations have been tested: one with a zoom lens (18 to 108 mm) and another with a fixed focus lens (70 mm). The camera observes a region of approximately 6 x 5 degrees in the sky, corresponding to a resolution, given by the number of pixels of the sensor, of approx. equal 45 arcseconds. The implementation of interpolation algorithms allowed an accuracy in the determination of the pointing coordinates of 1/10 of a pixel or, equivalently, a few arcseconds. The tests carried out with this sensor showed the following results: dispersion smaller than 4 arcseconds in the determination of the position of the stellar images, 100% of correct matching of the point patterns in more than 1500 images and error dispersion in the determination of the pointing coordinates smaller than 30 arcseconds.
Author
Fabrication; Product Development; Attitude Control; Accuracy; Errors; Measuring Instruments

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also 75 Plasma Physics.

19980206647 Florida Univ., Gainesville, FL USA
Dark matter axions and caustic rings
Sikivie, P., Florida Univ., USA; 1997; 12p; In English, 8-14 Jun. 1997, Castle Ringberg, Germany
Contract(s)/Grant(s): DE-FG05-86ER-40272
Report No.(s): DOE/ER/40272-287; UFIFT-HEP-97-26; CONF-9706173-; DE98-000712; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report contains discussions on the following topics: the strong CP problem; dark matter axions; the cavity detector of galactic halo axions; and caustic rings in the density distribution of cold dark matter halos.
DOE
Galaxies; Extraterrestrial Matter; Halos; Dark Matter; Quantum Chromodynamics

19980209648 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
Shock Modifications of Organic Compounds in Carbonaceous Chondrite Parent Bodies ***Final Report***
Cooper, George W., Search for Extraterrestrial Intelligence Inst., USA; Jun. 05, 1998; 4p; In English
Contract(s)/Grant(s): NCC2-948; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Impacts among asteroidal objects would have altered or destroyed pre-existing organic matter in both targets and projectiles to a greater or lesser degree depending upon impact velocities. to begin filling a knowledge gap on the shock metamorphism of organic compounds, we are studying the effects of shock impacts on selected classes of organic compounds utilizing laboratory shock facilities. Our approach is to subject mixtures of organic compounds, embedded in the matrix of the Murchison meteorite, to simulated hypervelocity impacts by firing them into targets at various pressures. The mixtures are then analyzed to determine the amount of each compound that survives as well as to determine if new compounds are being synthesized. The initial compounds added to the matrix (with the exception of thiosulfate). The sulfonic acids were chosen in part because they are relatively abundant in Murchison, relatively stable, and because they and the phosphonic acids are the first well-characterized homologous series of organic sulfur and phosphorus compounds identified in an extraterrestrial material. Experimental procedures were more fully described in the original proposal. A 20 mm gun, with its barrel extending into a vacuum chamber (10(exp -2) torr), was used to launch the projectile containing the sample at approx. 1.6 km/sec (3,600 mi/hr) into the target material. Maximum pressure of impact depend on target/projectile materials. The target was sufficiently thin to assure minimum pressure decay over the total sample thickness.
Derived from text
Mechanical Shock; Carbonaceous Chondrites; Impact Velocity; Metamorphism (Geology); Organic Materials; Organic Sulfur Compounds

19980209706 Oxford Univ., Dept. of Astrophysics, Oxford, UK
The Massive White Dwarf in the Recurrent Nova T CrB
Shahbaz, T., Oxford Univ., UK; Somers, M., Keele Univ., UK; Yudin, B., Moscow State Univ., Russia; Naylor, T., Keele Univ., UK; Feb. 26, 1997; 9p; In English
Contract(s)/Grant(s): RFFI-96-02-16353; RFFI-96-02-16794
Report No.(s): OUAST/97/4; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Physics, Astrophysics, Keble Rd., Oxford, OX1 3 RH, England); US Sales Only, Hardcopy, Microfiche

We have obtained I, J, H and K band light curves of the recurrent nova T CrB. We find that we can only fit the J band light curve with a Roche-lobe filling secondary star and a dark spot of radius 11 deg - 26 deg (90 per cent confidence) centered at the inner Lagrangian point. We obtain limits to the binary inclination of 38 deg - 46 deg (90 per cent confidence) which when combined with the value for the mass function allows us to determine the mass of the compact object to be 1.3-2.5 solar mass (90 per cent confidence). This mass range is consistent with the Chandrasekhar limiting white dwarf mass, and so we provide evidence needed to support the outbursts in recurrent novae in terms of a thermonuclear runaway process on the surface of a massive -1.4 solar mass white dwarf.
Author
Dwarf Novae; Stellar Mass; Light Curve

19980209791 Observatorio Astronomico Nacional, Facultad de Ciencias, Bogota, Colombia

Stellar Probabilities in the Region of Open Cluster NGC6530 ***Pertenencia de Estrellas en la Region del Cumulo Abierto NGC 6530***

Bustillo, Eduardo Brieva, Observatorio Astronomico Nacional, Colombia; Botero, Antonio Uribe, Universidad Nacional de Colombia, Colombia; Columbia Academy of Exact Sciences, Physical and Natural; Apr. 1994; ISSN 0370-3908; Volume 19, No. 72, pp. 7-17; In Spanish; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Membership probabilities are assigned to the stellar population in the region of the open cluster NGC653O solving a fourteen nonlinear equations system leading to the maximum likelihood parameters estimators of the bivariate normal model proposed by Vasilevskis et. al. and including the estimator for the correlation coefficient. Lagrange multipliers are used because the constraints on the correlation, the number of fields stars, and the standard deviations are included.

Author

Open Clusters; Probability Theory; Statistical Analysis; Maximum Likelihood Estimates; Star Distribution; Stellar Systems

19980209804 Communications Research Lab., Koganei, Japan

Collision Of Comet Shoemaker-levy 9 With Jupiter: Observational And Theoretical Works In CRL

Yoshikawa, Makoto, Communications Research Lab., Japan; Journal of the Communications Research Laboratory; Nov. 1994; ISSN 0914-9260; Volume 41, No. 3, pp. 185-194; In English; Copyright; Avail: Issuing Activity (Communications Research Laboratory, Ministry of Posts and Telecommunications, Nukui-Kitamachi, 4-chome, Koganei, Tokyo, 184 Japan), Hardcopy, Microfiche

From the 16th of July to the 22nd of July, 1994, about twenty fragments of the comet Shoemaker-Levy 9 (SL9) collided with Jupiter. These collisions were the first that human beings observed so clearly. In Japan, the Communications Research Laboratory (CRL) carried out radio and infrared observations of the collisions on various frequencies. As a result of these observations, infrared images of the spots produced by the collisions were obtained and radio signals which were supposed to be emitted as a result of the collisions were detected. Also, CRL carried out theoretical work and the orbital evolution of this comet was studied. This study revealed that the orbit and the motion of SL9 were both very complicated and chaotic. In this paper, the results of our observations and our theoretical studies are presented briefly.

Author

Shoemaker-Levy 9 Comet; Jupiter (Planet); Cometary Collisions; Radio Observation; Infrared Imagery

19980209865 Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Frascati, Frascati, Italy

Effective gravity and OSp(N, 4) invariant matter

Bellucci, S., Istituto Nazionale di Fisica Nucleare, Italy; Mar. 1997; 14p; In English

Report No.(s): INFN-P-LNF-97-016; DE98-712217; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

They re-examine the OSp(N, 4) invariant interacting model of massless chiral and gauge superfields, whose superconformal invariance was instrumental, both in proving the all-order no-renormalization of the mass and chiral self-interaction lagrangians, and in determining the linear superfield renormalization needed. They show that the renormalization of the gravitational action modifies only the cosmological term, without affecting higher-order tensors. This could explain why the effect of the cosmological constant is shadowed by the effects of Newtonian gravity.

DOE

Gravitation; Gravitational Effects; Measuring Instruments; Gauge Invariance; Gravitational Fields

19980210000 Fermi National Accelerator Lab., Batavia, IL USA

CP-Violating solitons in the early universe

Tornkvist, O., Fermi National Accelerator Lab., USA; Riotto, A., Fermi National Accelerator Lab., USA; Jul. 1997; 9p; In English; Fundamental Physics at the Birth of the Universe II, 19-24 May 1997, Rome, Italy

Contract(s)/Grant(s): DE-AC02-76CH-03000

Report No.(s): FNAL/C-97/179-A; CONF-9705201; DE97-053606; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Solitons in extensions of the Standard Model can serve as localized sources of CP violation. Depending on their stability properties, they may serve either to create or to deplete the baryon asymmetry. The conditions for existence of a particular soliton candidate, the membrane solution of the two-Higgs model, are presented. In the generic case, investigated by Bachas and Tomaras, membranes exist and are metastable for a wide range of parameters. For the more viable supersymmetric case, it is shown that the present-day existence of CP-violating membranes is experimentally excluded, but preliminary studies suggest that they may

have existed in the early universe soon after the electroweak phase transition, with important consequences for the baryon asymmetry of the universe.
DOE
Supersymmetry; Baryons; Electroweak Interactions (Field Theory); Stability; Invariance; Models; Solitary Waves

19980210011 Universities Space Research Association, Columbia, MD USA
High Energy Astrophysics Research and Programmatic Support ***Interim Report, 1 Oct. 1997 - 31 Mar. 1998***
Angelini, Lorella, Universities Space Research Association, USA; May 31, 1998; 68p; In English
Contract(s)/Grant(s): NAS5-32490
Report No.(s): Rept-11; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report reviews activities performed by members of the USRA contract team during the six months of the reporting period and projected activities during the coming six months. Activities take place at the Goddard Space Flight Center, within the Laboratory for High Energy Astrophysics. Developments concern instrumentation, observation, data analysis, and theoretical work in Astrophysics. Missions supported include: Advanced Satellite for Cosmology and Astrophysics (ASCA), X-ray Timing Experiment (XTE), X-ray Spectrometer (XRS), Astro-E, High Energy Astrophysics Science Archive Research Center (HEASARC), and others.
Author
Energy Technology; Data Processing; Procedures; Numerical Analysis; Astrophysics; Measuring Instruments

19980210063 Lunar and Planetary Inst., Houston, TX USA
S not equal to NC: Multiple source areas for Martian meteorites
Treiman, Allan H., Lunar and Planetary Inst., USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5329-5340; In English; Also announced as 19980210054
Report No.(s): Paper-94JE02184; LPI-Contrib-838; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

The Shergottite, Nakhlite, and Chassigny (SNC) meteorites are igneous rocks from Mars, inferred previously to have been propelled into space (and to Earth) by a single impact event. However, the sum of petrologic, chemical, and chronological data suggests two distinct sites of origin: S from one, NC from another. Differences between the S and NC include distributions of terrestrial residence ages, cosmic ray exposure ages, impact shock effects pre-terrestrial aqueous alteration products, bulk magma compositions, trace element magma chemistries, and mantle source compositions. If the S and NC did not come from the same site on Mars, selection criteria for determining source craters are relaxed, and a number of craters become candidate sources. Formation of two meteorite source craters on young Martian surfaces (Author
SNC Meteorites; Meteoritic Composition; Planetary Crusts; Planetary Geology; Mars (Planet); Mars Surface; Planetary Evolution

19980210071 Open Univ., Dept. of Earth Sciences, Milton Keynes, UK
A search for nitrates in Martian meteorites
Grady, Monica M., Open Univ., UK; Wright, I. P., Open Univ., UK; Pillinger, C. T., Open Univ., UK; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5449-5455; In English; Also announced as 19980210054; Sponsored in part by the Cosmic Mineralogy Program of the Natural History Museum.
Report No.(s): Paper-94JE02803; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A03, Microfiche

Martian atmospheric nitrogen is highly enriched in N-15; nitrates formed by interaction of the atmosphere with the Martian regolith should therefore also be characterized by an elevated delta N-15 value. A search has been made for nitrates in two Martian meteorites, in order to determine the extent of possible regolith-atmosphere interaction. Shock-produced glass from the Elephant Moraine (EET) A79001 shergottite (E1,149) and a water-soluble extract from Nakhla were analyzed by Fourier transform infrared (FTIR) spectroscopy and stepped combustion-stable isotope mass spectrometry. FTIR of both meteorites had features at 1375 cm(exp -1) and 1630 (exp -1), consistent with nitrates. On account of their low thermal stability, nitrates break down at temperatures below 600 C; in this temperature range, E1,149 yielded approx. 1250 ppb nitrogen with delta N-15 -8 +/- 5 0/00. If this nitrogen is from a nitrate, then it cannot be distinguished from terrestrial salts by its isotopic composition. The water-soluble extract from Nakhla also released nitrogen at low temperatures, approximately 17 ppb with delta N-15 approximately -11 +/- 4 0/00. Since Nakhla is an observed ”fall”, this is unlikely to be a terrestrial weathering product. Nitrates apparently occur in E1,149 and Nakhla, but in very low abundance, and their origin is unclear. The isotopic composition of the salts, which is within the range of that proposed for Martian magmatic volatiles, is far removed from that of nitrogen in the present-day Martian atmosphere. If the nitrates are Martian in origin, they did not form in recent times from reactions involving atmospheric gases. Rather, the nitrates could be

the result of an earlier episode of atmospheric interaction with the regolith, or with implantation of magmatic volatiles introduced during degassing.
Author
Regolith; Nitrates; Planetary Geology; Mars Surface Samples; SNC Meteorites; Shergottites; Nakhlites; Meteoritic Composition; Spectroscopic Analysis

