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STAR

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Langley Research Center

Scientific and Technical Information Program Office

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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.

Abstracts in *STAR* are categorized by 10 major subject divisions that are divided further into 76 specific subject categories. The subject divisions and categories are listed in the Table of Contents together with a note for each that defines its scope and provides any cross-references.

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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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E. Geosciences
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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01 Aeronautics (General) 1

02 Aerodynamics 1

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 7

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 10

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 11

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 N.A.

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 13

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 14

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) 15

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) 18

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

13 Astrodynamics 18

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

14 Ground Support Systems and Facilities (Space) 26

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 27

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 29

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 30

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 31

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 40

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

20 Spacecraft Propulsion and Power 41

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) 44

24 Composite Materials 47

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

25 Inorganic and Physical Chemistry 51

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

26 Metallic Materials 65

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

27 Nonmetallic Materials 75

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 84

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 88

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) 89

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

32 Communications and Radar 93

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 101

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 120

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 153

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 N.A.

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

37 Mechanical Engineering 169

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

38 Quality Assurance and Reliability 183

Includes product sampling procedures and techniques; and quality control.

39 Structural Mechanics 185

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) 189

43 Earth Resources and Remote Sensing 191

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 194

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 201

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics 212

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

47 Meteorology and Climatology 220

Includes weather forecasting and modification.

48 Oceanography 227

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) 230

52 Aerospace Medicine 232

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

53 Behavioral Sciences 234

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

54 Man/System Technology and Life Support 235

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 236

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

61 Computer Programming and Software 240

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

62 Computer Systems 256

Includes computer networks and special application computer systems.

63 Cybernetics 266

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 273

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability 283

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

66 Systems Analysis 286

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics 290

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) 291

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 294

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

72 Atomic and Molecular Physics 296

Includes atomic structure, electron properties, and molecular spectra.

73 Nuclear and High-Energy Physics 307

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

74 Optics 310

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

75 Plasma Physics 320

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics*.

76 Solid-State Physics 327

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

77 Thermodynamics and Statistical Physics 335

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

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

80 Social Sciences (General) 338

Includes educational matters.

81 Administration and Management 340

Includes management planning and research.

82 Documentation and Information Science 341

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 347

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy 348

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

85 Urban Technology and Transportation 348

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) 349

89 Astronomy 349

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

90 Astrophysics 349

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 351

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

92 Solar Physics 351

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

93 Space Radiation 355

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 356

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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Typical Report Citation and Abstract

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, AUGUST 31, 1998

01
AERONAUTICS (GENERAL)

19980203590 Nebraska Univ., Aviation Inst., Omaha, NE USA
Journal of Air Transportation World Wide, Volume 3
Bowen, Brent D., Editor, Nebraska Univ., USA; 1998; ISSN 1093-8826; 108p; In English; Also announced as 19980203591 through 19980203597
Contract(s)/Grant(s): NGT5-40037
Report No.(s): NASA/CR-1998-208347; NAS 1.26:208347; Copyright Waived (NASA); Avail: CASI; A06, Hardcopy; A02, Microfiche

The Journal of Air Transportation World Wide's (JATWW) mission is to provide the global community immediate key resource information in all areas of air transportation. Our goal is to be recognized as the preeminent scholarly journal in the aeronautical aspects of transportation. As an international and interdisciplinary journal, the JATWW will provide a forum for peer-reviewed articles in all areas of aviation and space transportation research, policy, theory, case study, practice, and issues. While maintaining a broad scope, a focal point of the journal will be in the area of aviation administration and policy.
Derived from text
Air Transportation; Civil Aviation; Policies

19980203985 Advisory Group for Aerospace Research and Development, Fluid Dynamics Panel, Neuilly-Sur-Seine, France
Advanced Aerodynamic Measurement Technology ***Technologies Avancees de Mesure Aerodynamique***
Advanced Aerodynamic Measurement Technology; May 1998; 420p; In English; In French; 81st; Fluid Dynamics Panel Symposium, 22-25 Sep. 1997, Seattle, WA, USA; Also announced as 19980203986 through 19980204020; Original contains color illustrations
Report No.(s): AGARD-CP-601; ISBN 92-836-0056-8; Copyright Waived; Avail: CASI; A18, Hardcopy; A04, Microfiche

The papers prepared for the AGARD Fluid Dynamics Panel (FDP) Symposium, "Advanced Aerodynamic Measurement Technology" are contained in this report. In addition, a Technical Evaluator's Report aimed at assessing the success of the Symposium in meeting its objectives, and an edited transcript of the General Discussion held at the end of the Symposium are also included. Measurement techniques were presented for flows from subsonic to hypersonic Mach numbers and environments from cryogenic to high-enthalpy reacting flows. Papers presented during the sessions addressed the following subjects: Particle Image Velocimetry; Doppler Global Velocimetry; Molecular Diagnostic Techniques; Holographic Interferometry; Skin Friction Measurements; Pressure Sensitive Paints; and Balance and Model Deformation Measurements.
Author
Aerodynamics; Particle Image Velocimetry; Skin Friction; Mechanical Measurement; Flow Visualization; Conferences; Measuring Instruments; Wind Velocity Measurement; Flow Measurement; Wind Tunnels; Flow Characteristics

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.

19980203477 Naval Postgraduate School, Monterey, CA USA
Design of Digital Control Algorithms for Unmanned Air Vehicles
Froncillo, Steven J., Naval Postgraduate School, USA; Mar. 1998; 100p; In English
Report No.(s): AD-A344726; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Recent advances in the design of high performance aircraft, such as fly by wire controls, complex autopilot systems, and unstable platforms for greater maneuverability, are all possible due to the use of digital control systems. With the aid of modem control tools and techniques based on state-space methods, the aerospace engineer has the ability to design a dynamic aircraft model, verify its accuracy, and design and implement the controller within a matter of a few months. This work examines the digital control design process utilizing a Rapid Prototyping System developed at the Naval Postgraduate School. The entire design process is presented, from design of the controller to implementation and flight test on an Unmanned Air Vehicle (UAV).
DTIC
Design Analysis; Algorithms; Aircraft Design; Aircraft Models; Digital Systems; Control Systems Design

19980203544 Lockheed Martin Engineering and Sciences Co., Hampton, VA USA
Surface Modeling and Grid Generation of Orbital Sciences X34 Vehicle, Phase 1
Alter, Stephen J., Lockheed Martin Engineering and Sciences Co., USA; Nov. 1997; 118p; In English
Contract(s)/Grant(s): NAS1-96014; RTOP 242-80-01-01
Report No.(s): NASA/CR-97-206243; NAS 1.26:206243; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The surface modeling and grid generation requirements, motivations, and methods used to develop Computational Fluid Dynamic volume grids for the X34-Phase 1 are presented. The requirements set forth by the Aerothermodynamics Branch at the NASA Langley Research Center serve as the basis for the final techniques used in the construction of all volume grids, including grids for parametric studies of the X34. The Integrated Computer Engineering and Manufacturing code for Computational Fluid Dynamics (ICEM/CFD), the Grid Generation code (GRIDGEN), the Three-Dimensional Multi-block Advanced Grid Generation System (3DMAGGS) code, and Volume Grid Manipulator (VGM) code are used to enable the necessary surface modeling, surface grid generation, volume grid generation, and grid alterations, respectively. All volume grids generated for the X34, as outlined in this paper, were used for CFD simulations within the Aerothermodynamics Branch.
Author
Computational Fluid Dynamics; Grid Generation (Mathematics); Surfaces; Orbitals; X-34 Reusable Launch Vehicle; Three Dimensional Models

19980203580 Instituto Nacional de Tecnica Aeroespacial, Div. de Aerodinamica, Madrid, Spain
Hybrid Grid: VISCGG2D VORTICE: Bidimensional Grid Improvement, 1 ***Mallador Hibrido: VISCGGSD (Version 01). VORTICE: Mejora Mallador Bidimensional***
Sanchez-Martinez, Francisco J., Instituto Nacional de Tecnica Aeroespacial, Spain; Oct. 31, 1997; 34p; In Spanish
Report No.(s): AT/TNO/4510/007/INTA/97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In this document is presented the generation of a hybrid grid, developed from a unstructured grid previously designed and implemented at INTA Aerodynamics Division. In the first section is given a justification of the grid use in the calculation of internal and external flows. Afterwards are explained the way follows for the selection of the method and the structure of the developed code.
Author
Unstructured Grids (Mathematics); Internal Flow; Computer Programs

19980203842 Massachusetts Inst. of Tech., Center for Aerodynamic Studies, Cambridge, MA USA
Unsteady Loads on Compressor and Turbine Blade Induced by Passage of a Density Wake ***Final Report, 1 Jul. 1994 - 31 Dec. 1997***
Ramer, B., Massachusetts Inst. of Tech., USA; Wijesinghe, S., Massachusetts Inst. of Tech., USA; Tam, C., Massachusetts Inst. of Tech., USA; Covert, E., Massachusetts Inst. of Tech., USA; Mar. 16, 1997; 47p; In English
Contract(s)/Grant(s): F49620-94-1-0202
Report No.(s): AD-A343829; R-99-003; AFRL-SR-BL-TR-98-0437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The object of the research funded under this grant is to study the unsteady aerodynamic forces and moments induced on cascade blades by a convected density gradient that is more or less normal to the flow path. Previous investigators have considered the effect of a variety of convected disturbances on cascade, compressor, and turbine performance. However, we believe this is the first investigation to focus on the production of unsteady loads associated with this process. The size and frequency content

of these loads, when combined with other loads as fan, compressor and turbine blades have the potential to reduce the blade's high cycle fatigue life.
DTIC
Aerodynamic Forces; Compressor Blades; Fan Blades; Turbine Blades

19980203926 Stanford Univ., Mechanical Engineering, Stanford, CA USA
Large Eddy Simulation of Turbulent Flow Over an Airfoil Using Both Structured and Unstructured Grids ***Final Report, 1 Aug. 1996 - 30 Nov. 1997***
Moin, Parviz, Stanford Univ., USA; Apr. 1998; 48p; In English
Contract(s)/Grant(s): F49520-96-1-0420
Report No.(s): AD-A343850; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the application of Large Eddy Simulations (LES) to turbulent flow over an airfoil. Two different approaches have been used, a second-order finite-difference solver on structured grid and a finite-element solver on unstructured grid. Results are presented for the flow around a NACA 4412 airfoil at maximum lift. The diversity of flow characteristics encountered in this flow include laminar, transitional and turbulent boundary layers, flow separation, unstable free shear layers and a wake. while Reynolds-averaged Navier-Stokes simulations (RANS) have had some success when tuned to flows dominated by one such flow characteristic, this variety of flow features taxes the presently available RANS models and presents an excellent opportunity to validate the utility of the dynamic SGS model for LES. Work has also been conducted on high order methods, both for the unstructured and the structured approach.
DTIC
Turbulent Boundary Layer; Turbulent Flow; Boundary Layer Separation; Computational Grids; Laminar Boundary Layer; Large Eddy Simulation

19980203997 Boeing Commercial Airplane Co., Aerodynamics Lab., Seattle, WA USA
Airplane Flow-Field Measurements and the Flying Strut
Crowder, J. P., Boeing Commercial Airplane Co., USA; May 1998; 8p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The prospect for useful measurements of airplane flow-field properties are reviewed. Early experience in flow-field measurements at Boeing is described, as are the requirements for quantitative flow-field surveys in industrial wind tunnels. Recent examples of quantitative flow-field measurements of lift and drag distributions in subsonic and transonic wind tunnels are presented. A new invention, called the Flying Strut, is introduced as a practical system for flow-field surveys in large wind tunnels and in flight.
Author
Aircraft Design; Transonic Wind Tunnels; Subsonic Wind Tunnels; Flow Distribution; Struts

19980204006 NASA Ames Research Center, Moffett Field, CA USA
Development of High Speed Interferometry Imaging and Analysis Techniques for Compressible Dynamic Stall
Chandrasekhara, M. S., Naval Postgraduate School, USA; Carr, L. W., NASA Ames Research Center, USA; Wilder, M. C., MCAT Inst., USA; May 1998; 12p; In English; Also announced as 19980203985
Contract(s)/Grant(s): ARO-MIPR-96-7; AF-AFOSR-MIPR-0004-92; AF-AFOSR-ISSA-0067-89; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The development of a high-speed, phase-locked, realtime, point diffraction interferometry system for quantitative imaging unsteady separated flows is described. The system enables recording of up to 224 interferograms of the dynamic stall flow over an oscillating airfoil using a drum camera at rates of up to 40 KHz controlled by custom designed electronic interlocking circuitry. Several thousand interferograms of the flow have been obtained using this system. A comprehensive image analysis package has been developed for automatic processing of this large number of images. The software has been specifically tuned to address the special characteristics of airfoil flow interferograms. Examples of images obtained using the standard and the high-speed interferometry techniques are presented along with a demonstration of the image processing routine's ability to resolve the fine details present in these images.
Author
Aerodynamic Stalling; Imaging Techniques; Interferometry; Image Processing; Airfoils

19980204014 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia

Study Result for the Application of Teo-Component PSP Technology to Aerodynamic Experiment

Bykov, A., Tsentralni Aerogidrodinamicheskii Inst., Russia; Fonov, S., Tsentralni Aerogidrodinamicheskii Inst., Russia; Mosharov, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Orlov, A., Tsentralni Aerogidrodinamicheskii Inst., Russia; Pesetsky, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Radchenko, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; May 1998; 8p; In English; Also announced as 19980203985

Contract(s)/Grant(s): ARO Proj. N36439-EG; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The increase in the PSP measurement accuracy in wind tunnels is related first of all to the application of the two-component PSP technology. Besides the active luminophor the luminescence of which depends on pressure, the two-component PSP formulation also contains an additional luminophor. The simultaneous measurement of the luminescence intensities of the active luminophor and the additional luminophor makes it possible to avoid numerous difficulties characteristic of the one-component PSP technology. Consideration is given to some processes affecting the two-component PSP measurement accuracy. The transonic wind tunnel investigations of the two-component PSP are presented. Also, the first results of investigating the possibilitiy of applying PSP pressure measurements to the helicopter rotor blade using the two-component PSP are given.

Author

Aerodynamics; Pressure Measurement; Aircraft

19980204015 Office National d'Etudes et de Recherches Aerospatiales, Modane, France

The Two-Component PSP Investigation on a Civil Aircraft Model in S2MA Wind Tunnel

Lyonnet, Marianne, Office National d'Etudes et de Recherches Aerospatiales, France; Deleglise, Bruno, Office National d'Etudes et de Recherches Aerospatiales, France; Grenat, Gerard, Office National d'Etudes et de Recherches Aerospatiales, France; Bykov, A., Tsentralni Aerogidrodinamicheskii Inst., Russia; Mosharov, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Orlov, A., Tsentralni Aerogidrodinamicheskii Inst., Russia; Fonov, S., Tsentralni Aerogidrodinamicheskii Inst., Russia; May 1998; 8p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Pressure sensitive paint (PSP) is a technology of major interest to wind tunnel operators. As part of the cooperation programme between ONERA and TsAGI an evaluation test of the optical pressure measurement system developed by TsAGI was performed in the transonic test section of the S2MA wind tunnel at the Modane centre. The tests were carried out on an Airbus model loaned by Aerospatiale. The left wing was instrumented with 240 pressure taps, the right wing was covered by a two-component PSP, developed by the Russian firm OPTROD. Experimental set-up, characteristics of the two component paint and data processing are described. Comparisons between results from conventional and PSP measurements are presented, and the effects of incidence, Mach number, pressure and temperature are discussed.

Author

Aircraft Models; Civil Aviation; Optical Measurement; Pressure Distribution; Pressure Measurement

19980204016 NASA Ames Research Center, Moffett Field, CA USA

Low-Speed Flow Studies Using the Pressure Sensitive Paint Technique

Brown, O. C., Stanford Univ., USA; Mehta, R. D., NASA Ames Research Center, USA; Cantwell, B. J., Stanford Univ., USA; May 1998; 14p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Optical pressure measurements have been made on a NACA 0012 airfoil coated with Pressure Sensitive Paint (PSP) at very low flow speeds (less than 50 m/s). Angle of attack was limited to 5 deg. for most measurements. Effects of temperature gradients and mis-registration errors on PSP response have been established and minimized. by reducing measurement error caused by these effects. PSP sensitivity has been enhanced. Acceptable aerodynamic data at flow speeds down to 20 m/s have been obtained and valid pressure paint response was observed down to 10 m/s. Measurement errors (in terms of pressure and pressure coefficient) using PSP with pressure taps as a reference are provided for the range of flow speeds from 50 m/s to 10 m/s.

Author

Aerodynamics; Paints; Coatings; Airfoils; Pressure Measurement; Temperature Effects

19980204019 NASA Langley Research Center, Hampton, VA USA

Model Deformation Measurements at NASA Langley Research Center

Burner, A. W., NASA Langley Research Center, USA; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Only recently have large amounts of model deformation data been acquired in NASA wind tunnels. This acquisition of model deformation data was made possible by the development of an automated video photogrammetric system to measure the changes in wing twist and bending under aerodynamic load. The measurement technique is based upon a single view photogrammetric determination of two dimensional coordinates of wing targets with a fixed third dimensional coordinate, namely the spanwise location. A major consideration in the development of the measurement system was that use of the technique must not appreciably reduce wind tunnel productivity. The measurement technique has been used successfully for a number of tests at four large production wind tunnels at NASA and a dedicated system is nearing completion for a fifth facility. These facilities are the National Transonic Facility, the Transonic Dynamics Tunnel, and the Unitary Plan Wind Tunnel at NASA Langley, and the 12-FT Pressure Tunnel at NASA Ames. A dedicated system for the Langley 16-Foot Transonic Tunnel is scheduled to be used for the first time for a test in September. The advantages, limitations, and strategy of the technique as currently used in NASA wind tunnels are presented. Model deformation data are presented which illustrate the value of these measurements. Plans for further enhancements to the technique are presented.

Author

Aerodynamic Loads; Deformation; Aircraft Models; Wind Tunnels

19980204020 Case Western Reserve Univ., School of Engineering, Cleveland, OH USA

MEMS Applications in Aerodynamic Measurement Technology

Reshotko, E., Case Western Reserve Univ., USA; Mehregany, M., Case Western Reserve Univ., USA; Bang, C., Advanced Micromachines, Inc., USA; May 1998; 10p; In English; Also announced as 19980203985

Contract(s)/Grant(s): F49620-96-I-0482; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Microelectromechanical systems (MEMS) embodies the integration of sensors, actuators, and electronics on a single substrate using integrated circuit fabrication techniques and compatible bulk and surface micromachining processes. Silicon and its derivatives form the material base for the MEMS technology. MEMS devices, including microsensors and microactuators, are attractive because they can be made small (characteristic dimension about 100 microns), be produced in large numbers with uniform performance, include electronics for high performance and sophisticated functionality, and be inexpensive. For aerodynamic measurements, it is preferred that sensors be small so as to approximate measurement at a point, and in fact, MEMS pressure sensors, wall shear-stress sensors, heat flux sensors and micromachined hot wires are nearing application. For the envisioned application to wind tunnel models, MEMS sensors can be placed on the surface or in very shallow grooves. MEMS devices have often been fabricated on stiff, flat silicon substrates, about 0.5 mm thick, and therefore were not easily mounted on curved surfaces. However, flexible substrates are now available and heat-flux sensor arrays have been wrapped around a curved turbine blade. Electrical leads can also be built into the flexible substrate. Thus MEMS instrumented wind tunnel models do not require deep spanwise grooves for tubes and leads that compromise the strength of conventionally instrumented models. With MEMS, even the electrical leads can potentially be eliminated if telemetry of the signals to an appropriate receiver can be implemented. While semiconductor silicon is well known for its electronic properties, it is also an excellent mechanical material for MEMS applications. However, silicon electronics are limited to operations below about 200 C, and silicon's mechanical properties start to diminish above 400 C. In recent years, silicon carbide (SiC) has emerged as the leading material candidate for applications in high temperature environments and can be used for high-temperature MEMS applications. With SiC, diodes and more complex electronics have been shown to operate to about 600 C, while the mechanical properties of SiC are maintained to much higher temperatures. Even when MEMS devices show benefits in the laboratory, there are many packaging challenges for any aeronautics application. Incorporating MEMS into these applications requires new approaches to packaging that goes beyond traditional integrated circuit (IC) packaging technologies. MEMS must interact mechanically, as well as electrically with their environment, making most traditional chip packaging and mounting techniques inadequate. Wind tunnels operate over wide temperature ranges in an environment that is far from being a 'clean-room.' In flight, aircraft are exposed to natural elements (e.g. rain, sun, ice, insects and dirt) and operational interferences(e.g. cleaning and deicing fluids, and maintenance crews). In propulsion systems applications, MEMS devices will have to operate in environments containing gases with very high temperatures, abrasive particles and combustion products. Hence deployment and packaging that maintains the integrity of the MEMS system is crucial. This paper presents an overview of MEMS fabrication and materials, descriptions of available sensors with more details on those being developed in our laboratories, and a discussion of sensor deployment options for wind tunnel and flight applications.

Author

Aerodynamics; Mechanical Properties; Micromachining; Semiconductors (Materials); Wind Tunnel Tests; Turbine Blades

19980204840 Rensselaer Polytechnic Inst., Troy, NY USA

Augmentation of Rotorcraft Technology Center ***Final Report, Jun. 1994 - Oct. 1996***

Bauchau, Olivier A., Rensselaer Polytechnic Inst., USA; Lemnios, Andrew, Rensselaer Polytechnic Inst., USA; Jan. 27, 1997; 5p; In English

Contract(s)/Grant(s): DAAH04-94-G-0073

Report No.(s): AD-A344153; A10546; ARO-32321.2-EG-RW; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project conducted research on tasks related to rotorcraft aerodynamics, dynamics, materials, and structures as approved by the Army Research Office. A total of seven fundamental and multidisciplinary research tasks in rotorcraft materials, structural dynamics, unsteady aerodynamics and aeroelasticity were pursued, each of them highly interactive with at least one of the other tasks in this project.