19980210207 Hawaii Univ., Inst. for Astronomy, Honolulu, HI USA
Outer Solar System Nomenclature ***Final Report, 1 Mar. 1990 - 30 Sep. 1997***
Owen, Tobias C., Hawaii Univ., USA; Mar. 06, 1998; 4p; In English
Contract(s)/Grant(s): NAGw-2153
Report No.(s): AD-A339090; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Principal Investigator's responsibilities on this grant fell into two categories according to his participation. In the nomenclature work of the International Astronomical Union (IAU). Owen is chair of the Task Group for the Outer Solar System. He is also a member of the IAU's Working Group on Planetary and Satellite Nomenclature (WGPSN) which is composed of the chairs of the several Task Groups plus the presidents of two IAU Commissions and several outside consultants. The WGPSN is presided over by its President, Professor Kaare Aksnes from the Rosseland Institute for Theoretical Astrophysics in Oslo, Norway.
DTIC
Astronomy; Astrophysics; Gas Giant Planets; Solar System

19980210249 Los Alamos National Lab., NM USA
Structure and evolution of the current sheet by multi-spacecraft observations
Zhou, X. Y., Academia Sinica, China; Russell, C. T., California Univ., USA; Gosling, J., Los Alamos National Lab., USA; [1997]; 5p; In English; COSPAR Colloquia Series, 15 - 19 Apr. 1996, Beijing, China; Sponsored by Committee on Space Research, France
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3577; CONF-9604236; DE98-001461; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

On April 22, 1979, from 0840 to 1018 UT, ISEE 1, ISEE 2 and IMP 8 were all in or near the magnetotail current sheet at 17 Re, 16 Re and 35 Re respectively while ISEE 3 monitored the solar wind 206 Re upstream of the Earth. A global perspective of the four spacecraft observations and of the ground magnetic records is presented in this paper. The hyperbolic tangent current sheet model of Harris has been used to calculate the current sheet thickness and to analyze the plasma distribution in the vertical direction. It is found that during this event the current sheet thickness varied from 2.5 Re to 1.5 Re for northward IMF but thinned abruptly to 0.5 Re when the IMF turned southward.
DOE
Current Sheets; Plasma Density; Solar Wind; Satellite Observation; Interplanetary Magnetic Fields; Planetary Magnetotails

19980210287 NASA Ames Research Center, Moffett Field, CA USA
Computer Modeling of the Thermal Conductivity of Cometary Ice ***Final Report***
Bunch, Theodore E., NASA Ames Research Center, USA; Wilson, Michael A., NASA Ames Research Center, USA; Pohorille, Andrew, NASA Ames Research Center, USA; Jul. 14, 1998; 9p; In English
Contract(s)/Grant(s): NCC2-5147; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The thermal conductivity was found to be only weakly dependent on the microstructure of the amorphous ice. In general, the amorphous ices were found to have thermal conductivities of the same order of magnitude as liquid water. This is in contradiction to recent experimental estimates of the thermal conductivity of amorphous ice, and it is suggested that the extremely low value obtained experimentally is due to larger-scale defects in the ice, such as cracks, but is not an intrinsic property of the bulk amorphous ice.
Author
Computerized Simulation; Thermal Conductivity; Ice

19980210409 Los Alamos National Lab., NM USA
Accretion onto black holes: The power generating mechanism
Colgate, S. A., Los Alamos National Lab., USA; Hills, J. G., Los Alamos National Lab., USA; Miller, W. A., Los Alamos National Lab., USA; [1998]; 11p; In English
Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-3609; DE98-001498; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The physical relationships among accretion disks, quasars, black holes, collimated radio sources and galactic dynamos previously has been only weakly related without explicit cause and effect. We have constructed a physical evolution from large, primordial density perturbations to ”damped Lyman alpha clouds,” to galaxy formation, to black holes, jets, and the the galactic dynamo. We have derived the general relativistic distortions of radiation emitted from close to the black hole and thereby have a new observational test of the central engine. The physics of accretion disks, the astrophysical dynamo, and magnetic reconnection are the least understood physical phenomena in astrophysics. They are still less understood in the general relativity (GR) field close to the black hole. This lack of physical understanding frustrates a quantitative evaluation of observations that define the evolution from the early universe to star formation. We have made progress in this understanding.

DOE

Black Holes (Astronomy); Accretion Disks; Astrophysics; Star Formation; Perturbation; Relativity; Early Stars

19980210479 NASA Ames Research Center, Moffett Field, CA USA

The Role of Grain Surface Reactions in the Chemistry of Star Forming Regions ***Final Report***

Kress, M. E., Rensselaer Polytechnic Inst., USA; Tielens, A. G. G. M., NASA Ames Research Center, USA; Roberge, W. G., Rensselaer Polytechnic Inst., USA; [1998]; 6p; In English

Contract(s)/Grant(s): NCC2-5168; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The importance of reactions at the surfaces of dust grains has long been recognized to be one of the two main chemical processes that form molecules in cold, dark interstellar clouds where simple, saturated (fully-hydrogenated) molecules such as H2 water, methanol, H2CO, H2S, ammonia and CH4 are present in quantities far too high to be consistent with their extremely low gas phase formation rates. In cold dark regions of interstellar space, dust grains provide a substrate onto which gas-phase species can accrete and react. Grains provide a ”third body” or a sink for the energy released in the exothermic reactions that form chemical bonds. In essence, the surfaces of dust grains open up alternative reaction pathways to form observed molecules whose abundances cannot be explained with gas-phase chemistry alone. This concept is taken one step further in this work: instead of merely acting as a substrate onto which radicals and molecules may physically adsorb, some grains may actively participate in the reaction itself, forming chemical bonds with the accreting species. Until recently, surface chemical reactions had not been thought to be important in warm circumstellar media because adspecies rapidly desorb from grains at very low temperatures; thus, the residence times of molecules and radicals on the surface of grains at all but the lowest temperatures are far too short to allow these reactions to occur. However, if the adspecies could adsorb more strongly, via a true chemical bond with surfaces of some dust grains, then grain surface reactions will play an important role in warm circumstellar regions as well. In this work, the surface-catalyzed reaction CO + 3 H2 yields CH4 + H2O is studied in the context that it may be very effective at converting the inorganic molecule CO into the simplest organic compound, methane. H2 and CO are the most abundant molecules in space, and the reaction converting them to methane, while kinetically inhibited in the gas phase under most astrophysical conditions, is catalyzed by iron, an abundant constituent of interstellar dust. At temperatures between 600 and 1000 K, which occur in the outflows from red giants and near luminous young stars, this reaction readily proceeds in the presence of an iron catalyst. Iron is one of the more abundant elements composing interstellar dust. Its abundance relative to hydrogen is almost that of silicon, and both of these heavy elements are primarily locked up in dust at all but the hottest regions of interstellar space.

Derived from text

Surface Reactions; Stellar Envelopes; Star Formation; Cosmic Dust; Exothermic Reactions; Heavy Elements; Interstellar Matter

19980210627 New Mexico Univ., Dept. of Geology, Albuquerque, NM USA

Cometary Evolution: Clues on Physical Properties from Chondritic Interplanetary Dust Particles

Rietmeijer, Frans J. M., New Mexico Univ., USA; Mackinnon, Ian D. R., Queensland Univ., Australia; 1989, pp. 247-253; In English

Contract(s)/Grant(s): NAG5-4441

Report No.(s): NASA/CR-89-208285; NAS 1.26:208285; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The degree of diversity or similarity detected in comets depends primarily on the lifetimes of the individual cometary nuclei at the time of analysis. It is inherent in our understanding of cometary orbital dynamics and the seminal model of comet origins by Oort that cometary evolution is the natural order of events in our Solar System. Thus, predictions of cometary behaviour in terms of bulk physical, mineralogical or chemical parameters should contain an appreciation of temporal variation(s). Previously, Rietmeijer and Mackinnon developed mineralogical bases for the chemical evolution of cometary nuclei primarily with regard to the predominantly silicate fraction of comet nuclei. We suggested that alteration of solids in cometary nuclei should be expected

and that indications of likely reactants and products can be derived from judicious comparison with terrestrial diagenetic environments which include hydrocryogenic and low-temperature aqueous alterations. In a further development of this concept, Rietmeijer provides indirect evidence for the formation of sulfides and oxides in comet nuclei. Furthermore, Rietmeijer noted that timescales for hydrocryogenic and low-temperature reactions involving liquid water are probably adequate for relatively mature comets, e.g. P/comet Halley. In this paper, we will address the evolution of comet nuclei physical parameters such as solid particle grain size, porosity and density. In natural environments, chemical evolution (e.g. mineral reactions) is often accompanied by changes in physical properties. These concurrent changes are well-documented in the terrestrial geological literature, especially in studies of sediment diagenesis and we suggest that similar basic principles apply within the upper few meters of active comet nuclei. The database for prediction of comet nuclei physical parameters is, in principle, the same as used for the proposition of chemical evolution. We use detailed mineralogical studies of chondritic interplanetary dust particles (IDPS) as a guide to the likely constitution of mature comets traversing the inner Solar System. While there is, as yet, no direct proof that a specific sub-group or type of chondritic IDP is derived from a specific comet, it is clear that these particles are extraterrestrial in origin and that a certain portion of the interplanetary flux received by the Earth is cometary in origin. Two chondritic porous (CP) MPs, sample numbers W7010A2 and W7029Cl, from the Johnson Space Center Cosmic Dust Collection have been selected for this study of putative cometary physical parameters. This particular type of particle is considered a likely candidate for a cometary origin on the basis of mineralogy, bulk composition and morphology. While many IDPs have been subjected to intensive study over the past decade, we can develop a physical parameter model on only these two CP IDPs because few others have been studied in sufficient detail.

Derived from text

Interplanetary Dust; Chondrites; Porosity; Density (Mass/Volume); Data Bases; Comet Nuclei; Cosmic Dust; Electromagnetic Properties

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LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

19980210054 NASA Ames Research Center, Moffett Field, CA USA

MSATT: Mars Surface and Atmosphere Through Time, Volume 100

Mar. 25, 1995; ISSN 0148-0227; 339p; In English; Mars: Past, Present and Future: Results from the MSATT Program, 23-25 Sep. 1995, Boulder, CO, Houston, TX, USA, USA, Held at the Lunar and Planetary Inst.; Also announced as 19980210055 through 19980210078

Report No.(s): NASA/TM-95-207228; NAS 1.15:207228; Copyright Waived (NASA); Avail: CASI; A15, Hardcopy; A03, Microfiche

The papers published here are based on a workshop entitled ”Mars: Past, Present, and Future: Results from the MSATT Program.” MSATT (Mars Surface and Atmosphere Through Time) was the last of the Mars data analysis programs and functioned mainly through a series of focused workshops, the final one being held at the Lunar and Planetary Institute in Houston, Texas on November 15-17, 1993. The program began and ended with workshops that brought the entire MSATT community together. Here you will find papers that address the geology, mineralogy, and meteorology of Mars in an effort to assess how the surface and atmosphere of this fascinating planet have evolved over time. Could early Mars have been warmed by a brighter young sun instead of a massive greenhouse effect? Were glaciers and hydrological cycles part of Mars’ relatively recent past, or was aeolian activity responsible for the putative glacial features? Do the SNCs come from a single source region, or is more than one site involved? and what really are the properties of Martian soils and what do they tell us about the weathering environment? Clearly, these are difficult questions, but progress toward answers can be found in this issue. Also contained in this issue are a mix of theoretical and observational papers that deal with the general circulation of the current atmosphere, the factors that drive it (dust properties), and the role it plays in controlling the current climate system.

Derived from text

Conferences; Mars Surface; Mars Atmosphere; Mars (Planet); SNC Meteorites; Planetary Evolution; Planetary Geology; Climatology; Atmospheric Models

19980210055 NASA Ames Research Center, Moffett Field, CA USA

Viking Lander image analysis of Martian atmospheric dust

Pollack, James B., NASA Ames Research Center, USA; Ockert-Bell, Maureen E., San Jose State Univ., USA; Shepard, Michael K., Washington Univ., USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5235-5250; In English; Also announced as 19980210054

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Report No.(s): Paper-94JE02640; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

We have reanalyzed three sets of Viking Lander 1 and 2 (VL1 and VL2) images of the Martian atmosphere to better evaluate the radiative properties of the atmospheric dust particles. The properties of interest are the first two moments of the size distribution, the single-scattering albedo, the dust single-scattering phase function, and the imaginary index of refraction. These properties provide a good definition of the influence that the atmospheric dust has on heating of the atmosphere. Our analysis represents a significant improvement over past analyses (Pollack et al. 1977,1979) by deriving more accurate brightnesses closer to the sun, by carrying out more precise analyses of the data to acquire the quantities of interest, and by using a better representation of scattering by nonspherical particles. The improvements allow us to better define the diffraction peak and hence the size distribution of the particles. For a lognormal particle size distribution, the first two moments of the size distribution, weighted by the geometric cross section, are found. The geometric cross-section weighted mean radius (r(sub eff)) is found to be 1.85 +/- 0.3 microns at VL2 during northern summer when dust loading was low and 1.52 +/- 0.3 microns at VL1 during the first dust storm. In both cases the best cross-section weighted mean variance (nu(eff)) of the size distribution is equal to 0.5 +/- 0.2 microns. The changes in size distribution, and thus radiative properties, do not represent a substantial change in solar energy deposition in the atmosphere over the Pollack et al. (1977,1979) estimates.