DTIC

Aerodynamic Characteristics; Rotary Wing Aircraft; Augmentation; Dynamic Structural Analysis; Aeroelasticity

19980204999 Ohio State Univ., Dept. of Mechanical Engineering, Columbus, OH USA

Vortex Surface Collisions ***Final Report***

Conlisk, A. T., Ohio State Univ., USA; Komerath, N. M., Georgia Inst. of Tech., USA; Mar. 1998; 293p; In English

Contract(s)/Grant(s): DAAH04-93-G-0048

Report No.(s): AD-A344207; Rept-760601/727272; ARO-30707.4-EG; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Many flows of practical interest contain discrete vortices. These include tornadoes, propeller wakes, and flows over swept wings and missile forebodies. The encounter of a vortex with a solid body is always a complex event involving very large gradients of pressure and velocity. We consider the problem in which a rotor-tip vortex collides with a helicopter airframe. The primary objective of this work is to describe both experimentally and computationally the interaction when the vortex ”collides” directly with the airframe in the sense that at some point the flow in the vortex core must be altered to accommodate the presence of the airframe. The pressure field caused by the collision is also described. The dominant physics of the collision process may be described by inviscid flow theory and it is the component directed along the tip-vortex axis, termed the axial flow, which is the major cause of the collision.

DTIC

Vortices; Axial Flow; Pressure Gradients; Aircraft Structures; Flow Visualization; Vortex Shedding; Unsteady Flow; Inviscid Flow; Boundary Layer Flow; Three Dimensional Flow; Interactional Aerodynamics

19980206350 NASA Lewis Research Center, Cleveland, OH USA

Experimental Investigation of Boundary Layer Behavior in a Simulated Low Pressure Turbine

Sohn, Ki-Hyeon, Toledo Univ., USA; Shyne, Rickey J., NASA Lewis Research Center, USA; DeWitt, Kenneth J., Toledo Univ., USA; Jun. 1998; 11p; In English; Turbo Expo 1998, 2-5 Jun. 1998, Stockholm, Sweden; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): RTOP 523-26-33

Report No.(s): NASA/TM-1998-207921; E-11204; NAS 1.15:207921; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A detailed investigation of the flow physics occurring on the suction side of a simulated Low Pressure Turbine (LPT) blade was performed. A contoured upper wall was designed to simulate the pressure distribution of an actual LPT blade onto a flat plate. The experiments were carried out at Reynolds numbers of 100,000 and 250,000 with three levels of freestream turbulence. The main emphasis in this paper is placed on flow field surveys performed at a Reynolds number of 100,000 with levels of freestream turbulence ranging from 0.8% to 3%. Smoke-wire flow visualization data was used to confirm that the boundary layer was separated and formed a bubble. The transition process over the separated flow region is observed to be similar to a laminar free shear layer flow with the formation of a large coherent eddy structure. For each condition, the locations defining the separation bubble were determined by careful examination of pressure and mean velocity profile data. Transition onset location and length determined from intermittency profiles decrease as freestream turbulence levels increase. Additionally, the length and height of the laminar separation bubbles were observed to be inversely proportional to the levels of freestream turbulence.

Author

Boundary Layer Transition; Turbines; Free Flow; Flow Visualization; Turbulent Boundary Layer; Boundary Layer Separation; Turbine Blades; Turbulent Flow; Laminar Flow; Flow Characteristics

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.

19980203494 General Accounting Office, National Security and International Affairs 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): AD-A343299; GAO/NSIAD-98-108; B-274598; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current C-130 fleet is comprised of 12 different variants and the missions vary with each variant. While most of the current fleet is comprised of combat delivery aircraft, many of the C-130 variants perform specialized missions. The combat delivery C-130 fleet, designated as C-130Es and C-130Hs, is used in a wide variety of wartime and peacetime missions. in wartime, the C-130 combat delivery aircraft primarily performs the intratheater portion of the airlift mission, leaving the long-range intratheater transport mission to larger aircraft such as the C-5 and C-17. These C-130s primarily provide rapid transportation of personnel or cargo for delivery by parachute to a designated drop zone, or by landing at austere locations within the conflict area. These aircraft are also the primary aeromedical evacuation aircraft in a conflict. In peacetime, the combat delivery C-130 is used for training flights, regularly scheduled channel operations, and special assignment missions. It is also used in fire fighting and humanitarian relief missions. For example, it has been used to airlift heavy equipment into remote areas of other countries to build airports and roads, and transport local goods. In addition to the missions performed by the basic combat delivery C-130 aircraft, 11 other variants perform specialized missions. These missions include (1) weather reconnaissance, performed by the WC-130 aircraft; (2) special communication missions, performed by the EC-130 aircraft; and (3) search and rescue, performed by the HC-130 aircraft. The 12 different C-130 models that are currently in the fleet and their respective missions are summarized in table 1.

DTIC
Transport Aircraft; Congressional Reports; Combat; Evacuating (Transportation); Fighter Aircraft; Rescue Operations; Transportation

19980203531 Sandia National Labs., Albuquerque, NM USA
Overview of composite projects at the FAA Airworthiness Assurance Validation Center
Shurtleff, W. W., Sandia National Labs., USA; Roach, D. P., Sandia National Labs., USA; Valley, M. T., Sandia National Labs., USA; 1997; 11p; In English; 11th; Composite Materials, 14 - 18 Jul. 1997, Gold Coast, Australia
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-2666C; CONF-970735-1; DE97-002544; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Airworthiness Assurance NDI Validation Center (AANC) was established by the Federal Aviation Administration (FAA) William J. Hughes Technical Center at Sandia National Laboratories in 1991 to support nondestructive inspection (NDI) technology development and assessment. The evaluations are done using a variety of characterized test specimens and test beds including entire transport and commuter aircraft. Although the initial work at the Center concentrated on metallic structure, the FAA has more recently expanded the AANC's charter to include projects directed at composite repair and inspection. The three projects briefly described in this paper are: (1) the validation and technology transfer of a thermographic techniques for composite inspection, (2) the development of generic composite laminate and honeycomb calibration reference standards, and (3) the certification of the use of boron epoxy doubler on a Lockheed L-1011.

DOE
Aircraft Reliability; Commuter Aircraft; Honeycomb Structures; Transport Aircraft

19980203593 Maryland Univ., Princess Anne, MD USA
Human Factors: Tenerife Revisited
McCreary, John, Maryland Univ., USA; Pollard, Michael, Maryland Univ., USA; Stevenson, Kenneth, Maryland Univ., USA; Wilson, Marc B., Maryland Univ., USA; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 23-31; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A02, Microfiche

This case study is a human factors analysis of the aircraft collision which occurred at the Los Rodeos airport in Tenerife, on the Canary Islands. The collision between two 747 jumbo jets cost the lives of 583 people. This collision is an example of how large scale disasters result from errors made by people in crucial circumstances and illustrates the potentially devastating conse-

quences of ineffective human and organizational behavior. This paper focuses on three areas that were the major contributing factors in the accident: stress, small group communication under stress, and small group dynamics. An analysis of the accident in each of these areas determined what measures can be taken to prevent catastrophes of this nature from reoccurring (reengineering for improvement).
Author
Airports; Canary Islands; Collisions; Disasters; Human Behavior; Human Factors Engineering; Aircraft Accident Investigation; Air Transportation

19980203595 Cranfield Univ., Bedford, UK
Air Transport Liberalization in Europe: The Progress So Far
Morrell, Peter, Cranfield Univ., UK; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 41-60; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A02, Microfiche

In April 1997, the final phase of a series of measures were implemented which were aimed at liberalizing air transport within the European Union (EU). These measures were introduced on a phased basis, the first package coming into force in 1988, the second in 1990, and the most significant third package in 1993 (which included a delayed 1997 lifting of cabotage protection). These applied on a multilateral basis within the European Community (with some exclusion clauses), and followed progress towards liberalization on a bilateral basis between 1985 and 1988, most notably on routes between the UK and a number of EU countries. This paper examines the progress so far in the achievement of liberalization and greater competition within Europe. It is based on extensive research carried out by the author and a team from Cranfield University over 1995 and 1996. This included desk research, a survey of and interviews with EU airlines and aviation authorities, and five more-detailed airline case studies. This has been updated by the author to take into account more recent developments, especially regarding new entrant airlines. Some of the expectations following the introduction of EU liberalization have not been met: there have been few serious challenges to the flag carrier duopolies, there has been a consolidation of the major airlines in their home markets, and business and fully flexible fares have continued to climb. However, many of the airlines' strategic changes were more in response to developments in global rather than EU markets. On the other hand, consumers have benefited from greater competition in promotional fares, and more dynamic pricing tactics overall have led to higher intra-EU traffic growth in the early 1990s than would have been the case without liberalization. There was also a substantial growth in the number of EU cities served by non-stop services, and some encouraging trends from new entrant airlines in some countries. On balance, it is argued that the net result has been disappointing; but this is hardly surprising given the timing of the final stage of liberalization in the middle of an economic recession, the concern of the larger airlines with more global events, and the time needed to change some of the more deep-seated structural barriers, such as airport slot availability, input market monopolies and state aids.
Author
Air Transportation; Airline Operations; Progress; Competition; Market Research; Air Traffic

19980203641 Illinois Univ., Urbana-Champaign, IL USA
Error Types and Related Error Detection Processes in the Aviation Domain
Alexander, Heather M., Illinois Univ., USA; May 07, 1998; 75p; In English
Report No.(s): AD-A343598; Rept-98-008; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Human error has been identified as a contributing factor in 75-80% of all aviation accidents. to date, most efforts to improve flight safety have focused on error prevention. A different approach that has received less attention is to avoid the negative consequences of erroneous actions and assessments by supporting their timely detection. In this study, aviation incidents were analyzed in terms of the type of error involved (errors of omission and commission; slips, lapses, and mistakes), the performance level at which the error occurred (skill-, rule-, or knowledge-based performance), and the relation between error types and error detection processes that prevented these incidents from turning into accidents. The majority of reported errors were lapses, i.e., failures to perform a required action, and mistakes, i.e., errors in the formation of an intention. Relatively few slips, i.e., inappropriate executions of intended actions, were reported. Slips appear to be detected and corrected by the pilot before they result in an unsafe situation that is worth reporting. Lapses and mistakes, on the other hand, are more difficult for the pilot committing the error to detect and, in most cases, required intervention by air traffic control. A large percentage of lapses resulted from inattention, either due to some distraction in the cockpit or due to multiple competing demands. Mistakes, on the other hand, frequently occurred as a consequence of some misunderstanding between pilots and air traffic controllers concerning clearances and intentions. Most lapses were detected incidentally based on routine checks of aircraft settings and performance, whereas errors of commission, which include both mistakes and slips, were detected equally often based on monitoring for the immediate outcome of an action

and by routine checks. These findings indicate the need for more effective support of error detection, particularly in the case of lapses and mistakes.
DTIC
Prevention; Pilot Error; Human Performance; Flight Safety; Aircraft Accidents

19980203657 National Transportation Safety Board, Washington, DC USA
Aircraft Accident Report: Uncontained Engine Failure Delta Air Lines Flight 1288, McDonnell Douglas MD-88, N927DA, Pensacola, Florida, July 6, 1996
Jan. 13, 1998; 136p; In English
Report No.(s): AD-A343392; NTSB/AAR-98/01; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report explains the accident involving Delta Air Lines flight 1288, an MD-88, which experienced and uncontained engine failure during the initial part of its takeoff roll at Pensacola Regional Airport in Pensacola, Florida, on July 6, 1996. Safety issues in the report include the limitations of the blue etch anodize process, manufacturing defects, standards for the fluorescent penetrant inspection process, the performance of nonconstructive testing, the use of alarm systems for emergency situations, and instructions regarding emergency exits. Safety recommendations concerning these issues were made to the Federal Aviation Administration.
DTIC
Aircraft Accident Investigation; Emergencies; Engine Failure; Safety; Accident Investigation

19980205675 Department of Transportation, Bureau of Statistics, Washington, DC USA
Air Carrier Reporting Punctuality Assessment. Accounting and Report Directive
May 26, 1998; 14p; In English
Report No.(s): PB98-145709; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains eight tables showing the timeliness factor for each air carrier's recurrent reporting. An average of days late per report is computed for all reports required to be filed during the specific six-month period. The computation considers only the timeliness of filing, and does no relate to the validity of data contained in the submissions. The multiple tables permit comparison among carriers with similar operations or revenue levels.
NTIS
Air Transportation; Tables (Data); Revenue; Accounting

19980206343 Armstrong Lab., Biodynamics and Biocommunications Div., Wright-Patterson AFB, OH USA
+GZ Impact Tests of the Large JPATS Manikin in a Simulated Martin-Baker Ejection Seat ***Interim Report, Jul - Oct. 1997***
Buhrman, John R., Armstrong Lab., USA; Oct. 1997; 179p; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A344944; AL/CF-TR-1997-0173; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

One Large Joint Primary Aircraft Training System (JPATS) manikin and one GARD CG manikin were exposed to a series of short-duration z-axis acceleration pulses on the Armstrong Laboratory Vertical Deceleration Tower. The manikins were placed in a test fixture intended to simulate the Martin-Baker MKUS16LA ejection seat. Biodynamic response data were collected in order to evaluate the dynamic effect of the manikins on the seat during a simulated ejection. The results demonstrated the presence of large lap belt loads and excessive hip and knee displacements in tests with the Large JPATS manikin. It was determined that these phenomena were due to several factors which included the pre-impact positioning of the manikin's thighs above the seat pan, the fabric of the flight suit, the length of the seat pan, and the center of mass of the manikin's lower torso. Modifications which altered the weight and center of mass of the Large JPATS manikin's legs and extended the seat pan length were successful in reducing the loads and motions.
DTIC
Impact Tests; Ejection Seats; Biodynamics; Center of Mass

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.

19980203347 Carnegie-Mellon Univ., Pittsburgh, PA USA
Assessment of CORBA and POSIX.21 Designs for FAA En Route Resectorization
Meyers, B. Craig, Carnegie-Mellon Univ., USA; Plakosh, Daniel R., Carnegie-Mellon Univ., USA; Place, Patrick R. H., Carnegie-Mellon Univ., USA; Klein, Mark, Carnegie-Mellon Univ., USA; Kazman, Rick, Carnegie-Mellon Univ., USA; Apr. 1998; 252p; In English
Report No.(s): AD-A343704; CMU/SEI-98-SR-002; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Modernizing the En Route system presents major acquisition issues to the Federal Aviation Administration (FAA). At the present time, efforts are underway to upgrade the En Route system, primarily focusing on the host computer system. Some of the major issues include the following: (1) What are the consequences of using different technologies and products? (2) How can one assess the use of different technologies? Resolving issues such as these will affect the acquisition strategy for upgrading the En Route system. For example, the use of different technologies will influence the design character of the En Route system. This will consequently effect the ability to integrate different components and influence the amount of developed integration code that may be required. Clearly, the ability to optimize the acquisition strategy will have far reaching consequences for the FAA and must be carefully considered. This report addresses the use of different technologies and an architecture trade off approach to a typical En Route system problem. We were requested to consider the problem of resectorization, i.e., the combination and decombination of sectors (and fix posting areas) during operation of an En Route center. Such capabilities may become desirable for an implementation of free flight. Two technologies have been applied to develop solutions to this problem, namely Common Object Request Broken Architecture (CORBA) and POSIX.21 (Portable Operating System Interface Standard). The former is based on an object oriented model, while the latter is based on a message passing model.
DTIC
Air Navigation; Free Flight; Messages; Resolution; Architecture (Computers); Air Traffic Control

19980203401 Geoloc Corp., Arlington, VA USA
Global Ionospheric Specification from GPS and Airglow Data ***Final Report, 4 Apr. 1997 - 3 Apr 1998***
Reilly, Michael H., Geoloc Corp., USA; Singh, Malkiat, Geoloc Corp., USA; May 07, 1998; 11p; In English
Contract(s)/Grant(s): N00014-97-C-0113
Report No.(s): AD-A343777; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The efficacy of GPS data-processing algorithms with the RIBG model is demonstrated, as is the problem with low latitude ionospheric models, by comparison of predictions from GPS-updated RIBG predictions with independent Topex, and incoherent scatter (ISR) data. Alternate plans are developed to solve the low-latitude model problem, and still retain a practical program for real-time processing of GPS data for ionospheric specification. In the regard, the GPS data-processing algorithms have been revamped for efficiency, now being an order of magnitude faster than before. This enables our program to meet high data throughput requirements for processing and updating GPS data from a global network of GPS receivers for global, near-real-time ionospheric specification. Algorithms have been partially developed to process multistation data for this purpose. The implications of our work for radio systems, ionospheric model development, and other developments are discussed, as well as its relationship to other work in this field.
DTIC
Global Positioning System; Atmospheric Models; Earth Ionosphere; Algorithms

19980203402 Naval Research Lab., Space Applications Branch, Washington, DC USA
Reliability Assessment Test (RAT) Program Life Data Analysis Methods
Danzy, Fredrick, Naval Research Lab., USA; Smathers, Jean S., Naval Research Lab., USA; May 08, 1998; 16p; In English
Report No.(s): AD-A343778; NRL/MR/8150--98-8161; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two life data analysis methods, which will be employed in the Global Positioning System Block IIR Rubidium Atomic Frequency Standard Assessment Test Program will be discussed. The analysis methods will provide information regarding the population characteristics.
DTIC
Frequency Standards; Reliability; Evaluation; Data Processing; Atomic Clocks

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.

19980203229 Defence Science and Technology Organisation, Canberra, Australia
Strain Surveys of Fuel Flow Vent Hole Number 13 and Stiffener Runout Number 2 in the F111 Wing Pivot Fitting for a Range of Rework Shapes
Watters, Kevin C., Defence Science and Technology Organisation, Australia; Aug. 1997; 197p; In English
Report No.(s): AD-A343707; DSTO-TR-0567; DODA-AR-010-305; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The strain distributions and magnitudes at two locations in the D6ac steel wing pivot fitting (WPF) of the F-111 aircraft have been evaluated by full-scale test of a wing. These locations, known as fuel flow vent hole number 13 and stiffener runout number 2 have been sites of in-service fatigue cracking. The structural features at these two locations produce large stress concentrations and extensive yielding occurs around them under cold proof load testing (CPLT) of the wing (which was simulated in these tests). These locations are subject to in-service reworking to remove detected fatigue cracks, and a range of reworks was simulated in these tests. The interaction of residual stress/strain states (after cyclic plasticity from CPLT loading) and material removal (during reworking) made interpretation of the strain versus load behaviour quite difficult. The difficulty was compounded by an overriding bi-linear elastic structural behaviour of the WPF and complex structural behaviour of the shear web in the WPF. A comprehensive strain versus load data base has been established for these locations to facilitate stress and fatigue analyses.
DTIC
Wings; F-111 Aircraft; Fuel Flow; Strain Distribution; Vents; Surveys; Pivots; Full Scale Tests; Fatigue Testing Machines; Cracking (Fracturing)

19980203350 Unistry Associates, Inc., Havertown, PA USA
Integrated Thermal Management of Advanced Aircraft ***Final Report, 9 Jun. 1997 - 9 Mar. 1998***
Issacci, Farrokh, Unistry Associates, Inc., USA; Traci, Richard, Unistry Associates, Inc., USA; Mar. 1998; 41p; In English
Contract(s)/Grant(s): F33615-97-C-2735
Report No.(s): AD-A339236; UAI-98-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the proposed effort was to evaluate the U.S. Air Force sponsored Vehicle Integrated Thermal Management Analysis Code (VITMAC) for: (1) including an optimization/expert systems architecture for analyzing thermal/fluid network configurations at the component, subsystems, and system level, and (2) coupling VITMAC with engine performance and cycle codes to provide a more integrated mission analysis capability as well as more accurate definitions of thermal loads. This effort resulted in the inclusion in VITMAC of a flow condition optimization method which automatically determines component operation to match user-specified thermal circuit operating conditions. This was the first step in implementing a plan for a multi-level optimization method which was developed for a Phase II program. Various engine performance and cycle models where evaluated which resulted in the recommendation that VITMAC be linked with APL's RJPA ram/scramjet engine performance code as well as NASA's CEA rocket performance model and NNEP turbine engine cycle code. Finally, a plan for commercializing VITMAC was developed which includes: (1) enhancing the graphical user Interface (GUI) to make it more user friendly and robust, (2) organizing workshops to provide industrial experts with influence on and knowledge of VITMAC capabilities, (3) providing end-user support and training and, (4) developing a market plan for transferring the technology for aircraft and non-aircraft applications.
DTIC
Architecture (Computers); Circuits

19980203484 Wayne State Univ., Inst. for Manufacturing Research, Detroit, MI USA
Thermal Wave Imaging of Hidden Corrosion ***Final Report, 1 Jul. 1996 - 31 Dec. 1997***
Thomas, Robert L., Wayne State Univ., USA; Favro, Lawrence D., Wayne State Univ., USA; Kuo, Pao-Kuang, Wayne State Univ., USA; Apr. 03, 1998; 17p; In English
Contract(s)/Grant(s): F49620-96-1-0166
Report No.(s): AD-A343638; AFRL-SR-BL-TR-98-0336; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A program of basic research was carried out, whose objective was to make the promising qualitative thermal wave imaging NDI technique a truly quantitative tool, which can have a major impact on the rapid, wide-area inspection of Air Force aircraft for hidden corrosion. Such thermal wave images of a square foot (or so) of aircraft skin are acquired on short time scales (a few seconds). Techniques were developed and studied to measure skin thickness and to identify corrosion products. The resulting cor-

rosion analysis has been shown to have a quantitative capability of measuring material losses as small as 1% on aluminum aircraft skins, and can be implemented rapidly to evaluate regions of corrosion which have been identified in the thermal wave images. The technique has also been shown to be capable of measuring intergranular corrosion in the vicinity of fasteners in KC-135 and B-52 wing skins.
DTIC
Aircraft Maintenance; B-52 Aircraft; Thermal Mapping; Imaging Techniques; Thickness; C-135 Aircraft; Intergranular Corrosion