Author

Mars Atmosphere; Image Analysis; Dust; Particle Size Distribution; Distribution Moments; Radiation Absorption; Radiative Transfer; Atmospheric Scattering; Atmospheric Heating

19980210056 NASA Ames Research Center, Moffett Field, CA USA

A new model for Mars atmospheric dust based upon analysis of ultraviolet through infrared observations from Mariner 9, Viking, and Phobos

Clancy, R. T., Space Science Inst., USA; Lee, S. W., Colorado Univ., USA; Gladstone, G. R., Southwest Research Inst., USA; McMillan, W. W., San Francisco State Univ., USA; Rousch, T., NASA Ames Research Center, USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5251-5263; In English; Also announced as 19980210054

Report No.(s): Paper-94JE01885; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

We propose key modifications to the Toon et al. (1977) model of the particle size distribution and composition of Mars atmospheric dust, based on a variety of spacecraft and wavelength observations of the dust. A much broader (r(sub eff)variance-0.8 micron), smaller particle size (r(sub mode)-0.02 microns) distribution coupled with a ”palagonite-like” composition is argued to fit the complete ultraviolet-to-30-micron absorption properties of the dust better than the montmorillonite-basalt r(sub eff)variance= 0.4 micron, r(sub mode)= 0.40 micron dust model of Toon et al. Mariner 9 (infrared interferometer spectrometer) IRIS spectra of high atmospheric dust opacities during the 1971 - 1972 Mars global dust storm are analyzed in terms of the Toon et al. dust model, and a Hawaiian palagonite sample with two different size distribution models incorporating smaller dust particle sizes. Viking Infrared Thermal Mapper (IRTM) emission-phase-function (EPF) observations at 9 microns are analyzed to retrieve 9-micron dust opacities coincident with solar band dust opacities obtained from the same EPF sequences. These EPF dust opacities provide an independent measurement of the visible/9-microns extinction opacity ratio (> or equal to 2) for Mars atmospheric dust, which is consistent with a previous measurement by Martin (1986). Model values for the visible/9-microns opacity ratio and the ultraviolet and visible single-scattering albedos are calculated for the palagonite model with the smaller particle size distributions and compared to the same properties for the Toon et al. model of dust. The montmorillonite model of the dust is found to fit the detailed shape of the dust 9-micron absorption well. However, it predicts structured, deep absorptions at 20 microns which are not observed and requires a separate ultraviolet-visible absorbing component to match the observed behavior of the dust in this wavelength region. The modeled palagonite does not match the 8- to 9-micron absorption presented by the dust in the IRIS spectra, probably due to its low SiO2 content (31%). However, it does provide consistent levels of ultraviolet/visible absorption, 9- to 12-micron absorption, and a lack of structured absorption at 20 microns. The ratios of dust extinction opacities at visible, 9 microns, and 30 microns are strongly affected by the dust particle size distribution. The Toon et al. dust size distribution (r(sub mode)= 0.40, r(sub eff)variance= 0.4 microns, r(sub cw mu)= 2.7 microns) predicts the correct ratio of the 9- to 30-micron opacity, but underpredicts the visible/9-micron opacity ratio considerably (1 versus > or equal to 2). A similar particle distribution width with smaller particle sizes (r(sub mode)= 0.17, r(sub eff)variance= 0.4 microns, r(sub cw mu)=1.2 microns) will fit the observed visible/9-micron opacity ratio, but overpredicts the observed 9-micron/30-micron opacity ratio. A smaller and much broader par-

ticle size distribution (r(sub mode)= 0.02, r(sub eff)variance= 0.8 microns, r(sub cw mu)= 1.8 microns) can fit both dust opacity ratios. Overall, the nanocrystalline structure of palagonite coupled with a smaller, broader distribution of dust particle sizes provides a more consistent fit than the Toon et al. model of the dust to the IRIS spectra, the observed visible/9-micron dust opacity ratio, the Phobos occultation measurements of dust particle sizes, and the weakness of surface near IR absorptions expected for clay minerals.
Author
Mars Atmosphere; Atmospheric Models; Dust; Particle Size Distribution; Montmorillonite; Opacity; Infrared Spectroscopy; Ultraviolet Spectroscopy; Spectroscopic Analysis

19980210057 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Temperature measurements of a Martian local dust storm
Kahn, Ralph, Jet Propulsion Lab., California Inst. of Tech., USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5265-5275; In English; Also announced as 19980210054
Contract(s)/Grant(s): NsG7-398
Report No.(s): Paper-94JE02766; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

A technique for estimating the ground and near-ground atmospheric temperatures within a Martian local dust storm is presented. It is applied to soundings taken by the Viking orbiter infrared thermal mapper (IRTM) instrument at four times-of-day for one storm. Essentially, a comparison is made between infrared radiances emerging from the storm interior and those from the region surrounding the storm. Particle extinction properties are assumed to be independent of position in the storm region, and scattering properties must be selected arbitrarily. For the storm studied here, the ground temperature in the interior is at least 6 K cooler, whereas the near-ground atmospheric temperature may be less than or comparable to, those of the surroundings. The thermal structure of the storm interior did not change measurably between 11.5 and 16.6 hours local time. These observations favor theories of dust storm development in which regional winds rather than local, dust-driven convection initiate the mobilization of dust from the surface. It is also concluded that the optical properties of dust particles in this local storm differ from those observed by Mariner 9 during the 1971-1972 global dust storm.
Author
Atmospheric Temperature; Mars Environment; Temperature Measurement; Atmospheric Sounding; Mars Atmosphere; Dust Storms; Infrared Radiation; Radiance; Wind Effects; Thermal Mapping; Temperature Distribution

19980210058 NASA Ames Research Center, Moffett Field, CA USA
Atmospheric effects on the mapping of Martian thermal inertia and thermally derived albedo
Hayashi, Joan N., Colorado Univ., USA; Jakosky, Bruce M., Colorado Univ., USA; Haberle, Robert M., NASA Ames Research Center, USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5277-5284; In English; Also announced as 19980210054
Contract(s)/Grant(s): JPL-957571; NAGw-771
Report No.(s): Paper-94JE02449; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

We examine the effects of a dusty C02 atmosphere on the thermal inertia and thermally derived albedo of Mars and we present a new map of thermal inertias. This new map was produced using a coupled surface atmosphere (CSA) model, dust opacities from Viking infrared thermal mapper (IRTM) data, and C02 columns based on topography. The CSA model thermal inertias are smaller than the 2% model thermal inertias, with the difference largest at large thermal inertia. Although the difference between the thermal inertias obtained with the two models is moderate for much of the region studied, it is largest in regions of either high dust opacity or of topographic lows, including the Viking Lander 1 site and some geologically interesting regions. The CSA model thermally derived albedos do not accurately predict the IRTM measured albedos and are very similar to the thermally derived albedos obtained with models making the 2% assumption.
Author
Mars (Planet); Mars Atmosphere; Thermal Mapping; Temperature Distribution; Thermal Emission; Dust; Atmospheric Effects; Atmospheric Models; Albedo

19980210059 California Inst. of Tech., Div. of Geological and Planetary Sciences, Pasadena, CA USA
Thermal inertias in the upper millimeters of the Martian surface derived using Phobos' shadow
Betts, Bruce H., California Inst. of Tech., USA; Murray, Bruce C., California Inst. of Tech., USA; Svitek, Tomas, California Inst. of Tech., USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5285-5296; In English; Also announced as 19980210054
Contract(s)/Grant(s): NAGw-1426; NAGw-2491
Report No.(s): Paper-95JE00226; CIT-Contrib-5384; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

The first thermal images of Phobos' shadow on the surface of Mars, in addition to simultaneous visible images, were obtained by the Phobos'88 Termoskan instrument. The best observed shadow occurrence was on the flanks of Arsia Mons. For this occurrence, we combined the observed decrease in visible illumination of the surface with the observed decrease in brightness temperature to calculate thermal inertias of the Martian surface. The most realistic of our three models of eclipse cooling improves upon our preliminary model by including nonisothermal initial conditions and downward atmospheric flux. Most of our derived inertias fall within the range 38 to 59 J/(sq m s(exp 1/2) K), (0.9 to 1.4 x 10(exp -3) cal/(sq cm s(exp 1/2) K)) corresponding to dust-sized particles (for a homogeneous surface), consistent with previous theories of Tharsis as a current area of dust deposition. Viking infrared thermal mapper (IRTM) inertias are diurnally derived and are sensitive to centimeter depths, whereas the shadow-derived inertias sample the upper tenths of a millimeter of the surface. The shadow-derived inertias are lower than those derived from Viking IRTM measurements (84 to 147), however, uncertainties in both sets of derived inertias make conclusions about layering tenuous. Thus, near-surface millimeter versus centimeter layering may exist in this region, but if it does, it is likely not very significant. Both eclipse and diurnal inertias appear to increase near the eastern end of the shadow occurrence. We also analyzed a shadow occurrence near the crater Herschel that showed no observed cooling. This analysis was limited by cool morning temperatures and instrument sensitivity, but yielded a lower bound of 80 on eclipse inertias in that region. Based upon our results, we strongly recommend future spacecraft thermal observations of Phobos' shadow, and suggest that they will be most useful if they improve upon Terinoskan's geographic and temporal coverage and its accuracy.
Author
Temperature Distribution; Mars Surface; Land Surface Temperature; Phobos; Shadows; Image Analysis; Spaceborne Photography; Eclipses; Thermal Analysis

19980210060 NASA Ames Research Center, Moffett Field, CA USA
Mid-infrared transmission spectra of crystalline and nanophase iron oxides/oxyhydroxides and implications for remote sensing of Mars
Bell, James F., III, National Academy of Sciences - National Research Council, USA; Roush, Ted L., NASA Ames Research Center, USA; Morris, Richard V., NASA Johnson Space Center, USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5297-5307; In English; Also announced as 19980210054
Report No.(s): Paper-95JE01389; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche
Ferric-iron-bearing materials play an important role in the interpretation of visible to near-IR Mars spectra, and they may play a similarly important role in the analysis of new mid-IR spacecraft spectral observations to be obtained over the next decade. We review existing data on mid-IR transmission spectra of ferric oxides/oxyhydroxides and present new transmission spectra for ferric-bearing materials spanning a wide range of mineralogy and crystallinity. These materials include 11 samples of well-crystallized ferric oxides (hematite, maghemite, and magnetite) and ferric oxyhydroxides (goethite, lepidocrocite). We also report the first transmission spectra for purely nanophase ferric oxide samples that have been shown to exhibit spectral similarities to Mars in the visible to near-IR and we compare these data to previous and new transmission spectra of terrestrial palagonites. Most of these samples show numerous, diagnostic absorption features in the mid-IR due to Fe(3+)-O(2-) vibrational transitions, structural and/or bound OH, and/or silicates. These data indicate that high spatial resolution, moderate spectral resolution mid-IR ground-based and spacecraft observations of Mars may be able to detect and uniquely discriminate among different ferric-iron-bearing phases on the Martian surface or in the airborne dust.
Author
Infrared Radiation; Near Infrared Radiation; Remote Sensing; Visible Spectrum; Infrared Spectra; Emission Spectra; Iron Oxides; Hydroxides; Infrared Imagery; Mars Surface Samples; Mars Surface

19980210064 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA
Simultaneous adsorption of CO2 and H2O under Mars-like conditions and application to the evolution of the Martian climate
Zent, Aaron, P., Search for Extraterrestrial Intelligence Inst., USA; Quinn, Richard C., Search for Extraterrestrial Intelligence Inst., USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5341-5349; In English; Also announced as 19980210054
Contract(s)/Grant(s): RTOP 155-01-60-02; RTOP 155-01-60-11
Report No.(s): Paper-94JE01899; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche
The Martian regolith is the most substantial volatile reservoir on the planet; estimates of its adsorbed inventory have been based on simple measurements of the adsorption of either water or CO2 in isolation. Under some conditions, H2O can poison adsorbate surfaces, such that CO2 uptake is greatly reduced. We have made the first measurements of the simultaneous adsorption of CO2 and H2O under conditions appropriate to the Martian regolith and have found that at H2O monolayer coverage above about 0.5, CO2 begins to be displaced into the gas phase. We have developed an empirical expression that describes our co-adsorption

data and have applied it to standard models of the Martian regolith. We find that currently, H2O does not substantially displace CO, implying that the adsorbate inventories previously derived may be accurate, not more than 3-4 kPa (30-40 mbar). No substantial increase in atmospheric pressure is predicted at higher obliquities because high-latitude ground ice buffers the partial pressure of H2O in the pores, preventing high monolayer coverages of H2O from displacing CO2. The peak atmospheric pressure at high obliquity does increase as the total inventory of exchangeable CO2 increases.
Author
Mars Surface; Mars Atmosphere; Carbon Dioxide; Adsorption; Climate Models; Gas-Solid Interactions; Water Vapor