19980203893 Cornell Univ., Dept. of Theoretical and Applied Mechanics, Ithaca, NY USA
Synergistic Diagnostics of Aircraft Materials and Structures ***Final Report, 15 May 1995 - 14 Aug. 1997***
Sachse, Wolfgang, Cornell Univ., USA; Mar. 15, 1998; 16p; In English
Contract(s)/Grant(s): F49620-95-1-0383
Report No.(s): AD-A344202; AFRL-SR-BL-TR-98-0423; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report summarizes the results obtained with a synergistic measurement system used as the basis of a diagnostic system for monitoring and characterizing aircraft materials and structures. The system utilizes the development of an empirical model describing the characteristics and dynamics of the material or structure. It is demonstrated that this approach is useful for processing the signals of linear as well as non-linear systems. The linear modeler has been used to obtain a characterization of the strength and location of impacts on a truss-like structure. While the more general, automatic modeler which resembles a multi-dimensional, non-parametric regression approach was utilized to locate sources of acoustic emissions in a structure and also to predict fatigue crack growth in Al alloys under different loading conditions. Applications have been to measured as well as existing data which comprise a corrosion-fatigue material property data base. It was found that the prediction performance of the modeler is excellent if the measured input data closely resembles one of the previous data sets residing in the memory. An enhanced predictive performance can be obtained from the modeler if a predictor-corrector algorithm is used.
DTIC
Aircraft Structures; Aircraft Maintenance; Mathematical Models; Acoustic Emission; Diagnosis; Crack Propagation; Fatigue (Materials)

19980203908 Naval Postgraduate School, Monterey, CA USA
A Case Study: Acquisition Reform and the New V-22 Osprey Program
Riegert, Paul M., Naval Postgraduate School, USA; Mar. 1998; 139p; In English
Report No.(s): AD-A344702; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This thesis provides background information on the once cancelled V-22 program and acquisition reform and then examines the impact of the latter on the former. It analyzes the V-22 program using DoD's ten guiding principles of acquisition reform as a standard and concludes that acquisition reform is having mixed results on this Major Defense Acquisition Program. Much is being accomplished with acquisition reform in the V-22 program. A transformation of the business process from the top down is enabling the program office and its prime contractors to optimize cost, schedule, and performance. Earned value management metrics are actively being incorporated into the program's risk management process. Concurrent contractor Government testing and maintenance reduces test time required by 72 percent Cross functional IPTs, as the backbone of the program, are breaking down 'stove pipes' and facilitating concurrent engineering. Successfully implementing initiatives like CAIV and CLS and focusing on overall cost of ownership are reducing the cost of the program from cradle to grave. Commercial products and processes, like the Allison AE-1107C engine and CATIA software, are providing high quality systems at market controlled prices. Commercial item acquisition and CLS are being used effectively to minimize life cycle costs. 'Win-Win' contracting with industry is providing engine reliability that should improve with time and save 30 percent in support costs. Much can be accomplished still. Realistic contingency finding should be included in fiscal budgets to eliminate the migration of funds from R&D and PROC to O&S. SPI should be altered to pass a proportion of any program related savings back to the program office.
DTIC
Concurrent Engineering; V-22 Aircraft

19980205668 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Airbus Traceability Case Study
Pearson, S., Newcastle-upon-Tyne Univ., UK; Rowlands, M., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 46p; In English
Report No.(s): PB98-147937; TRS-606; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A preliminary traceability method was introduced previously which detailed the construction of the traceability structures following a method which consisted of four main parts: an underlying model, a language, defined steps and ordering, and guid-

ance; this was based on the conceptual framework proposed in the ATMOSPHERE project. The method was applied to the Attitude Monitor case study provided by Military Aircraft; the results of the case study formed part of the guidance for the method.
NTIS
Attitude Indicators; Software Engineering

19980206272 Naval Postgraduate School, Monterey, CA USA
Solid Modeling for Rotary Wing Design at NPS with AutoCAD R13
Lincoln, Jeffrey S., Naval Postgraduate School, USA; Dec. 1997; 109p; In English
Report No.(s): AD-A345698; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis is intended to be a reference for solid modeling and Computer Aided Design (CAD) tailored specifically for the Naval Postgraduate School's capstone helicopter design course, AA 4306. The goal is to present the use of AutoCAD R13 software as a central design tool throughout the conceptual design phase of the American Helicopter Society (AHS) Graduate Design Competition project. The specifics of AutoCAD that are essential to performing the design project are explored through examples of model construction and lessons learned from the 1997 VIPER design effort. The usage of solid modeling as a design tool for design team integration is investigated. It is intended for this work to allow future classes to acquire sufficient proficiency with Computer Aided Design and solid modeling. Maximizing the practical usage of CAD techniques in a single quarter will provide an improved learning experience in a more realistic design environment.
DTIC
Computer Aided Design; Helicopters; Helicopter Design; Rotary Wings

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.

19980203267 Portsmouth Univ., Dept. of Mechanical and Manufacturing Engineering, Portsmouth, UK
The Effects of LCF Loadings on HCF Crack Growth ***Final Report***
Hall, R. F., Portsmouth Univ., UK; Powell, B. E., Portsmouth Univ., UK; Apr. 28, 1998; 44p; In English
Contract(s)/Grant(s): F61708-97-W-0112
Report No.(s): AD-A344374; EOARD-SPC-97-4021; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking University of Portsmouth as follows: The contractor will investigate the effects of low-cycle fatigue (LCF) on high-cycle fatigue (HCF) crack growth for aerospace propulsion applications.
DTIC
Fatigue (Materials); Crack Propagation; Loads (Forces); Performance Tests; Engine Parts

19980203496 California Inst. of Tech., Pasadena, CA USA
Mechanisms of Unsteady Flow in Scramjet Combustors ***Final Report, 1 Sep. 1996 - 31 Dec. 1997***
Marble, Frank E., California Inst. of Tech., USA; Cadou, Christopher P., California Inst. of Tech., USA; Mar. 31, 1998; 56p; In English
Contract(s)/Grant(s): F49620-96-1-0435; AF Proj. 2308
Report No.(s): AD-A343276; AFRL-SR-BL-TR-98-0364; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report covers analytic and experimental gasdynamic studies relevant to stability issues of the scramjet supersonic combustion chamber. Its intended purpose was to search for small amplitude very short time scale precurser signals which eventually grew into combustor flow instability, but at a much longer time scale than the signal itself, and consequently offer possibility of control before amplitudes got out of hand. The experiments were done in a basic 2.5 Mach number stream with an artificially thickened boundary layer corresponding to the ingested ramp boundary layer that occurs in the usual installation. A disturbance produced downstream by a small shock tube discharging normally to the gas flow successfully disgorged the shock structure; time resolved pressure and Schlieren image records were obtained. Because upstream signal propagation through the subsonic boundary layer of a supersonic flow is seen as an important issue in the phenomenon under investigation, a rudamentary analytic model was developed. It consists of an acoustically compact element, in which mixing and heat release may occur, with long constant area ducts upstream and downstream of this element. It employs a two stream one dimensional approximation, the main supersonic

stream and a subsonic second stream representing the thick boundary layer. Conditions under which interfacial disturbances may be propagated upstream are examined through several examples.
DTIC
Gas Dynamics; Unsteady Flow; Supersonic Combustion; Supersonic Combustion Ramjet Engines; Combustion Chambers

19980206364 NASA Lewis Research Center, Cleveland, OH USA
The High Stability Engine Control (HISTEC) Program: Flight Demonstration Phase
DeLaat, John C., NASA Lewis Research Center, USA; Southwick, Robert D., Pratt and Whitney Aircraft, USA; Gallops, George W., Pratt and Whitney Aircraft, USA; Orme, John S., NASA Dryden Flight Research Center, 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; Original contains color illustrations
Contract(s)/Grant(s): RTOP 523-53-13
Report No.(s): NASA/TM-1998-208482; E-11257; NAS 1.15:208482; AIAA Paper 98-3756; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Future aircraft turbine engines, both commercial and military, must be able to accommodate expected increased levels of steady-state and dynamic engine-face distortion. The current approach of incorporating sufficient design stall margin to tolerate these increased levels of distortion would significantly reduce performance. The objective of the High Stability Engine Control (HISTEC) program is to design, develop, and flight-demonstrate an advanced, integrated engine control system that uses measurement-based estimates of distortion to enhance engine stability. The resulting distortion tolerant control reduces the required design stall margin, with a corresponding increase in performance and decrease in fuel burn. The HISTEC concept has been developed and was successfully flight demonstrated on the F-15 ACTIVE aircraft during the summer of 1997. The flight demonstration was planned and carried out in two phases, the first to show distortion estimation, and the second to show distortion accommodation. Post-flight analysis shows that the HISTEC technologies are able to successfully estimate and accommodate distortion, transiently setting the stall margin requirement on-line and in real-time. This allows the design stall margin requirement to be reduced, which in turn can be traded for significantly increased performance and/or decreased weight. Flight demonstration of the HISTEC technologies has significantly reduced the risk of transitioning the technology to tactical and commercial engines.
Author
Engine Control; Gas Turbine Engines; Flight Tests; F-15 Aircraft; Flow Distortion; Real Time Operation; On-Line Systems; Control Systems Design; Inlet Pressure; Stability Augmentation

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.

19980203955 NASA Langley Research Center, Hampton, VA USA
Modeling the Benchmark Active Control Technology Wind-Tunnel Model for Active Control Design Applications
Waszak, Martin R., NASA Langley Research Center, USA; Jun. 1998; 30p; In English
Contract(s)/Grant(s): RTOP 522-33-11-01
Report No.(s): NASA/TP-1998-206270; NAS 1.60:206270; L-17625; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the formulation of a model of the dynamic behavior of the Benchmark Active Controls Technology (BACT) wind tunnel model for active control design and analysis applications. The model is formed by combining the equations of motion for the BACT wind tunnel model with actuator models and a model of wind tunnel turbulence. The primary focus of this report is the development of the equations of motion from first principles by using Lagrange's equations and the principle of virtual work. A numerical form of the model is generated by making use of parameters obtained from both experiment and analysis. Comparisons between experimental and analytical data obtained from the numerical model show excellent agreement and suggest that simple coefficient-based aerodynamics are sufficient to accurately characterize the aeroelastic response of the BACT wind tunnel model. The equations of motion developed herein have been used to aid in the design and analysis of a number of flutter suppression controllers that have been successfully implemented.
Author
Active Control; Dynamic Characteristics; Wind Tunnel Models; Mathematical Models; Dynamic Response; Design Analysis

19980204841 Florida Atlantic Univ., Dept. of Mechanical Engineering, Boca Raton, FL USA

Parallel-Computing Concepts and Methods in Large Scale Floquet Analysis of Helicopter Trim and Stability ***Final Report***

Gaonkar, G. H., Florida Atlantic Univ., USA; Subramanian, S., Florida Atlantic Univ., USA; Venkataratnam, S., Florida Atlantic Univ., USA; Mar. 03, 1998; 60p; In English

Contract(s)/Grant(s): DAAH04-94-G-0185

Report No.(s): AD-A344155; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Rotorcraft stability investigation involves a nonlinear trim analysis for the control inputs and periodic responses, and, as a follow-up, a linearized stability analysis for the Floquet Transition Matrix (FTM), and its eigenvalues and eigenvectors. The trim analysis is based on a shooting method with damped Newton iteration, which gives the FTM as a byproduct, and the eigenanalysis on the QR method; the corresponding trim and stability analyses are collectively referred to as the Floquet analysis. A rotor with Q blades that are identical and equally spaced has Q planes of symmetry. Exploiting this symmetry, the fast-Floquet analysis, in principle, reduces the run time and frequency indeterminacy of the conventional Floquet analysis by a factor of Q. It is implemented on serial computers and on all three types of mainstream parallel computing hardware: SIMD and MIMD computers, and a distributed computing system of networked workstations; large models with hundreds of states are treated. A comprehensive database is presented on computational reliability such as the eigenvalue condition number and on parallel performance such as the speedup and efficiency, which show, respectively, how fast a job can be completed with a set of processors and how well their idle times are minimized. Despite the Q-fold reduction, the serial run time is excessive and grows between quadratically and cubically with the number of states. by contrast, the parallel run time can be reduced dramatically and its growth can be controlled by a judicious combination of speedup and efficiency. Moreover, the parallel implementation on a distributed computing system is as routine as the serial implementation on a workstation.

DTIC

Aerodynamic Stability; Helicopters; Aircraft Models; Parallel Processing (Computers); Floquet Theorem; Helicopter Control; Stability Tests; Nonlinearity

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).

19980203397 Calspan Corp., Flight Research Dept., Buffalo, NY USA

Vista NF-16D Programmable Display System Development ***Final Report, Mar. 1997 - Mar 1998***

Bailey, Randall E., Calspan Corp., USA; Landers, Thomas F., Calspan Corp., USA; Apr. 1998; 15p; In English

Contract(s)/Grant(s): F33615-93-C-3608; AF Proj. 3005

Report No.(s): AD-A343745; AFRL-VA-WP-TR-98-3019; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Wright Laboratory's Variable Stability In Flight Simulator Test Aircraft (VISTA) NV-16D is the newest in flight simulator in the USAF inventory. This unique research aircraft will perform a multitude of missions: to evaluate flight characteristics of new aircraft that have not yet flown, to perform research in the areas of flying qualities, flight control design, pilot vehicle interface, weapons and avionics integration, and to train test pilots and engineers. The VISTA is being upgraded to enhance its simulation fidelity and its research capabilities through the addition of a programmable Helmet Mounted Display (HMD) and head up display (HUD) in the front cockpit. The programmable helmet mounted display system consists of a GEC Marconi Avionics Viper 2 Helmet Mounted Optics Module integrated with a modified Helmet Integrated Systems Limited (HISL) HGU-86/P helmet, the Honeywell Advanced Metal Tolerant tracker, and a GEC Marconi Avionics Programmable Display Generator. The monocular HMD system is designed for growth to stroke on video, binocular capability. Lessons learned in the VISTA HMD development are reviewed. An outline of the proposed VISTA HMD demonstration flight is given to highlight the VISTA programmable displays system capabilities.

DTIC

Product Development; Display Devices; Evaluation; Flight Characteristics; Design Analysis; Test Pilots; Training Analysis

19980203609 National Aerospace Lab., Tokyo, Japan

Roll Motion Restraint System for NAL 0.6 m MSBS

Kohno, Takashi, National Aerospace Lab., Japan; Sawada, Hideo, National Aerospace Lab., Japan; Kunimasu, Tetsuya, National Aerospace Lab., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 141-150; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Suspension of a wind tunnel model and control of its motion in 5 degrees of freedom is realized in the National Aerospace Laboratory (NAL) 0.6 m Magnetic Suspension and Balance System (MSBS), but roll motion of the model is not controlled. Controlling the roll motion by adding additional magnets for roll control is realized in some small facilities including the NAL 0.1 m MSBS, but it is not suitable for large wind tunnels. A mechanical roll motion control system for the 0.6 m MSBS is described and simulation and experimental results are presented.
Author
Roll; Magnetic Suspension; Wind Tunnel Models; Wind Tunnel Tests; Constraints

19980203610 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA
Wind Tunnel Magnetic Suspension and Balance Systems With Transversely Magnetized Model Cores
Britcher, Colin P., Old Dominion Univ., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 151-161; In English; Also announced as 19980203598
Contract(s)/Grant(s): NCC1-248; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper discusses the possibility of using vertically magnetized model cores for wind tunnel Magnetic Suspension and Balance Systems (MSBS) in an effort to resolve the traditional ”roll control” problem. A theoretical framework is laid out, based on previous work related to generic technology development efforts at NASA Langley Research Center. The impact of the new roll control scheme on traditional wind tunnel MSBS configurations is addressed, and the possibility of demonstrating the new scheme with an existing electromagnet assembly is explored. The specific system considered is the ex- Massachusetts Institute of Technology (MIT), ex-NASA, 6-inch MSBS currently in the process of recommissioning at Old Dominion University. This system has a sufficiently versatile electromagnet configuration such that straightforward ”conversion” to vertically magnetized cores appears possible.
Author
Wind Tunnels; Magnetic Suspension; Magnetic Cores; Balancing

19980203844 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
Network Evaluation for Training and Simulation ***Final Report, 1 Feb. 1996 - 30 Nov. 1997***
Purdy, Stephen G., Air Force Research Lab., USA; Wuerfel, Roger, Air Force Research Lab., USA; Barnhart, David, Air Force Research Lab., USA; Ewart, Ron, Air Force Research Lab., USA; Nov. 1997; 204p; In English
Contract(s)/Grant(s): AF Proj. 2403
Report No.(s): AD-A344849; AFRL-VA-WP-TR-1998-3013; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Advancements in networking hardware and software have increased the numbers of training and research simulators being used in networked environments. Various technical issues and problems involved with networking simulations exist, one of the most notable being latency. The Training Systems Product Group (ASC/YWE) of the Aeronautical Systems Center commissioned a study into some of these networking issues. This study was conducted by the Control Integration and Assessment Branch (AFRL/VACD), of Air Force Research Laboratory. The purpose of this study was to analyze different simulation network configurations to determine an optimized architecture for training purposes. This program was aimed at Unit Training Device (UTD) applications with low numbers of entities and sites. The basic training architecture of two LANs with a few local nodes connected together by a WAN was assumed. The ideal network configuration would minimize LAN/WAN latencies while maintaining simulation data accuracy. Analysis on both the local and entire network configurations was performed relative to effects of network loading. Issues such as bandwidth, latency, accuracy, thresholds, and delay compensation were investigated. Distributed Interactive Simulating (DIS) and DIS Lite protocols were used. DIS Lite, developed under a SBIR contract with MaK Technologies is a low bandwidth protocol for networked high fidelity flight simulations.
DTIC
Training Simulators; Wide Area Networks; Bandwidth

19980203988 Centre d’Etudes et de Recherches, Dept. of Aerothermodynamics, Toulouse, France
Measurement Techniques Developed for Cryogenic Field in T2 Transonic Wind Tunnel
Seraudie, A., Centre d’Etudes et de Recherches, France; Archambaud, J. P., Centre d’Etudes et de Recherches, France; Mignosi, A., Centre d’Etudes et de Recherches, France; May 1998; 12p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

T2 is an induction driven wind tunnel in which Reynolds number variations are obtained by increasing the total pressure (P(sub t) = 1,4 to 3bar) and reducing the total temperature (T(sub t) = 300 to 110K). The flow is driven by an injection of dry air at ambient temperature and cooled by another injection of liquid nitrogen. Advanced development of conventional techniques and modern measurement techniques have been performed for low-temperature cryogenic flows. This paper presents the evolu-

tion of the specific tools sometimes developed, always tested and mainly used for different 2D or 3D flows at ambient and cryogenic conditions. Firstly, it gives the developments performed in the field of anemometer and pressure probes to measure the flow quality of the cryogenic wind tunnel. Secondly, it describes the use of an infrared technique for the qualification of the boundary layer transition on 2D and 3D models. Finally, this paper presents some L.D.A. typical 2D and 3D measurements at ambient condition and the adaptation of this velocity measurement device to work in cryogenic conditions.
Author
Mechanical Measurement; Cryogenic Wind Tunnels; Transonic Wind Tunnels; Infrared Imagery; Reynolds Number; Aerodynamic Coefficients; Aerodynamics

19980203989 Imperial Coll. of Science Technology and Medicine, Dept. of Aeronautics, London, UK
Development of PIV for Two and Three Component Velocity Measurements in a Large Low Speed Wind Tunnel
Bearman, P. W., Imperial Coll. of Science Technology and Medicine, UK; Harvey, J. K., Imperial Coll. of Science Technology and Medicine, UK; Stewart, J. N., Imperial Coll. of Science Technology and Medicine, UK; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The use of particle image velocimetry, PIV, to make measurements in flows generated around models in a low speed wind tunnel is described. The tunnel test section employed is 3m wide by 1.5m high. The problems associated with using PIV in air at large scale, and how they can be overcome, are discussed. Stereoscopic PIV is used to measure all three components of velocity in planes across a flow. Errors due to parallax that are present in velocity components measured in the plane of a light sheet when there is an accompanying flow through the sheet, are corrected. The flows studied are generated by a l/8th scale passenger car model and a l/8th scale model of an aircraft with a wing sweep of 70 degrees. It is found that a reasonable estimate of a mean flow field can be obtained by averaging as few as ten instantaneous spatial distributions of velocity.
Author
Particle Image Velocimetry; Low Speed Wind Tunnels; Velocity Measurement; Flow Measurement

19980205662 National Inst. of Standards and Technology, Gaithersburg, MD USA
National Voluntary Laboratory Accreditation Program 1998 Directory
White, V. R., National Inst. of Standards and Technology, USA; Jan. 1998; 312p; In English
Report No.(s): PB98-149123; NIST/SP-810-ED-1998; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

Approximately 700 laboratories in 23 fields of accreditation are included in the 1998 edition. The directory lists the name, address, contact person, phone and fax numbers, e-mail and ERL addresses (if available), accreditation renewal date, and scope of accreditation for each laboratory. The directory contains a description of the NVLAP program, a summary of laboratory accreditations, user instructions, followed by five laboratory indexes which are cross-referenced by NVLAP Lab Code: Index A, Listing by laboratory Name, Index B, Listing by Field of Accreditation; Index C, Listing by State/Country; Index D, Listing by Testing Laboratories by NVLAP Lab Code; and Index E, Listing of Calibration Laboratories by NVLAP Lab Code. The scope of accreditation are provided for testing and calibration laboratories in Indexes D and E respectively.
NTIS
Directories; Laboratories

19980206043 Universitaet der Bundeswehr, Lab. fuer Stroemungsmaschinen, Hamburg, Germany
A Quantitative 2D Density Measuring System Using UV Rayleigh Scattering at an Atmospheric Wind Tunnel
Jakiel, C., Universitaet der Bundeswehr, Germany; Fiedler, K., Universitaet der Bundeswehr, Germany; Sieber, O., Universitaet der Bundeswehr, Germany; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

An optical density measuring system based on Rayleigh scattering was installed in an atmospheric wind tunnel. The system monitors the scattered light induced by a laser sheet irradiating the flow field behind a plane VKI-1 turbine cascade. The measuring procedure needing very short time is based on a relative measurement. This paper presents a brief summary of fundamentals, the experimental setup, and the measurement principles. As experimental result plane density distributions at different blade heights are given for subsonic and transonic flow. The experimental data is compared to results of a three-dimensional Navier-Stokes calculation.
Author
Density Measurement; Rayleigh Scattering; Gas Jets; Cascade Flow; Optical Measuring Instruments; Turbines; Wind Tunnels

12
ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

19980203234 Texas Univ., Austin, TX USA
Numerical Simulation of Ballistic Limit Curves for Orbital Debris Shielding
Rabb, Robert J., Texas Univ., USA; May 1998; 83p; In English
Report No.(s): AD-A343674; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