19980210065 Geological Survey, Flagstaff, AZ USA
Evidence of ancient continental glaciation in the Martian northern plains
Kargel, Jeffrey, S., Geological Survey, USA; Baker, Victor R., Arizona Univ., USA; Beget, James E., Alaska Univ., USA; Lockwood, Jeffrey, Sahuaro High School, USA; Pewe, Troy L., Arizona State Univ., USA; Shaw, John S., Alberta Univ., Canada; Strom, Robert G., Arizona Univ., USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5351-5368; In English; Also announced as 19980210054
Report No.(s): Paper-94JE02447; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

Whorled ridges, spaced about 2-6 km and forming lobate patterns with lobe widths of about 150 km, occur at many locations in the northern plains of Mars, commonly in close association with sinuous troughs that contain medial ridges. These landforms resemble moraines, tunnel channels, and eskers found in terrestrial glacial terrains, such as the midcontinent of North America. Some Martian landscapes may have formed by disintegration of continental glaciers that covered much of the northern plains into the early Amazonian (i.e., late in Martian geologic history). Meltwater processes apparently were important in the collapse of these hypothesized ice sheets; hence, the glaciers apparently were wet based in part. Whereas striking similarities exist among areas of the northern plains and some glaciated Pleistocene terrains on Earth, there are also important differences; notably, drumlin fields, such as those in many glacial landscapes on Earth, are rare, absent, or not yet resolved in images of the Martian northern plains. Another major difference is that postglacial fluvial and other water-related modifications (especially erosion) of Pleistocene terrains are substantial, but similar modifications are not observed in the northern plains; a virtually complete and sudden decline in the activity of liquid surface water following glaciation in the northern plains seems to be implied. The climatic implications of the hypothesized Martian glaciers and their decline are unclear. We investigate two possibilities, alternatively involving a relatively warm paleoclimate and the modern Martian climate. The hypothesized ice sheets in the basins within the northern plains (generally at elevations lower than -1 km) suggest a relationship of these frozen bodies of water with former regional lakes or seas, which may have formed in response to huge discharges of water from Martian outflow channels. This possible relationship has been modeled. Glaciers may have evolved from seas by their progressive freezing and then grounding and sublimational redistribution of sea ice. The transition to glaciation may have taken several million years if the climate was very cold, comparable to today's, or tens of thousands of years if the climate was as warm as modern Antarctica. A glacierized sea may have involved an extended period of glaciolacustrine and ice shelf processes.
Author
Glaciers; Mars Surface; Mars (Planet); Climatology; Geomorphology

19980210066 Brown Univ., Dept. of Chemistry and Geological Sciences, Providence, RI USA
Low-temperature and low atmospheric pressure infrared reflectance spectroscopy of Mars soil analog materials
Bishop, Janice L., Brown Univ., USA; Pieters, Carle M., Brown Univ., USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5369-5379; In English; Also announced as 19980210054; Supported in part by the ZONTA Foundation and the Keck Foundation.
Contract(s)/Grant(s): NAGw-28; NAGw-748
Report No.(s): Paper-94JE03331; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

Infrared reflectance spectra of carefully selected Mars soil analog materials have been measured under low atmospheric pressures and temperatures. Chemically altered montmorillonites containing ferrihydrite and hydrated ferric sulfate complexes are examined, as well as synthetic ferrihydrite and a palagonitic soil from Haleakala, Maui. Reflectance spectra of these analog materials exhibit subtle visible to near-infrared features, which are indicative of nanophase ferric oxides or oxyhydroxides and are similar to features observed in the spectra of the bright regions of Mars. Infrared reflectance spectra of these analogs include hydration features due to structural OH, bound H2O, and adsorbed H2O. The spectral character of these hydration features is highly dependent on the sample environment and on the nature of the H2O/OH in the analogs. The behavior of the hydration features near 1.9 micron, 2.2 micron, 2.7 micron, 3 micron, and 6 microns are reported here in spectra measured under a Marslike atmospheric environment. In spectra of these analogs measured under dry Earth atmospheric conditions the 1.9-micron band depth is 8-17%; this band is much stronger under moist conditions. Under Marslike atmospheric conditions the 1.9-micron feature is broad and barely discernible (1-3% band depth) in spectra of the ferrihydrite and palagonitic soil samples. In comparable spectra of the ferric

sulfate-bearing montmorillonite the 1.9-micron feature is also broad, but stronger (6% band depth). In the low atmospheric pressure and temperature spectra of the ferrihydrite-bearing montmorillonite this feature is sharper than the other analogs and relatively stronger (6% band depth). Although the intensity of the 3-micron band is weaker in spectra of each of the analogs when measured under Marslike conditions, the 3-micron band remains a dominant feature and is especially broad in spectra of the ferrihydrite and palagonitic soil. The structural OH features observed in these materials at 2.2-2.3 micron and 2.75 microns remain largely unaffected by the environmental conditions. A shift in the Christiansen feature towards shorter wavelengths has also been observed with decreasing atmospheric pressure and temperature in the midinfrared spectra of these samples.
Author
Infrared Spectroscopy; SOIl Sampling; Mars Surface Samples; Analogs; Spectral Reflectance; Montmorillonite; Infrared Spectra

19980210067 Cornell Univ., Center for Radiophysics and Space Research, Ithaca, NY USA
Longitudinal dunes on Mars: Relation to current wind regimes
Lee, Pascal, Cornell Univ., USA; Thomas, Peter C., Cornell Univ., USA; MSATT; Mar. 25, 1995; Volume 100, No. E3, pp. 5381-5395; In English; Also announced as 19980210054
Contract(s)/Grant(s): NAGw-3274; NAGw-3275
Report No.(s): Paper-95JE00225; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

Longitudinal dunes are extremely rare on Mars, but constitute a substantial fraction of terrestrial desert dunes. We report finding isolated examples of longitudinal dunes on Mars and relate their occurrence to expected sand transport regimes. Terrestrial longitudinal dunes form in bimodal and multimodal transport regimes. General circulation models and streak data indicate that bimodal and multimodal transport of sand should be very rare on Mars. Thus the dearth of longitudinal dunes on Mars is consistent with their apparent formation conditions on Earth.
Author
Dunes; Mars Surface; Wind Effects; Sands; Transport Properties; Mars (Planet)

19980210068 Cornell Univ., Center for Radiophysics and Space Research, Ithaca, NY USA
Polar margin dunes and winds on Mars
Thomas, Peter C., Cornell Univ., USA; Gierasch, Peter, Cornell Univ., USA; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5397-5406; In English; Also announced as 19980210054
Contract(s)/Grant(s): NAGw-3274; NAGw-1997
Report No.(s): Paper-94JE02639; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A03, Microfiche

The approximately concentric arrangement of layered deposits and dune fields at the two Martian poles may reflect a nearly steady state dispersal of material from the polar deposits. Data on effective surface winds from high resolution Viking Images combined with theory of local winds suggest that the northern dunes are in part confined to a latitude band by winds generated by their own low albedo. Dispersal of the dark sand from the southern polar region is not subject to this kind of feedback because the irregular topography prevents areal accumulations sufficiently extensive to produce winds.
Author
Image Analysis; Mars (Planet); Ground Wind; Wind Effects; Polar Regions; Dunes; Sediments

19980210069 Geological Survey, Flagstaff, AZ USA
Geology and landscape evolution of the Hellas region of Mars
Tanaka, Kenneth L., Geological Survey, USA; Leonard, Gregory J., Geological Survey, USA; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5407-5432; In English; Also announced as 19980210054
Report No.(s): Paper-94JEO2804; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A03, Microfiche

Hellas basin on Mars has been the site of volcanism, tectonism, and modification by fluvial, mass-wasting, and eolian processes over its more than 4-b.y. existence. Our detailed geologic mapping and related studies have resulted in the following new interpretations. The asymmetric distribution of highland massifs and other structures that define the uplifted basin rim suggest a formation of the basin by the impact of a low-angle bolide having a trajectory heading S 60 deg E. During the Late Noachian, the basin was infilled, perhaps by lava flows, that were sufficiently thick (>1 km) to produce wrinkle ridges on the fill material and extensional faulting along the west rim of the basin. At about the same time, deposits buried northern Malea Planum, which are interpreted to be pyroclastic flows from Amphitrites and Peneus Paterae on the basis of their degraded morphology, topography, and the application of a previous model for pyroclastic volcanism on Mars. Peneus forms a distinctive caldera structure that indicates eruption of massive volumes of magma, whereas Amphitrites is a less distinct circular feature surrounded by a broad, low, dissected shield that suggests generally smaller volume eruptions. During the Early Hesperian, an approx. 1- to 2-km-thick sequence of primarily fined-grained, eolian material was deposited on the floor of Hellas basin. Subsequently, the deposit was

deeply eroded, except where armored by crater ejecta, and it retreated as much as 200-300 km along its western margin, leaving behind pedestal craters and knobby outliers of the deposit. Local debris flows within the deposit attest to concentrations of groundwater, perhaps in part brought in by outflow floods along the east rim of the basin. These floods may have deposited approx. 100-200 m of sediment, subduing wrinkle ridges in the eastern part of the basin floor. During the Late Hesperian and Amazonian, eolian mantles were emplaced on the basin rim and floor and surrounding highlands. Their subsequent erosion resulted in pitted and etched plains and crater fill, irregular mesas, and pedestal craters. Local evidence occurs for the possible former presence of ground ice or ice sheets approx. 100 km across; however, we disagree with a hypothesis that suggests that the entire south rim and much of the floor of Hellas have been glaciated. Orientations of dune fields and yardangs in lower parts of Hellas basin follow directions of the strongest winds predicted by a recently published general circulation model (GCM). Transient frost and dust splotches in the region are, by contrast, related to the GCM prediction for the season in which the images they appear in were taken. Author

Mars Surface; Planetary Geology; Geomorphology; Structural Basins; Calderas; Planetary Evolution; Hypotheses

19980210070 NASA Ames Research Center, Moffett Field, CA USA

The circum-Chryse region as a possible example of a hydrologic cycle on Mars: Geologic observations and theoretical evaluation

Moore, Jeffrey M., National Academy of Sciences - National Research Council, USA; Clow, Gary D., Geological Survey, USA; Davis, Wanda L., NASA Ames Research Center, USA; Gulick, Virginia C., National Academy of Sciences - National Research Council, USA; Janke, David R., Arizona State Univ., USA; McKay, Christopher P., NASA Ames Research Center, USA; Stoker, Carol R., NASA Ames Research Center, USA; Zent, Aaron P., NASA Ames Research Center, USA; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5433-5447; In English; Also announced as 19980210054
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The transection and superposition relationships among channels, chaos, surface materials units, and other features in the circum-Chryse region of Mars were used to evaluate relative age relationships and evolution of flood events. Channels and chaos in contact (with one another) were treated as single discrete flood-carved systems. Some outflow channel systems form networks and are inferred to have been created by multiple flood events. Within some outflow channel networks, several separate individual channel systems can be traced to a specific chaos which acted as flood-source area to that specific flood channel. Individual flood-carved systems were related to widespread materials units or other surface features that served as stratigraphic horizons. Chryse outflow channels are inferred to have formed over most of the perceivable history of Mars. Outflow channels are inferred to become younger with increasing proximity to the Chryse basin. In addition, outflow channels closer to the basin show a greater diversity in age. The relationship of subsequent outflow channel sources to the sources of earlier floods is inferred to disfavor episodic flooding due to the progressive tapping of a juvenile near-surface water supply. Instead, we propose the circum-Chryse region as a candidate site of past hydrological recycling. The discharge rates necessary to carve the circum-Chryse outflow channels would have inevitably formed temporary standing bodies of H2O on the Martian surface where the flood-waters stagnated and pooled (the Chryse basin is topographically enclosed). These observations and inferences have led us to formulate and evaluate two hypotheses: (1) large amounts of the sublimated H2O off the Chryse basin flood lakes precipitated (snowed) onto the flood-source highlands and this H2O was incorporated into the near surface, recharging the H2O sources, making possible subsequent deluges; and (2) ponded flood-water in Chryse basin drained back down an anti basinward dipping subsurface layer accessed along the southern edge of the lake, recharging the flood-source aquifers. H2O not redeposited in the flood-source region was largely lost to the hydrologic cycle. This loss progressively lowered the vitality of the cycle, probably by now killing it. Our numerical evaluations indicate that of the two hypotheses we formulated, the groundwater seep cycle seems by far the more viable. Optimally, approx. 3/4 of the original mass of an ice-covered cylindrical lake (albedo 0.5, 1 km deep, 100-km radius, draining along its rim for one quarter of its circumference into substrata with a permeability of 3000 darcies) can be modeled to have moved underground (on timescales of the order of 10(exp 3) years) before the competing mechanisms of sublimation and freeze down choked off further water removal. Once underground, this water can travel distances equal to the separation between Chryse basin and flood-source sites in geologically short (approx. 10(exp 6) year-scale) times. Conversely, we calculate that optimally only approx. 40% of the H2O carried from Chryse can condense at the highlands, and most of the precipitate would either collect at the base of the highlands/lowlands scarp or sublimate at rates greater than it would accumulate over the flood-source sites. Further observations from forthcoming missions may permit the determination of which mechanisms may have operated to recycle the Chryse flood-waters.
Author

Mars Surface; Planetary Evolution; Hypotheses; Hydrological Cycle; Hydrology Models; Structural Basins; Floods; Image Analysis

19980210072 NASA Ames Research Center, Moffett Field, CA USA

A slightly more massive young Sun as an explanation for warm temperatures on early Mars

Whitmire, Daniel P., University of Southwestern Louisiana, USA; Doyle, Laurance R., Search for Extraterrestrial Intelligence Inst., USA; Reynolds, Ray T., NASA Ames Research Center, USA; Matese, John J., University of Southwestern Louisiana, USA; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5457-5464; In English; Also announced as 19980210054

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The valley network channels on the heavily cratered ancient surface of Mars suggest the presence of liquid water approx. 3.8 Gyr ago. However, the implied warm climate is difficult to explain in the context of the standard solar model, even allowing for the maximum CO2 greenhouse heating. In this paper we investigate the astronomical and planetary implications of a nonstandard solar model in which the zero-age, main-sequence Sun had a mass of 1.05 +/- 0.02 Solar Mass. The excess mass was subsequently lost in a solar wind during the first 1.2(sup -0.2)(sub +.04) Gyr of the Sun's main sequence phase. The implied mass-loss rate of 4(sup +3)(sub -2) x 10(exp -11) Solar Mass/yr, or about 10(exp 3) times that of the current Sun, may be detectable in several nearby young solar type stars.