EXOS is a recently developed particle finite element code well suited to modeling hypervelocity impact phenomena. A series of EXOS simulations were conducted to evaluate the use of this new code for orbital debris shielding design. Two sets of simulations, one for a single bumper Whipple shield and one for a two bumper or stuffed Whipple shield, were compared to well known equations for the ballistic limit of Whipple shields, derived from experiment. The results show that EXOS provides an accurate and computationally tractable approach to simulate orbital debris shield performance.
DTIC
Numerical Analysis; Ballistic Trajectories; Shielding; Mathematical Models; Protection; Evaluation; Space Debris; Defense Program

19980203775 NASA Goddard Space Flight Center, Greenbelt, MD USA
AAS/GSFC 13th International Symposium on Space Flight Dynamics, Volume 1
Stengle, Tom, Editor, NASA Goddard Space Flight Center, USA; May 1998; 543p; In English; 13th; Space Flight Dynamics, 11-15 May 1998, Greenbelt, MD, USA; Also announced as 19980203776 through 19980203819
Report No.(s): NASA/CP-1998-206858/Vol-1; Rept-98B00041; NAS 1.55:206858/Vol-1; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

This conference proceedings preprint includes papers and abstracts presented at the 13th International Symposium on Space Flight Dynamics. Cosponsored by American Astronautical Society and the Guidance, Navigation and Control Center of the Goddard Space Flight Center, this symposium featured technical papers on a wide range of issues related to orbit-attitude prediction, determination, and control; attitude sensor calibration; attitude dynamics; and mission design.
Author (revised)
Space Flight; Mission Planning; Flight Optimization; Flight Mechanics; Spacecraft Maneuvers; Spacecraft Propulsion

19980205680 Rutherford Appleton Lab., Chilton, UK
Report of the Council for the Central Laboratory of the Research Councils *Annual Report, 1 Apr. 1996 - 31 Mar. 1997*
1997; ISSN 1366-235X; 52p; In English
Report No.(s): PB98-142805; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report covers the second year of the existence of the Council for the Central Laboratory of the Research Councils as a Research Council created under the 1965 Science and Technology Act. In last year's Annual Report, the report of Council's first year of independent existence, the main achievements were concerned with establishing the structure and systems needed for the Daresbury Laboratory and the Rutherford Appleton Laboratory to be operated as an integrated entity, the Central Laboratory of the Research Councils. In 1996 Council published its first Corporate Plan which identified nine Corporate Objectives. During 1996-1997, Council's strategy has been to begin to implement policies which allow these Corporate Objectives to be met.
NTIS
Research and Development; Synchrotron Radiation; Tests

13
ASTRODYNAMICS

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

19980203779 Centre National de la Recherche Scientifique, Space Mathematics Div., Toulouse, France
Scheduling techniques for a constellation visibilities
Agnese, Jean-Claude, Centre National de la Recherche Scientifique, France; Brousse, Pascal, Centre National de la Recherche Scientifique, France; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 45-53; In English; Also announced as 19980203775

Report No.(s): AAS-98-303; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Many conception or scheduling problems of space systems are based on combinatorial optimization techniques. In this paper, we describe the application of these techniques to the resolution of the scheduling problem appearing in the choice of visibility windows of satellites of a constellation. The problem we try to solve is described by: - given a set of tracking antennas, - one antenna can only follow one satellite at a time and needs a certain delay to allow reconfiguration before being able to track another satellite, - satellites must all be tracked more than a certain time every day, - as much as possible the load of the antennas must be equal. Among all the visibility windows, the problem consist in choosing one set that satisfies theses constraints at best. We describe several methods initially developed in the framework of the scheduling problem of imaging for the future Spot-5 satellite: - exact methods like the so called Russian dolls based on a Depth First Branch and Bound algorithm to find an optimal solution at the price of a sometimes very large computation time, - approximate methods like greedy search (iterative or random) to find a good solution with a very short computation time.

Author

Satellite Constellations; Stationkeeping; Spatial Distribution

19980203782 NASA Goddard Space Flight Center, Greenbelt, MD USA

A modernized approach to meet diversified earth observing system (EOS) AM-1 mission requirements

Newman, Lauri Kraft, NASA Goddard Space Flight Center, USA; Hametz, Mark E., AI Solutions, Inc., USA; Conway, Darrel J., AI Solutions, Inc., USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 71-85; In English; Also announced as 19980203775

Report No.(s): AAS-98-306; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

From a flight dynamics perspective, the EOS AM-1 mission design and maneuver operations present a number of interesting challenges. The mission design itself is relatively complex for a low Earth mission, requiring a frozen, Sun-synchronous, polar orbit with a repeating ground track. Beyond the need to design an orbit that meets these requirements, the recent focus on low-cost, 'lights out' operations has encouraged a shift to more automated ground support. Flight dynamics activities previously performed in special facilities created solely for that purpose and staffed by personnel with years of design experience are now being shifted to the mission operations centers (MOCs) staffed by flight operations team (FOT) operators. These operators' responsibilities include flight dynamics as a small subset of their work; therefore, FOT personnel often do not have the experience to make critical maneuver design decisions. Thus, streamlining the analysis and planning work required for such a complicated orbit design and preparing FOT personnel to take on the routine operation of such a spacecraft both necessitated increasing the automation level of the flight dynamics functionality. The FreeFlyer(TM) software developed by AI Solutions provides a means to achieve both of these goals. The graphic interface enables users to interactively perform analyses that previously required many parametric studies and much data reduction to achieve the same result In addition, the fuzzy logic engine enables the simultaneous evaluation of multiple conflicting constraints, removing the analyst from the loop and allowing the FOT to perform more of the operations without much background in orbit design. Modernized techniques were implemented for EOS AM-1 flight dynamics support in several areas, including launch window determination, orbit maintenance maneuver control strategies, and maneuver design and calibration automation. The benefits of implementing these techniques include increased fuel available for on-orbit maneuvering, a simplified orbit maintenance process to minimize science data downtime, and an automated routine maneuver planning process. This paper provides an examination of the modernized techniques implemented for EOS AM-1 to achieve these benefits.

Author

Earth Observing System (EOS); Earth Observations (From Space); Satellite Design; Satellite Constellations; Satellite Ground Tracks; Applications Programs (Computers)

19980203788 National Space Development Agency, Tsukuba, Japan

Improvement of orbit determination and prediction accuracy of ADEOS/RIS

Ogawa, Mina, National Space Development Agency, Japan; Maeda, Maki, National Space Development Agency, Japan; Sawabe, Mikio, National Space Development Agency, Japan; Hirota, Masao, National Space Development Agency, Japan; Yamamoto, Yousuke, Fujitsu Ltd., Japan; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 135-149; In English; Also announced as 19980203775

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The Advanced Earth Observing Satellite (hereafter ADEOS) was launched on August 17th, 1996 and its operation was terminated on the end of June 1997. The ADEOS carries a large aperture laser-reflector, referred as 'Retro-reflector-in-Space'(RIS). In order to hit laser properly onto the RIS, we need a trajectory prediction with accuracy of about 100 m. The flight-dynamics team at the NASDA/TACC (Tracking and Control Center) ordinarily derives a satellite trajectory with Range and Range Rate (RARR) measurements using S-band radio wave. However, the trajectory prediction is expected to be only as accurate as 1 km

for the ADEOS. This uncertainty is not acceptable for the RIS. Although the operation of the ADEOS was terminated, NASDA keeps on making every effort to improve the accuracy of trajectory determination and propagation of the ADEOS/RIS with Satellite Laser Ranging (SLR) data obtained at world-wide SLR ground stations. As a result we achieved a hundred-fold and a ten-fold improvement on accuracy of orbit determination and prediction respectively. This paper presents the summary of the experiment and the latest results. A brief discussion of the post-ADEOS mission plan will be found in this paper as well.
Author
Scientific Satellites; Laser Range Finders; Rangefinding; Satellite Instruments; Satellite Control; Satellite Communication

19980203789 Centre National d'Etudes Spatiales, Orbit Metrology Group, Toulouse, France
Next day precise orbits for TOPEX/Poseidon using DORIS
Berthias, Jean-Paul, Centre National d'Etudes Spatiales, France; Houry, Sabine, Centre National d'Etudes Spatiales, France; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 151-161; In English; Also announced as 19980203775
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Until now, TOPEX/Poseidon precise orbits were needed only for the production of Geophysical Data Record files, and thus were not required until about 5 weeks after data acquisition. Recent developments in operational oceanography now require the rapid delivery of precise altimeter data within days, and possibly hours, of data acquisition. The processing of the altimeter measurements can be accomplished according to this schedule, and the only difficulty rests with the production of the precise orbit ephemerides. The long delay involved in the current production scheme results from the necessity to collect laser tracking data from ground stations and also from the need to wait for the final and most accurate values of the solar activity and Earth orientation parameters. A reduction in the orbit production delay forces the processing to deal with DORIS data only and with predicted values for the parameters. In addition, this reduces the amount of validation that can be performed before delivery. Fortunately, the spatial and temporal coverage of the DORIS tracking system is such that the DORIS data by itself is sufficient to produce a precise orbit. Also, predictions of solar activity and Earth orientation parameters have improved considerably over the last few years, so that using them instead of actual data does not significantly degrade the orbit accuracy. Using this strategy, DORIS orbits have been computed on a daily basis within 24 to 48 hours of data acquisition. and since the beginning of October 1997, these orbits have been included on the Poseidon Interim Geophysical Data Record files for all cycles when this altimeter is on. Evaluations of these daily orbits reveal that their radial accuracy is very close to that of the standard precise orbits ephemerides.
Author
Poseidon Satellite; Earth Orientation; Topex; Satellite Guidance; Global Positioning System; Communication Satellites; Stationkeeping; Spatial Distribution; Satellite Navigation Systems

19980203791 European Space Agency. European Space Operations Center, Darmstadt, Germany
Isolation of tracking error sources within orbit determination
Delhaise, F., European Space Agency. European Space Operations Center, Germany; Mikkelsen, O., European Space Agency. European Space Operations Center, Germany; Pallaschke, S., European Space Agency. European Space Operations Center, Germany; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 179-189; In English; Also announced as 19980203775
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The orbit determination programs often apply a least squares estimator which provides good statistical information on the quality of the obtained solution, but does not provide adequate means for the identification of error sources. Isolation of error sources may be achieved with certain difficulty, e.g., by selecting specific sets of the tracking data and varying the solve-for parameters in successive runs. However, the obtained results of this trial-and-error process are often ambiguous and unhelpful in the identification of the source for the degraded orbit determination result. This paper summarizes an investigation into additional functionality for the detection of unmodeled orbit determination errors such as station or transponder delay biases or an unexpectedly high noise level for a particular station. The respective merits of two different basic approaches involving extensions to the common least squares method or, conversely, alternatives to the least squares estimator, were studied.
Author
Orbit Calculation; Orbital Mechanics; Satellite Guidance; Satellite Ground Tracks

19980203792 Communications Research Lab., Space Systems Section, Kashima, Japan
Accuracy modeling for short-arc determination of low earth orbits
Kawase, S., Communications Research Lab., Japan; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 191-204; In English; Also announced as 19980203775

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A concise accuracy model is derived for orbit determination and prediction. Optical and radar tracking, in the form of single-site single-pass observation, are evaluated. Orbit prediction error's are formulated analytically as functions of tracking arc length and prediction time length. The relative merits of the optics and radars are clarified through the analysis. These results offer a basis for discussing short term strategies of spacecraft near-miss avoidance in low earth orbits.