Author

Planetary Temperature; Solar Activity Effects; Solar Planetary Interactions; Mars Environment; Planetary Evolution; Stellar Models; Stellar Mass; Climate Change

19980210073 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Diagnostic calculations of the circulation in the Martian atmosphere

Santee, Michelle L., California Inst. of Tech., USA; Crisp, David, Jet Propulsion Lab., California Inst. of Tech., USA; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5465-5484; In English; Also announced as 19980210054

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The circulation of the Martian atmosphere during late southern summer is derived from atmospheric temperature and dust distributions retrieved from a subset of the Mariner 9 infrared interferometer spectrometer (IRIS) thermal emission spectra (L(sub s) = 343-348 deg). Zonal-mean zonal winds are calculated by assuming gradient wind balance and zero surface zonal wind. Both hemispheres have intense midlatitude westerly jets with velocities of 80-90 m/s near 50 km; in the southern tropics the winds are easterly with velocities of 40 m/s near 50 km. The net effect of the zonal mean meridional circulation and large-scale waves can be approximated by the diabatic circulation, which is defined from the atmospheric thermal structure and net radiative heating rates. The radiative transfer model described by Crisp (1990) and Santee (1993) is used to compute solar heating and thermal cooling rates from diurnal averages of the retrieved IRIS temperature and dust distributions. At pressures below 4 mbar, there are large net radiative heating rates (up to 5 K/d) in the equatorial region and large net radiative cooling rates (up to 12 K/d) in the polar regions. These net radiative heating rates are used in a diagnostic stream function model which solves for the meridional and vertical components of the diabatic circulation simultaneously. We find a two-cell circulation, with rising motion over the equator, poleward flow in both hemispheres, sinking motion over both polar regions, and return flow in the lowest atmospheric levels. The maximum poleward velocity is 3 m/s in the tropics at approx. 55 km altitude, and the maximum vertical velocity is 2.5 cm/s downward over the north pole at approx. 60 km altitude. If these large transport rates are sustained for an entire season, the Martian atmosphere above the 1-mbar level is overturned in about 38 days. This diabatic circulation is qualitatively similar to the terrestrial diabatic circulation at the comparable season, but is more vigorous.

Author

Mars Atmosphere; Atmospheric General Circulation Models; Wind (Meteorology); Zonal Flow (Meteorology); Radiative Heat Transfer; Stream Functions (Fluids); Atmospheric Circulation; Transport Properties; Dust; Annual Variations; Convective Flow

19980210074 Oxford Univ., Dept. of Physics, Oxford, UK

Western boundary currents in the Martian atmosphere: Numerical simulations and observational evidence

Joshi, M. M., Oxford Univ., UK; Lewis, S. R., Oxford Univ., UK; Read, P. L., Oxford Univ., UK; Catling, D. C., Oxford Univ., UK; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5485-5500; In English; Also announced as 19980210054

Report No.(s): Paper-94JE02716; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A03, Microfiche

Western boundary currents (hereafter WBCs) are an intensification of meridional fluid flow along the eastward facing flank of a boundary. They occur in the Earth's oceans, the best known instance being the Gulf Stream, and in the terrestrial atmosphere, an example of which is the East African Jet. We have investigated WBCs in numerical simulations of the Martian atmosphere, where they occur in the presence of large longitudinal topographical gradients, combined with the beta effect. We suggest that

WBCs have already been simulated by other Martian atmospheric models, although not identified as such. The intensity of these currents is dependent on basic model parameters, notably surface drag. We show that for physically reasonable values of drag, frictional forces dominate the WBCs' behavior. The requirement of zero net cross-equatorial time-mean mass flow produces a "return flow" in simulations with relatively low surface drag, which acts in opposition to the Tharsis WBC. We also show that the intense flow associated with WBCs advects potential vorticity across the equator, although the presence of strong radiative damping inhibits low-level inertial instabilities that might result from this. Slope winds are found to have a profound effect on WBC structure, especially where they have a component parallel to the jet. In these cases, slope winds can cancel out or reinforce WBCs, depending on their direction. Enhanced low-level winds associated with WBCs may be a factor that influences the locations of dust storm generation. The high vertical shear associated with WBCs may also play a role in the maintenance and subsequent decay of these dust storms. Some observational evidence may exist for WBCs in the form of the alignment of bright depositional dust streaks, wave clouds, and in wind measurements taken during the parachute descent phase of Viking Lander 1 through the planetary boundary layer.
Author
Atmospheric Models; Planetary Boundary Layer; Boundary Layer Flow; Computerized Simulation; Three Dimensional Models; Dust Storms; Mars Atmosphere; Meridional Flow; Friction Drag

19980210075 Ecole Normale Superieure, Dynamic Meteorology Lab., Paris, France
The sensitivity of the Martian surface pressure and atmospheric mass budget to various parameters: A comparison between numerical simulations and Viking observations
Hourdin, Frederic, Ecole Normale Superieure, France; Forget, Francois, Ecole Normale Superieure, France; Talagrand, Olivier, Ecole Normale Superieure, France; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5501-5523; In English; Also announced as 19980210054
Report No.(s): Paper-94JE03079; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A03, Microfiche

The sensitivity of the Martian atmospheric circulation to a number of poorly known or strongly varying parameters (surface roughness length, atmospheric optical depth, CO2 ice albedo, and thermal emissivity) is investigated through experiments performed with the Martian version of the atmospheric general circulation model of Laboratoire de Meteorologie Dynamique, with a rather coarse horizontal resolution (a grid with 32 points in longitude and 24 points in latitude). The results are evaluated primarily on the basis of comparisons with the surface pressure records of the Viking mission. to that end, the records are decomposed into long-period seasonal variations due to mass exchange with the polar caps and latitudinal redistribution of mass, and short-period variations due to transient longitudinally propagating waves. The sensitivity experiments include a 5-year control simulation and shorter simulations (a little longer than 1 year) performed with "perturbed" parameter values. The main conclusions are that (1) a change of horizontal resolution (twice as many points in each direction) mostly affects the transient waves, (2) surface roughness lengths have a significant impact on the near-surface wind and, as a matter of consequence, on the latitudinal redistribution of mass, (3) atmospheric dust optical depth has a significant impact on radiative balance and dynamics, and (4) CO2 ice albedo and thermal emissivity strongly influence mass exchange between the atmosphere and the polar caps. In view of this last conclusion, an automatic procedure is implemented through which the albedo and emissivity of each of the two polar caps are determined, together with the total (i.e., including the caps) atmospheric CO2 content, in such a way as to get the closest fit of the model to the Viking pressure measurements.
Author
Atmospheric General Circulation Models; Atmospheric Circulation; Mars Atmosphere; Mars Surface; Surface Roughness; Pressure Measurement; Carbon Dioxide Concentration; Emissivity; Thermal Emission; Albedo; Land Ice; Ground Wind; Mass Distribution; Pressure Distribution

19980210076 Centre National de la Recherche Scientifique, Service d'Aeronomie, Verrieres-Le Buisson, France
Post-Phobos model for the altitude and size distribution of dust in the low Martian atmosphere
Chassefiere, Eric, Centre National de la Recherche Scientifique, France; Drossart, P., Observatoire de Paris-Meudon, France; Korablev, O., Institute of Space Research, USSR; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5525-5539; In English; Also announced as 19980210054
Report No.(s): Paper-94JE03363; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A03, Microfiche

Four experiments flown on board Phobos 2 provided information on the characteristics of the dust particles suspended in the Martian atmosphere: Auguste (UV-visible-IR spectrometer working in solar occultation geometry), ISM (IR spectrometer measuring the light of the Sun reflected by the planet), Termoskan (scanning radiometer mapping the planetary thermal radiation), KRFM (UV-visible multiphotometer providing limb-to-limb profiles). These experiments, which sounded equatorial regions (20 deg S-20 deg N) near the northern spring equinox (L(sub S)=0-20 deg), are shown to yield a reasonably consistent picture of the

dust distribution over the whole altitude range from the ground level, or just above, outside the boundary layer, up to approx. 25 km. The vertical profiles of particle volume mixing ratio and effective (projected area-weighted) radius deduced from Auguste measurements, performed in the 15-25 km altitude range, are extrapolated down to the ground by using a simple, physical parameterization of the altitude dependence of dust mixing ratio and radius. This parameterization, which must be understood as describing the vertical distribution of dust in the zonal average and on the mesoscale in latitude, assumes that gravitational settling and eddy diffusion are the only two processes driving vertical dust transport. The vertically averaged effective radius and optical depth of dust particles, as well as vertical profiles of related quantities, are obtained. Optical depth at 1.9-microns wavelength is found to be 0.2 on average, with a typical variation of +/- 0.1 with time and space. This result is similar to that obtained from ISM spectra analysis. It is also consistent with the Termoskan and KRFM measurements, which yield near-infrared optical depths of 0.12-0.26 and 0.12-0.24, respectively. The particle number density near the surface, as derived from extrapolation of solar occultation profiles, is in the range 1-3 cm(exp -3), in good agreement with Termoskan results (1-2 cm(exp -3)). The scale height of the dust volume mixing ratio just above the surface is approx. 8-9 km on average, that is, of the same order as the background atmospheric scale height. The vertically averaged effective radius of dust particles is found to lie in the range 1.7 +/- 0.2 microns, possibly approx. 2 microns in the case of a large effective variance of 0.4. The most likely ISM value is 1.2 microns, with a rather large uncertainty of +/- 0.4 microns, mainly due to the fact that the spectral dependence of the Minnaert coefficient is not well known. Because ISM data used in the present work were obtained on the Tharsis plateau, at a mean altitude of approx. 7 km, the ISM radius must be compared to the Auguste vertically averaged radius for z > 7 km, that is, approx. 1.5 +/- 0.2 microns. Auguste and ISM radii are therefore consistent at the 1-delta level. Three typical vertical profiles of the dust particle radius and number density, obtained by averaging all solar occultation profiles, including their extrapolated parts below approx. 15 km, are proposed as reference models, for three selected values of the effective variance of the particle size distribution (0.10, 0.25, and 0.40).
Author
Mars Atmosphere; Dust; Particles; Atmospheric Effects; Atmospheric Composition; Atmospheric Models; Vertical Distribution; Planetary Boundary Layer; Particle Size Distribution

19980210077 Observatoire de Paris-Meudon, Dept. de Recherche Spatiale, France
A reexamination of the relationship between eddy mixing and O2 in the Martian middle atmosphere
Rosenqvist, Jan, Observatoire de Paris-Meudon, France; Chassefiere, E., Centre National de la Recherche Scientifique, France; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5541-5551; In English; Also announced as 19980210054
Report No.(s): Paper-95JE00324; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A03, Microfiche

A value of the eddy diffusion coefficient K of approx. 1.5 x 10(exp 6) sq cm/s in the middle atmosphere of Mars was obtained from Phobos 2 solar occultation measurements of dust, ozone, and clouds at low latitude. The aim of the present study is to complete this picture by using a steady state photochemical one-dimensional model. The main regulation mechanism of O2 is the reaction of O with itself, whose rate depends on the value of K in the middle atmosphere. by comparing calculated and observed values of the O2 abundance, an upper limit of approx. 2 x 10(exp 7) sq cm/s on K is inferred. by including an additional constraint provided by H2 balance, a lower limit of 4 x 10(exp 6) sq cm/s may be placed. It results from the present analysis that the most realistic value of K to be used in works resorting to one-dimensional modeling (long-term evolution, escape, surface/atmosphere exchanges) is approx. 10(exp 7) sq cm/s rather than approx. 10(exp 6) sq cm/s. The difference between theoretical and observational values might be due to the regular occurrence of global dust storms, whose effect should be to increase the yearly average value of K. The present study suggests less than 3 precipitable micrometer of the yearly averaged water vapor column, unless H2O is confined in a layer near the ground. Although the first possibility seems more probable, the second hypothesis cannot be ruled out. It could reflect a continuous supply of H2O from the regolith to the atmosphere on a seasonal scale. The loss to production ratio of CO, which has a lifetime of approx. 5 years, is shown to depart from unity by no more than approx. 10% over a wide range of atmospheric conditions. The stability of the Martian atmosphere is therefore realized in the classical frame of homogeneous chemistry.
Author
Mars Atmosphere; Middle Atmosphere; Turbulent Diffusion; Oxygen; Diffusion Coefficient; Turbulent Mixing; Dust; Mathematical Models; Photochemical Reactions

19980210078 North Carolina Univ., Dept. of Geography and Space Sciences, Charlotte, NC USA
A case for ancient evaporite basins on Mars
Forsythe, Randall D., North Carolina Univ., USA; Zimbelman, James R., Smithsonian Institution, USA; MSATT: Mars Surface and Atmosphere Through Time; Mar. 25, 1995; Volume 100, No. E3, pp. 5553-5563; In English; Also announced as 19980210054
Report No.(s): Paper-95JE00325; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A03, Microfiche

Observations indicate that a Martian analog to the Earth's salt pans and saline lakes of arid regions may have existed in crater-basins during Mars' early (Noachian) epoch. Terraced and channelized crater-basins point to ponding of surface water as well as possible prolonged and evolving base levels. In addition, supportive (evaporite basin) analogs are offered for three other morphologic features of Martian crater-basins. An evaporite basin model for crater-basins on Mars has major implications for the mechanical, chemical, and even biological processes that potentially have operated in Mars' past, and represent a spectrum of potential mineral resources.
Author
Mars (Planet); Mars Craters; Mars Surface; Surface Water; Planetary Evolution; Salt Beds; Flats (Landforms); Structural Basins; Image Analysis

19980210217 Michigan Univ., Space Physics Lab., Ann Arbor, MI USA
Archival Study of Energetic Processes in the Upper Atmosphere of the Outer Planets ***Final Report, 1995-1998***
Ballester, Gilda E., Michigan Univ., USA; Harris, Walter M., Michigan Univ., USA; Jun. 02, 1998; 5p; In English
Contract(s)/Grant(s): NAG5-3044
Report No.(s): NASA/CR-1998-208266; NAS 1.26:208266; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
We compare International Ultraviolet Explorer (IUE) spectral observations of Jupiter's UltraViolet (UV) aurora in H-Lyman alpha (H-Lya) and H2 emissions with images of the UV aurora with HST to make more realistic interpretations of the IUE dataset. Use the limited spatial information in the IUE line-by-line spectra of the bright H-Lya line emission in the form of pseudo-monochromatic images at the IUE 3.5 arcsec resolution (Lya pseudo-images), to derive information on the emissions. Analysing of H2 spectra of Saturn's UV aurora to infer atmospheric level of auroral excitation from the methane absorption (color ratios). Analysing of a Uranus IUE dataset to determine periodicity in the emissions attributable to auroral emission fixed in magnetic longitude. Reviewing of the results from IUE observations of the major planets, upper atmospheres and interactions with the planets magnetospheres. Analysing of IUE spectra of the UV emissions from Io to identify excitation processes and infer properties of the Io-torus-Jupiter system.
Derived from text
Upper Atmosphere; Planets; Lyman Alpha Radiation; IUE; H Lines; Auroras; Exploration

19980210405 Michigan Univ., Space Physics Research Lab., Ann Arbor, MI USA
Studies of Tenuous Planetary Atmospheres ***Final Report, 1 Aug. 1996 - 31 Jul. 1997***
Combi, Michael R., Michigan Univ., USA; 1997; 10p; In English
Contract(s)/Grant(s): NAGw-3417
Report No.(s): NASA/CR-1997-208226; NAS 1.26:208226; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
In order to understand the physical and chemical processes which produce the dust comae in comets and various tenuous planetary and planetary satellite (upper) atmospheres through interactions with their particle, field, and radiation environs, it is necessary analyze remotely observed and spacecraft data with physically meaningful models. With this in mind, we have undertaken a coupled program of theoretical modeling and complementary data analysis regarding the distribution of dust in comets, and the global distributions of neutral and ionized gases in, and escape from, tenuous planetary atmospheres. The nature of the atmospheres and ionospheres of Jupiter's natural satellites Io and Europa and their interactions with their surrounding radiation, and particles and fields environments is a very active and timely field of study. Various kinds of work, depending on different regime-dependent approaches have been adopted in recent years, with the hope of understanding the basic global structure of the atmospheres, and their interactions with solar radiation and with the Jovian plasma torus environment. Io's interaction with Jupiter's corotating plasma torus has been studied for over 25 years. Io has a neutral atmosphere which is probably locally thick but rather uneven across its surface. (See Lellouch 1996 for an excellent review of pre-1996 literature.) The ultimate source for atmospheric gases appears to be the numerous active volcanoes on the surface, moderated by condensation and sublimation from the surface. The energetic particle environment near Io is responsible for the balance of the plasma heating, Joule heating, ionization, and surface d responsible I an atmospheric sputtering, and in some form drives the escape of the neutral atmosphere. The tenuous atmosphere portion of our work involves developing and applying coupled three-dimensional magnetohydrodynamic (MHD) and fully kinetic ion and neutral Direct Simulation Monte Carlo models to describe the upper atmospheres and ionosphere of Jupiter's planetary satellites and their interaction with the corotating plasma torus. This is first being done for Jupiter's moon Io and then for Europa.
Derived from text
Planetary Atmospheres; Dust; Energetic Particles; Chemical Reactions; Atmospheric Composition; Solar Radiation; Upper Atmosphere

19980210630 Lunar and Planetary Inst., Houston, TX USA

In Situ Resource Utilization (ISRU II) Technical Interchange Meeting

Kaplan, David, Compiler, NASA Johnson Space Center, USA; Saunders, Stephen R., Compiler, Jet Propulsion Lab., California Inst. of Tech., USA; 1997; 51p; In English; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting, 18-19 Nov. 1997, Houston, TX, USA; Also announced as 19980210631 through 19980210649

Contract(s)/Grant(s): NASw-4574

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This volume contains extended abstracts that have been accepted for presentation at the In Situ Resource Utilization (ISRU II) Technical Interchange Meeting, November 18-19, 1997, at the Lunar and Planetary Institute, Houston, Texas. Included are topics which include: Extraterrestrial resources, in situ propellant production, sampling of planetary surfaces, oxygen production, water vapor extraction from the Martian atmosphere, gas generation, cryogenic refrigeration, and propellant transport and storage. CASI

Abstracts; Resources Management; Planetary Geology; Planetary Environments; Oxygen Production; Mars Surface; Mars Exploration; Extraterrestrial Resources; Propellants

19980210631 Alabama Univ., Dept. of Physics, Birmingham, AL USA

In-Situ resource assessment and process control with laser Raman spectroscopy

Agresti, D. G., Alabama Univ., USA; Wdowiak, T. J., Alabama Univ., USA; Mirov, S. B., Alabama Univ., USA; Kudryavtsev, A. B., Alabama Univ., USA; Kinney, T. R., Control Development, Inc., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 1-2; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

For in-situ resource utilization certain tasks must be accomplished, including prospecting for available resources and process monitoring and control. During prospecting, surface materials are identified as to whether they contain mineral or molecular components needed for the anticipated process; then ores are found in which these materials are most concentrated. Following size reduction and/or pulverization, raw materials are transported and introduced into the processor unit, where intermediate and final products are analyzed to ascertain that the production process is proceeding as desired. With continual monitoring of intermediate products, feedback may be employed as part of the control strategy. For in-situ application, laser Raman spectroscopy is the ideal resource assessment technique for all these tasks. It has the capability to (1) characterize resource minerals in rocks, soils, or ices; (2) prospect for ores by identifying high concentrations of desired resource material; and (3) monitor a production process by characterizing intermediate and final products (solids or liquids). Moreover, the technique has been implemented in a compact instrument suitable for spacecraft use, e.g. on the surfaces of Mars, the Moon, asteroids, etc.

Derived from text

Laser Spectroscopy; Raman Spectroscopy; Composition (Property); Extraterrestrial Resources; Resource Allocation; Process Control (Industry); Sampling; SOIl Sampling; In Situ Measurement; Spectroscopic Analysis

19980210632 Washington Univ., Aerospace and energetics Research Program, Seattle, WA USA

Feasibility studies of the extraction of water vapor from the Martian atmosphere by adsorption in zeolite 3A

Bruckner, A. P., Washington Univ., USA; Coons, S. C., Washington Univ., USA; Williams, J. D., Washington Univ., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 3-4; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To achieve the maximum benefit from Martian in situ resource utilization (ISRU), an indigenous source of water must be developed. The possibility of obtaining water on Mars would make feasible the operation of a Sabatier/electrolysis (S/E) propellant plant without having to import the necessary seed hydrogen from Earth. This paper presents the results of a continuing feasibility study of the extraction of water vapor by adsorption from the Martian atmosphere.

Derived from text

Adsorption; Feasibility Analysis; Water; Mars Atmosphere; Zeolites; Water Vapor; Extraction; Extraterrestrial Resources

19980210633 NASA Johnson Space Center, Houston, TX USA

Characterization of the Resource Potential of Martian SOIl using the Integrated Dust/SOIl Experiment Package (IDEP)

Cooper, Bonnie L., Oceaneering Space Systems, USA; Mckay, David S., NASA Johnson Space Center, USA; Allen, Carlton C., Lockheed Martin Space Mission Systems and Services, USA; Hoffman, John H., Texas Univ. at Dallas, USA; Gittleman, Mark E., Oceaneering Space Systems, USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 5-6; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Integrated Dust/SOIl Experiment Package (IDEP) is a suite of instruments that can detect and quantify the abundances of useful raw materials on Mars. We focus here on its capability for resource characterization in the martian soil; however, it is also capable of detecting and quantifying gases in the atmosphere. This paper describes the scientific rationale and the engineering design behind the IDEP.
Derived from text
Mars Surface; SOIl Sampling; Extraterrestrial Resources; Mass Spectroscopy

19980210634 Amparo Corp., Santa Fe, NM USA
A LiF silicon sandwich counter to measure water content of planetary surfaces
Drake, D. M., Amparo Corp., USA; Clark, Benton C., Lockheed Martin Astronautics, USA; Jakosky, Bruce M., Colorado Univ., USA; Reedy, Robert, Los Alamos National Lab., USA; Squyres, Steven W., Cornell Univ., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 7; In English; Also announced as 19980210630
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The neutron counter proposed here has a long history and was commercially available in a somewhat different form. This counter would be suitable for a rover or lander since it requires a rather long measuring time for each placement. It consists of two silicon wafer charged-particle counters with a layer of Li-6F deposited on the inner surface of one. The neutron detecting reaction is Li-6(n,H-3)He-4 in which the alpha particle and the triton are emitted from the Li-6 deposit back to back. If one of the detectors sees the alpha particle, the other will see the triton. This allows one to use a coincidence technique that virtually eliminates all background. The signals from each detector can be added together so that the total energy of the reaction, Q=4.6 MeV and the kinetic energy of the neutron, can be recorded.
Derived from text
Neutron Counters; Lithium Isotopes; Alpha Particles; Moisture Content; Planetary Surfaces; Neutron Spectra

19980210636 NASA Ames Research Center, Moffett Field, CA USA
In-situ generation of carrier gases for scientific analyses on Mars
Finn, J. E., NASA Ames Research Center, USA; Sridhar, K. R., Arizona Univ., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 11-12; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The search for useful raw materials on planetary surfaces will involve various scientific analyses of soil and rock samples. The devices performing these measurements often require inert carrier gases for moving analytes and purging instrumentation. At present, the carrier or sweep gas must be carried from Earth in a compressed gas cylinder, and so the supply of this depletable resource sets a hard limit on the (flexible) life span of the experiment. If a suitable carrier gas could be produced in-situ, then the scientific return of exploration missions could be extended and enhanced greatly. Many more samples could be analyzed, long-ranging rovers could have independent gas supplies, and designs could have added flexibility with respect to gas consumption.
Derived from text
Gas Generators; Compressed Gas; Gas Mixtures; Nitrogen; Argon; Mars Surface

19980210637 Honeybee Robotics Ltd., New York, NY USA
Miniaturized material sampling and transfer devices for extraterrestrial exploration
Gorevan, S., Honeybee Robotics Ltd., USA; Rafeek, S., Honeybee Robotics Ltd., USA; Myrick, T., Honeybee Robotics Ltd., USA; Kong, K. Y., Honeybee Robotics Ltd., USA; Mahaffey, P., Honeybee Robotics Ltd., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 13; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

For early extraterrestrial exploration with a limited payload, miniaturized sampling devices that can be mounted on a rover platform will be crucial in locating areas with high resource concentration for future extraction, storage and utilization. Two such rover friendly sampling devices are the gas Sniffer and the Sample Acquisition and Transfer Mechanism (SATM). The Sniffer is a miniaturized gas sampler that can be utilized for the characterization of atmospheric, surface and subsurface molecular composition as a function of time and site location. The device is embodied in the tip of a non-rotating, drill sleeve just behind the auger and cutting head. SATM is another highly developed miniature sampling device that can repeatedly deliver solid samples (acquired from the surface to depths of 1 meter below surface) to a number of on-board instruments such as microscopes (for cataloging), ovens (for composition analyses) and/or to a hermetically sealed sample return canister for a sample return mission.
Derived from text
Miniaturization; Samplers; Extraterrestrial Resources; Gas Composition; SOIl Sampling; Onboard Equipment; Planetary Atmospheres; Planetary Surfaces; In Situ Measurement

19980210639 Charles Univ., Prague, Inst. of Geochemistry, Mineralogy and Mineral Resources, Stredocesky, Czechoslovakia

Microtel: A TV Microscope for planetary field geology and resource evaluation

Jakes, Petr, Charles Univ., Prague, Czechoslovakia; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 17-19; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To obtain ”mineralogical and morphologic” information ”in situ” on planetary surfaces we have designed, constructed and undertaken preliminary tests of a Microtel, compact TV-microscope imaging system that allows us to image an area of several square centimeters and/or millimeters of planetary surface (regolith or rock samples). The Microtel has been constructed with a minimum of moving parts. Because of its simplicity it could be part of a robotic probe or could be used by an astronaut as a hand-held lens. The microscope (or hand held lens equivalent) uses a photosensitive device (e.g., CCD chip) combined with the microscopic lenses, mirrors, internal light and/or fiber optics to image the area in visible, UV or NIR. The size of the monitored area translated to magnification could be easily changed, depending on needs, by varying the optics. The other modes of magnification, i.e., false electronic magnification, through dense CCD chips could be used as well. Microscope lenses with a short working distance between the optic system and the ”eye” (CCD) are used. Magnification of 10 to 1000 times (using a TV screen) were explored. The best results were obtained with magnifications of 10 times to about 100 times at the TV screen. Good images were provided with sufficient depth of focus and good resolution (better than 5 microns). Different apertures are used to vary the depth of the focus. The device is connected by cable to a signal processing unit and to a TV monitor, videoprinter, videorecorder or PC. The equipment camera and illumination with focusing system is small and lightweight (50 x 50 x 20 millimeters, or tube of 100 mm long and 20 mm in diameter) and less than 250g. The Microtel has its own light source and is easily transportable, allowing the imaging of normally inaccessible areas.

Derived from text

Charge Coupled Devices; CCD Cameras; Imaging Techniques; Optical Microscopes; Photomicrography; Television Systems; Planetary Surfaces; In Situ Measurement; Extraterrestrial Resources

19980210640 Johnson and Associates, Albuquerque, NM USA

Engineering properties of the regolith on the moon and Mars related to ISRU

Johnson, Stewart W., Johnson and Associates, USA; Chua, Koon Meng, New Mexico Univ., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 21-22; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In Situ Resource Utilization on the Moon and Mars requires devices that detect and quantify the abundance of useful raw materials. We also need machines that process the raw materials into useful resources. Knowledge of the mechanical properties of lunar and Mars regolith is essential to success in designing both the devices and machines. We suggest that each future visit by robots and humans be used as an opportunity to gather required data on the regolith mechanical properties and behavior at all locations visited. An active program is needed to analyze the data and do comparisons and correlations of what is learned in this data-gathering effort. One product of this effort will be validated simulants of Mars surface materials and enhancements of current lunar soil simulants. Validated simulated Mars and lunar soils are required to do meaningful pre-flight testing on Earth of ISRU soil-handling equipment intended for use on the Moon and Mars.

Derived from text

Planetary Geology; Mars Surface; Handling Equipment; Regolith; Extraterrestrial Resources; Resources Management; Mars (Planet); Lunar Composition; In Situ Measurement; Mars Surface Samples; Moon

19980210643 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA USA

In Situ identification of mineral resources with an X-ray-optical ”Hand-Lens” instrument

Marshall, J., Search for Extraterrestrial Intelligence Inst., USA; Koppel, L., Oryx Technology Corp., USA; Bratton, C., Search for Extraterrestrial Intelligence Inst., USA; Metzger, E., San Jose State Univ., USA; Hecht, M., Jet Propulsion Lab., California Inst. of Tech., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 27; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The recognition of material resources on a planetary surface requires exploration strategies not dissimilar to those employed by early field geologists who searched for ore deposits primarily from surface clues. In order to determine the location of mineral ores or other materials, it will be necessary to characterize host terranes at regional or subregional scales. This requires geographically broad surveys in which statistically significant numbers of samples are rapidly scanned from a roving platform. to enable broad-scale, yet power-conservative planetary-surface exploration, we are developing an instrument that combines x-ray diffractometry (XRD), x-ray fluorescence spectrometry (XRF), and optical capabilities; the instrument can be deployed at the end of a rover’s robotic arm, without the need for sample capture or preparation. The instrument provides XRD data for identification of mineral species and lithological types; diffractometry of minerals is conducted by ascertaining the characteristic lattice parame-

ters or ”d-spacings” of mineral compounds. D-spacings of 1.4 to 25 angstroms can be determined to include the large molecular structures of hydrated minerals such as clays. The XRF data will identify elements ranging from carbon (Atomic Number = 6) to elements as heavy as barium (Atomic Number = 56).
Derived from text
In Situ Measurement; Extraterrestrial Resources; Mineral Deposits; Lattice Parameters; Lenses; X Ray Imagery; X Ray Optics; Planetary Surfaces

19980210648 Los Alamos National Lab., NM USA
Stand-off planetary surface analysis using laser-induced breakdown spectroscopy and laser-induced plasma ion mass spectrometry
Wiens, R. C., Los Alamos National Lab., USA; Cremers, D. A., Los Alamos National Lab., USA; Blacic, J. D., Los Alamos National Lab., USA; Funsten, H. O., Los Alamos National Lab., USA; Nordholt, J. E., Los Alamos National Lab., USA; In Situ Resource Utilization (ISRU II) Technical Interchange Meeting; 1997, pp. 37-39; In English; Also announced as 19980210630; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Characterization of useable planetary materials will require high sampling throughput. Although remote observations from orbiting spacecraft provide spatially wide coverage, they do not, by themselves, provide sufficient information for materials utilization purposes. On the other hand, active rover-based in-situ analyses can provide detailed geological information but can be very time-consuming and limited in scope, as was recently demonstrated by the Mars Pathfinder Mission. The optimum configuration for detailed analysis with wide spatial coverage may be a stand-off technique. Stand-off techniques are being tested which utilize laser interrogation for elemental and isotopic analyses. We are simultaneously testing both emission spectroscopy, to measure characteristic wavelengths in the laser-induced spark, and a mass spectrometer to measure the mass of ions generated and accelerated by the spark. Material can be analyzed from within a radius of several tens of meters from the instrument platform. A relatively large area can thus be sampled from a simple lander without requiring a rover or sampling arms. On a rover, such an instrument would allow sampling of locations not otherwise accessible, such as on a steep ledge, and its versatility would reduce travel requirements for the rover.
Derived from text
Mass Spectroscopy; Planetary Composition; Planetary Surfaces; SOIl Sampling; Emission Spectra; Laser Spectroscopy

19980210762 Search for Extraterrestrial Intelligence Inst., Mountain View, CA USA
Radio Occultation Studies of Venus’ Atmosphere with Magellan ***Final Report, 1 Feb. 1997 - 31 Jan. 1998***
Jenkins, Jon M., Search for Extraterrestrial Intelligence Inst., USA; 1998; 16p; In English
Contract(s)/Grant(s): NAGw-4450
Report No.(s): NASA/CR-1998-208215; NAS 1.26:208215; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have been conducting a systematic study of the middle and lower atmosphere of Venus through analysis of 20 radio occultation experiments conducted with the Magellan spacecraft between October, 1991, and August, 1994. These studies have revealed a rich but sparsely sampled trove of information regarding the structure, composition and dynamics of the Venus atmosphere. The five sets of experiments sampled a variety of latitudes. Basic results include vertical profiles of: (1) electron density in the ionosphere, (2) pressure, temperature, density, and static stability in the neutral atmosphere (from 33 km to 98 km), and (3) sulfuric acid vapor (H2SO4) abundance below the main cloud deck. Further analysis of the temperature profiles led to the discovery of small vertical-scale gravity waves in the neutral atmosphere. The retrieved profiles show intriguing zonal variations that might be due to planetary- scale waves. During the performance period of this grant, we have concentrated on reanalyzing the 15 experiments conducted in 1994 using improved trajectory files for Magellan provided by JPL, obtaining more reliable results, and on conducting an error analysis of the derived profiles. In addition, we have begun an analysis of microwave emission maps of Venus obtained at the Very Large Array (VLA) in April, 1996. This report is organized as follows: A summary of results is presented, giving representative examples of the various physical profiles retrieved from all the Magellan radio occultation studies, emphasizing latitudinal variations evident in the data. Next, a preliminary analysis of the VLA maps is given. A summary of activities follows the scientific results, detailing papers published and presented at various conferences. This report concludes with a ”Conclusions and Suggestions for Future Work” section.
Author
Venus Atmosphere; Radio Occultation; Electron Density (Concentration); Cloud Cover; Microwave Emission; Sulfuric Acid; Temperature Profiles

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.

19980209703 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Modeling Solar Variability: Synthetic Models
Avrett, Eugene H., Smithsonian Astrophysical Observatory, USA; 1997; 24p; In English
Report No.(s): Preprint-Series-4466; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Observations of the Sun at high spatial resolution show that features that are relatively bright (or dark) at one wavelength are, in predictable ways, also bright (or dark) at all other wavelengths. Using such relationships, the observed intensity of a feature at one wavelength can be used to predict the intensity of that feature at other wavelengths. Solar atmospheric models have been constructed for individual bright and dark features that give calculated intensities in reasonable agreement with the intensities observed with high spatial resolution over a wide range of wave- lengths, from soft X-rays to radio waves. Such calculated intensities can be used to fill in the many gaps between the portions of the observed spectrum that are we calibrated. to the extent that the model calculations agree with observations, we can use available solar images at a given time at one or more wavelengths (e.g., in the visible) to define the pattern of bright and dark regions, construct the correspond- ing images at other wavelengths, and integrate to obtain the spectral irradiance at those wavelengths. In this review we summarize the current status of the solar atmospheric models for the different brightness components of quiet and active regions that are used in such calculations of spectral irradiance.
Author
Atmospheric Models; Solar Atmosphere; Brightness; Solar Activity

19980209714 NASA Marshall Space Flight Center, Huntsville, AL USA
3D-Stereoscopic Analysis of Solar Active Region Loops: I: SoHo/EIT Observations at Temperatures of 1.0-1.5 MK
Aschwanden, Markus J., Maryland Univ., USA; Newmark, Jeff, NASA Goddard Space Flight Center, USA; Delaboudiniere, Jean-Pierre, NASA Goddard Space Flight Center, USA; Neupert, Werner M., Hughes STX, Inc., USA; Portier-Fozzani, Fabrice, Centre National de la Recherche Scientifique, France; Gary, G. Allen, NASA Marshall Space Flight Center, USA; Zucker, Arik, Eidgenoessische Technische Hochschule, Switzerland; Astrophysical Journal: Manuscript Version; Apr. 09, 1998, pp. 1-28; In English
Report No.(s): NASA/TM-1998-208103; NAS 1.15:208103; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The three-dimensional (3D) structure of solar active region NOAA 7986 observed on 1996 August 30 with the Extrem-ultraviolet Imaging Telescope (EIT) onboard the Solar and Heliospheric Observatory (SoHO) is analyzed. We develop a new method of Dynamic Stereoscopy to reconstruct the 3D geometry of dynamically changing loops, which allows us to determine the orientation of the loop plane with respect to the line-of-sight, a prerequisite to correct properly for projection effects in 3D loop models. With this method and the filter-ratio technique applied to EIT 171 A and 195 A images we determine the 3D coordinates (x(s), y(s), z(s)), the loop width) w(s), the electron density n(sub e)(s), and the electron temperature T(sub e)(s) as function of the loop length s for 30 loop segments. Fitting the loop densities with an exponential density model n(sub e)(h) we find that the so inferred scale height temperatures, T(sub e)(sup lambda) = 1.22 +/- 0.23 MK, match closely the EIT filter-ratio temperatures, T(sub e)(sup FIT) = 1.21 +/- 0.06 MK. We conclude that these rather large-scale loops (with heights of h approx. equals 50 - 200 Mm) that dominate EIT 171 A images are close to thermal equilibrium. Most of the loops show no significant thickness variation w(s), but many exhibit a trend of increasing temperature (dT/ds greater than 0) above the footpoint.
Author
Three Dimensional Models; Stereoscopy; Solar Activity; Ultraviolet Telescopes; Procedures; Coordinates; Imaging Techniques

19980210218 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Mapping the Solar Wind from its Source Region into the Outer Corona ***Annual Report, 1 Aug. 1997 - 31 Jul. 1998***
Esser, Ruth, Smithsonian Astrophysical Observatory, USA; Jun. 1998; 10p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-6192
Report No.(s): NASA/CR-1998-208346; NAS 1.26:208346; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Knowledge of the radial variation of the plasma conditions in the coronal source region of the solar wind is essential to exploring coronal heating and solar wind acceleration mechanisms. The goal of the present proposal is to determine as many plasma

parameters in that region as possible by coordinating different observational techniques, such as Interplanetary Scintillation Observations, spectral line intensity observations, polarization brightness measurements and X-ray observations. The inferred plasma parameters are then used to constrain solar wind models.
Derived from text
Mapping; Solar Wind; Plasmas (Physics); Coronas

19980210401 NASA Marshall Space Flight Center, Huntsville, AL USA
A Two-Fluid, MHD Coronal Model
Suess, Steven T., NASA Marshall Space Flight Center, USA; Wang, A.-H., Alabama Univ., USA; Wu, S. T., Alabama Univ., USA; Poletto, G., Osservatorio Astrofisico di Arcetri, Italy; McComas, D. J., Los Alamos National Lab., USA; 1998; 34p; In English
Contract(s)/Grant(s): N00014-C-95-2058; NAGw-4665; NSF ATM-96-33629
Report No.(s): NASA/CR-1997-208263; NAS 1.26:208263; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe first results from a numerical two-fluid MHD model of the global structure of the solar corona. The model is two-fluid in the sense that it accounts for the collisional energy exchange between protons and electrons. As in our single-fluid model, volumetric heat and momentum sources are required to produce high speed wind from coronal holes, low speed wind above streamers, and mass fluxes similar to the empirical solar wind. by specifying different proton and electron heating functions we obtain a high proton temperature in the coronal hole and a relatively low proton temperature in the streamer (in comparison with the electron temperature). This is consistent with inferences from SOHO/UVCS, and with the Ulysses/SWOOPS proton and electron temperature measurements which we show from the fast latitude scan. The density in the coronal hole between 2 solar radii and 5 solar radii (2RS and 5RS) is similar to the density reported from SPARTAN 201-01 measurements by Fisher and Guhathakurta. The proton mass flux scaled to 1 AU is 2.4 x 10(exp 8)/sq cm s, which is consistent with Ulysses observations. Inside the closed field region, the density is sufficiently high so that the simulation gives equal proton and electron temperatures due to the high collision rate. In open field regions (in the coronal hole and above the streamer) the proton and electron temperatures differ by varying amounts. In the streamer, the temperature and density are similar to those reported empirically by Li et al and the plasma beta is larger than unity everywhere above approx. 1.5 R(sub s), as it is in all other MHD coronal streamer models.
Author
Magnetohydrodynamics; Mathematical Models; Two Fluid Models; Numerical Analysis; Solar Corona

19980210796 Fermi National Accelerator Lab., Batavia, IL USA
Bayesian analysis of the solar neutrino anomaly
Bhat, C. M., Fermi National Accelerator Lab., USA; Feb. 1998; 9p; In English; 8th; Lomonosov Conference on Elementary Particle Physics, 25-30 Aug. 1997, Moscow, Russian Federation
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-98/066; CONF-9708153; DE98-052299; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

We present an analysis of the recent solar neutrino data from the five experiments using Bayesian approach. We extract quantitative and easily understandable information pertaining to the solar neutrino problem. The probability distributions for the individual neutrino fluxes and, discrepancy distribution for B and Be fluxes, which include theoretical and experimental uncertainties have been extracted. The analysis carried out assuming that the neutrinos are unaltered during their passage from the sun to earth, clearly indicate that the observed PP flux is consistent with the 1995 standard solar model predictions of Bahcall and Pinsonneault within 2(sigma) (standard deviation), whereas the B-8 flux is down by more than 12(sigma) and the Be-7 flux is maximally suppressed. We also deduce the experimental survival probability for the solar neutrinos as a function of their energy in a model-independent way. We find that the shape of that distribution is in qualitative agreement with the MSW oscillation predictions.
DOE
Bayes Theorem; Solar Neutrinos; Anomalies; Data Acquisition

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts. For biological effects of radiation see 52 Aerospace Medicine. For theory see 73 Nuclear and High-Energy Physics.

19980209649 Colorado Univ., Boulder, CO USA
Hertzsprung Gap Coronae: ASCA Guest Investigator Program ***Final Report***
Ayres, Thomas R., Colorado Univ., USA; [1997]; 2p; In English
Contract(s)/Grant(s): NAG5-3327; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective was a deep (40 ks) SIS/GIS pointing on the bright stellar X-ray source 31 Comae (G0 III) to record the 1-10 keV spectrum and obtain a lightcurve over the approx. 1 day duration of the observation.
Author
X Ray Sources; X Ray Spectra; Experimentation

19980209653 Rutherford Appleton Lab., Chilton, UK
Post-GZK Air Showers, FCNC, Strongly Interacting Neutrinos and Duality
Bordes, J., Valencia Univ., Spain; Chan, H. M., Rutherford Appleton Lab., UK; Faridani, J., Rutherford Appleton Lab., UK; Pfaudler, J., Oxford Univ., UK; Tsou, S. T., Oxford Univ., UK; Dec. 1997; ISSN 1358-6254; 22p; In English; Physics Beyond the Standard Model, Oct. 1997, Valencia, Spain
Report No.(s): PB98-142722; RAL-TR-97-067; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A review is given on the recently proposed idea that air showers with energy greater than 10 to the 20th power eV beyond the Greisen-Zatsepin-Kuz'min cut-off may be due to neutrinos having acquired a strong interaction at these energies, as suggested by the Dualized Standard Model. Such a hypothesis is shown to be consistent with the so far known facts. Further, by linking the astrophysical puzzle of post-GZK air showers through electric-magnetic duality to the problem of fermion generations in particle physics, one obtains on the one hand estimates for the rates of some flavour-changing neutral current decays which are accessbile to experiments being planned, and on the other direct tests on the hypothesis performable by new air shower detectors such as the Auger. The suggestion does not exclude other explanations for post-GZK showers given in the literature. However, the authors disagree with a recent paper by Burdman, Halzen and Gandhi which sweeplingly claimed to have excluded nearly all explanations by new particle physics including the authors'.
NTIS
Cosmic Ray Showers; Astrophysics; Neutrinos; Fermions; High Energy Interactions

19980209869 Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Frascati, Frascati, Italy
NESTOR: Deep underwater neutrino astronomy
Trasatti, L., Istituto Nazionale di Fisica Nucleare, Italy; Feb. 1997; 6p; In English
Report No.(s): INFN-P-LNF-97-006; DE98-712210; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

NESTOR is the first step toward the construction of a neutrino telescope using the depth of the sea both as a shield against atmospheric muons and as detector material. The experiment is based on the detection of Cerenkov radiation produced by neutrino muons using 12 in. photomultiplier tubes. 168 PMTs will be arranged in 12 floors separated by 20 m each and with a radius of 16 m.
DOE
Neutrinos; Construction; Telescopes; Depth; Water Depth; Astronomy

19980210482 San Francisco Univ., Physics Research Lab., CA USA
Environmental Radiation Measurements on the Mir Space Station, Program 1, Internal Experiment Program ***Progress Report, 1997***
Benton, E. V., San Francisco Univ., USA; Frank, A. L., San Francisco Univ., USA; Benton, E. R., Eril Research, Inc., USA; May 12, 1998; 30p; In English
Contract(s)/Grant(s): NCC2-893; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As part of the NASA/Mir Phase 1B Science Program, the ionizing radiation environment inside and outside the Russian Mir's Space Station was monitored using a combination of Thermoluminescent Detectors (TLD) and CR-39 Plastic Nuclear Track Detectors (PNTD). Radiation measurements inside the Mir station were carried out using six Area Passive Dosimeters (APD), four located inside the Mir Base Block and two located inside the Kvant 2 module, during the NASA-2/Mir-21, NASA-3/Mir-22

and NASA-4/Mir-23 missions. The radiation environment under low shielding was measured using an External Dosimeter Array (EDA) mounted on the outer surface of the Kvant 2 module. The external radiation environment and a location inside the Kvant 2 roughly corresponding to the location of the EDA were monitored for 130 days during the NASA- 4/Mir-23 and NASA-5/Mir-24 missions. Dose rates measured by APD TLDs ranged from 271 to 407 microGy/d during the NASA-2/Mir-21 mission, from 265 to 378 microGy/d during the NASA-3/Mir-22 mission, and from 287 to 421 microGy/d during the NASA-4/Mir-23 mission. APD PNTDs have been analyzed and LET spectra have been Cenerated for the five APDs exposed on the NASA-2/Mir-21 mission and for two APD PNTDs exposed on the NASA-3/Mir-22 mission. Dose equivalent rates on the NASA-2/Mir-21 mission ranged from 513 microSv/d in the Kvant 2 module to 710 microSv/d on the floor of the Base Block. Dose as a function of shielding depth in TLDs has been measured in the thin TLD stacks including in the EDA. EDA dose range from 72.5 Gy under 0.0146 g/sq cm to 0.093 Gy under 3.25 g/sq cm of shielding. Readout and analysis of the reaming PNTDs form the NASA-3/Mir-22 mission and PNTDs from the NASA-4/Mir-23 mission (including those from the EDA) is ongoing and will be completed during the final year of this experiment. Dose equivalent rates for the NASA-3/Mir-22 and NASA-4/Mir-23 APDs will then be determined and comparisons will be made with both model calculations and with results from similar measurements.
Author
Environment Pollution; Radiation Measurement; Mir Space Station; Radiation Shielding

19980210617 Fermi National Accelerator Lab., Batavia, IL USA
What will we learn from the CMB?
Dodelson, S., Fermi National Accelerator Lab., USA; Oct. 1997; 11p; In English; Fundamental Physics at the Birth of the Universe, 19-24 May 1997, Rome, Italy
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/333-A; CONF-9705201; DE98-050653; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Within the next decade, experiments measuring the anisotropies in the Cosmic Microwave Background (CMB) will add greatly to our knowledge of the universe. There are dozens of experiments scheduled to take data over the next several years, capped by the satellite missions of NASA (MAP) and ESA (PLANCK). What will we learn from these experiments? I argue that the potential pay-off is immense: We are quite likely to determine cosmological parameters to unprecedented accuracy. This will provide key information about the theory of structure formation and even about the physics behind inflation. If the experiments succeed, can anything spoil this pay-off? I focus on three possible spoilers - foregrounds, reionization, and defect models - and argue that we have every reason to be optimistic.
DOE
Background Radiation; Microwaves; Cosmology

19980210700 Fermi National Accelerator Lab., Batavia, IL USA
Using the cosmic microwave background to discriminate among inflation models
Kinney, W. H., Fermi National Accelerator Lab., USA; Dec. 23, 1997; 7p; In English; Particle Physics and the Early Universe (Cosmo-97), 15-19 Sep. 1997, Ambleside, UK
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/429-A; CONF-9709172; DE98-051677; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The upcoming satellite missions MAP and Planck will measure the spectrum of fluctuations in the Cosmic Microwave Background with unprecedented accuracy. I discuss the prospect of using these observations to distinguish among proposed models of inflationary cosmology.
DOE
Cosmology; Background Radiation

19980210726 Fermi National Accelerator Lab., Batavia, IL USA
Detection of cosmic ray tracks using scintillating fibers and position sensitive multi-anode photomultipliers
Atac, M., Fermi National Accelerator Lab., USA; Streets, J., Fermi National Accelerator Lab., USA; Wilcer, N., Fermi National Accelerator Lab., USA; Feb. 1998; 8p; In English; 7th; ICFA School on Instrumentation In Elementary Particle Physics, 7-19 Jul. 1997, Leon, Mexico
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/393; CONF-9707140; DE98-052293; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This experiment demonstrates detection of cosmic ray tracks by using Scintillating fiber planes and multi-anode photomultipliers (MA-PMTs). In a laboratory like this, cosmic rays provide a natural source of high-energy charged particles which can be detected with high efficiency and with nanosecond time resolution.
DOE
Cosmic Rays; Detection; Experiment Design; Scintillation Counters

19980210798 Fermi National Accelerator Lab., Batavia, IL USA
Anisotropies in the cosmic microwave background: Theory
Dodelson, S., Fermi National Accelerator Lab., USA; Feb. 1998; 13p; In English; 18th; Relativistic Astrophysics, 15-20 Dec. 1996, Chicago, IL, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/036-A; CONF-961254; DE98-052132; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Anisotropies in the Cosmic Microwave Background (CMB) contain a wealth of information about the past history of the universe and the present values of cosmological parameters. I online some of the theoretical advances of the last few years. In particular, I emphasize that for a wide class of cosmological models, theorists can accurately calculate the spectrum to better than a percent. The spectrum of anisotropies today is directly related to the pattern of inhomogeneities present at the time of recombination. This recognition leads to a powerful argument that will enable us to distinguish inflationary models from other models of structure formation. If the inflationary models turn out to be correct, the free parameters in these models will be determined to unprecedented accuracy by the upcoming satellite missions.
DOE
Anisotropy; Relic Radiation; Microwaves; Cosmology; Spectrum Analysis

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GENERAL

19980210650 Advisory Group for Aerospace Research and Development, Sensor and Propagation Panel, Neuilly-Sur-Seine, France
Multi-Sensor Systems and Data Fusion for Telecommunications, Remote Sensing and Radar ***Les Systemes Multi-Senseurs et le Fusionnement des Donnees pour les Telecommunications, la Teledetection et les Radars***
Apr. 1998; 416p; In English; In French, 29 Sep. - 2 Oct. 1997, Lisbon, Portugal; Also announced as 19980210651 through 19980210690; Original contains color illustrations
Report No.(s): AGARD-CP-595; ISBN 92-836-0051-7; Copyright Waived; Avail: CASI; A18, Hardcopy; A04, Microfiche

This publication reports the unclassified papers presented at a specialists' meeting held by the Sensor and Propagation Panel at its Fall 1997 meeting. The topics covered included: - Applications of multiple sensors and data fusion - Data fusion techniques and methods - Sensor data networks and management techniques - Validation studies, experiments, technologies.
Author
Telecommunication; Remote Sensing; Communication Networks; Data Transmission; Management Methods; Multisensor Fusion

Subject Term Index

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