Author

Low Earth Orbits; Orbit Calculation; Orbital Mechanics; Satellite Guidance; Satellite Ground Tracks; Satellite Control

19980203793 Universidade Estadual de Paulista, Grupo de Dinamica orbital e Planetologia, Sao Paulo, Brazil

Orbital perturbations using geopotential coefficients up to high degree and order: Highly eccentric orbits

deMoraes, Rodolpho Vilhena, Universidade Estadual de Paulista, Brazil; Wnuk, Edwin, Adam Mickiewicz Univ., Poland; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 205-216; In English; Also announced as 19980203775

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Several methods have been proposed for calculations of the eccentricity function for a high value of the eccentricity, however they cannot be used when the high degree and order coefficients of gravity fields are taken into account. The method proposed by Wnuk is numerically stable in this case, but when is used, a large number of terms occurs in formulas for geopotential perturbations.

Author

Orbital Mechanics; Astrodynamics; Earth Orbits; Flight Optimization; Flight Mechanics; Eccentricity; Perturbation

19980203794 DeMaria Electro-Optics Systems, Inc., Bloomfield, CT USA

On the analysis of lunar albedo effects on low lunar orbit and gravity field determination

Floberghagen, Rune, Technische Univ., Netherlands; Visser, Pieter, DeMaria Electro-Optics Systems, Inc., USA; Weischede, Frank, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Vasile, Massimiliano, Politecnico di Milano, Italy; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 217; In English; Also announced as 19980203775

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A force model for the lunar albedo effect on low lunar orbiters is developed on the basis of Clementine imagery and absolute albedo measurements. The model, named the Delft Lunar Albedo Model 1 (DLAM-1), is a 15 x 15 spherical harmonics expansion, and is intended to improve force modeling for low satellite orbits, and moreover to help avoid aliasing of non-gravitational force model defects in future lunar gravity solutions from satellite tracking data. The development of the model from the available lunar albedo data sources is described, followed by a discussion on its calibration using absolute albedo measurements. Further interpretation of the model is based on a comparison with main selenological features. Next, the implementation of DLAM-1 in satellite force computations is outlined, with emphasis on computation costs. DLAM-1 is also applied in low lunar orbit determination, and results for typical orbits of current and prospective satellite missions are presented. Finally, the effect of lunar albedo on future solutions for the gravitational potential of the Moon is presented. In this regard, particular interest is on gravity mapping from global data sets, e.g. satellite-to-satellite tracking, which is expected to be one of the experiments of coming lunar missions. It is shown that albedo-induced orbit perturbations have a magnitude and frequency signature which are non-negligible for precise orbit and gravity modeling. Radial orbit errors are in the order of 1-2 m for one week arcs.

Author

Gravitational Fields; Clementine Spacecraft; Albedo; Lunar Albedo; Lunar Gravitation; Lunar Orbits; Microgravity; Orbit Calculation; Orbit Perturbation

19980203795 National Space Development Agency, Office of Research and Development, Tsukuba, Japan

Navigation and guidance error analysis of SELENE lunar lander considering orbit determination error

Oono, Hayato, National Space Development Agency, Japan; Ishikawa, Shinich, National Space Development Agency, Japan; Nakajima, Ken, Mitsubishi Space Software Corp., Japan; Hayashi, Kentaro, Mitsubishi Space Software Corp., Japan; Odaka, Rie, Mitsubishi Space Software Corp., Japan; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 219-229; In English; Also announced as 19980203775

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Generally, to achieve the high accurate navigation, both the radar altimeter and the inertial measurement sensors consisting of the accelerometers and the gyros are used during the powered decent to the lunar surface. In the current conceptual design, the

SELENE (SELenological ENgineering Explorer) lander is considered to have no way to use the radar altimeter during the most part of the powered decent from the restriction of cost, weight, etc. Therefore, the initial navigation error of the lander at the start of the powered decent brings about an important influence on a safe landing. This initial state error corresponds to the accuracy of the orbit determination in the ground system. To relax the effect of this initial state error, we carried out the accuracy analysis of the orbit determination by using the satellite-to-satellite tracking via a lunar relay satellite. The obtained results are then used in the navigation and guidance error analysis. It can be shown that there is the adequate possibility of the safe landing by the navigation with the only inertial measurement sensors during the braking phase. In this paper, the nominal trajectory, the guidance method and the results of error analyses mentioned above are reported.
Author
Satellite-to-Satellite Tracking; Trajectory Control; Relay Satellites; Orbit Calculation; Lunar Satellites; Lunar Orbits; Accelerometers

19980203796 National Space Development Agency, Advanced Mission Research Center, Tsukuba, Japan
Trajectory design of SELENE lunar orbiting and landing
Kawakatsu, Yasuhiro, National Space Development Agency, Japan; Kaneko, Yutaka, National Space Development Agency, Japan; Takizawa, Yoshisada, National Space Development Agency, Japan; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 231-242; In English; Also announced as 19980203775
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This paper focuses on the three topics related to the trajectory design of SELENE. The first is the orbit maneuver of the orbiter. The altitude of the orbiter is 100 km and the orbit is strongly perturbed by high order term of the gravity potential. In order to satisfy the mission requirements, ten maneuvers are scheduled during one year mission. The second topic is the orbit design of relay satellite. The relay satellite has no propulsion system and has no orbit maneuver capability. The orbit of the relay satellite is perturbed mainly by earth's gravity and the shape of the orbit changes through the one year mission. The initial orbit is selected carefully to meet the mission requirements through the mission considering the effect of perturbation. The third topic is the trajectory design of the landing mission. The navigation error in the landing phase is expected to be large value. Main reason of the error is orbit determination error and long duration of inertial navigation. The landing trajectory is designed to permit this navigation error and assure the safe landing.
Author
Earth Gravitation; Gravitation; Inertial Navigation; Relay Satellites

19980203797 Politecnico di Milano, Dipt. di Ingegneria Aerospaziale, Milan, Italy
Optimal trajectories for lunar landing missions
Vasile, Massimiliano, Politecnico di Milano, Italy; Floberghagen, Rune, Technische Univ., Netherlands; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 243-257; In English; Also announced as 19980203775
Report No.(s): AAS-98-321; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper a temporal finite element method is developed for dynamics and optimal control problems. The approach is here proposed in order to determine the optimal initial conditions, and the optimal control law to perform the desired soft landing on the South Pole of the Moon. The spacecraft is modeled as a point mass subject to gravity forces due to the Moon, the Earth and the Sun, and controlled by an ideal thrust. An estimation of total propellant consumption is presented taking, into account possible errors arising from a poor knowledge of the present force model. Finally an optimal control strategy, for obstacles avoidance is proposed. Some sample problems show the effectiveness of the proposed approach.
Author
Lunar Landing; Obstacle Avoidance; Control Theory; Dynamic Control; Soft Landing; Trajectories

19980203798 National Space Development Agency, Tsukuba Space Center, Tsukuba, Japan
High-order state estimation for approach and landing of lunar or planetary spacecraft
Ono, Shuji, National Space Development Agency, Japan; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 259-270; In English; Also announced as 19980203775
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This paper presents a new algorithm for the independent estimation of the high-order state vector of attitude, angular rate, thrust, and dynamic parameters, needed for the spacecraft control in the approach and landing to the moon or a planet. Without aid of the inner information of a gyroscope and an accelerometer, the constructed algorithm uses only the outer information (range & range rate) of the tracking station measurement or the topographical measurement by the reflection wave, for the multi-beans emitted from several antennas equipped on a vehicle. The simulation results well verify the effectiveness of this algorithm,even

in place of an attitude sensor. The new excellent result is especially obtained by the topographical assumption of a ground surface model. This paper gives one of fundamental guidelines not only for the new design of the navigation system and the ground control system of an aircraft, a future space-plane,or a planet-surveyor, but also for the identification of a planetary surface model.
Author
Interplanetary Spacecraft; Lunar Spacecraft; Spacecraft Control; Ground Based Control

19980203799 NASA Ames Research Center, Moffett Field, CA USA
Lunar prospector mission design and trajectory support
Lozier, David, NASA Ames Research Center, USA; Galal, Ken, NASA Ames Research Center, USA; Folta, David, NASA Goddard Space Flight Center, USA; Beckman, Mark, NASA Goddard Space Flight Center, USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 271-285; In English; Also announced as 19980203775
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The Lunar Prospector mission is the first dedicated NASA lunar mapping mission since the Apollo Orbiter program which was flown over 25 years ago. Competitively selected under the NASA Discovery Program, Lunar Prospector was launched on January 7, 1998 on the new Lockheed Martin Athena 2 launch vehicle. The mission design of Lunar Prospector is characterized by a direct minimum energy transfer trajectory to the moon with three scheduled orbit correction maneuvers to remove launch and cislunar injection errors prior to lunar insertion. At lunar encounter, a series of three lunar orbit insertion maneuvers and a small circularization burn were executed to achieve a 100 km altitude polar mapping orbit. This paper will present the design of the Lunar Prospector transfer, lunar insertion and mapping orbits, including maneuver and orbit determination strategies in the context of mission goals and constraints. Contingency plans for handling transfer orbit injection and lunar orbit insertion anomalies are also summarized. Actual flight operations results are discussed and compared to pre-launch support analysis.
Author
Lunar Exploration; Lunar Landing; Lunar Landing Sites; Trajectories; Orbit Calculation; Mission Planning; Lunar Orbits; Cislunar Space

19980203802 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Div. I: Kinematics and Dynamics of the Earth, Oberpfaffenhofen, Germany
An efficient on-board orbit propagator/estimator for LEO missions
Neumayer, Karl Hans, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Koenig, Rolf, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 301-310; In English; Also announced as 19980203775
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In the context of scientific investigations related to the CHAMP project and other upcoming LEO missions, the GeoForschungsZen- trum Potsdam (GFZ) initiated the development of an efficient real-time on-board orbit estimation and propagation software called POPE. The methods specific to POPE are in fact adaptions of orbit prediction algorithms that are being in operational use for the PRARE system on-board METEOR 3/7 and ERS-2 for several years. Simulation studies show that orbit elements generated by POPE from on-board GPS measurements suffice to bridge a gap of up to one week without GPS data with position errors of 10 to 20 km on the average for LEO orbits at 300 km altitude.
Author
Global Positioning System; Low Earth Orbits; Orbits; Space Commercialization; Orbital Mechanics

19980203803 NASA Goddard Space Flight Center, Greenbelt, MD USA
Attitude/attitude-rate estimation from GPS differential phase measurements using integrated-rate parameters
Oshman, Yaakov, NASA Goddard Space Flight Center, USA; Markley, Landis, NASA Goddard Space Flight Center, USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 311-325; In English; Also announced as 19980203775
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A sequential filtering algorithm is presented for attitude and attitude-rate estimation from Global Positioning System (GPS) differential carrier phase measurements. A third-order, minimal-parameter method for solving the attitude matrix kinematic equation is used to parameterize the filter's state, which renders the resulting estimator computationally efficient. Borrowing from tracking theory concepts, the angular acceleration is modeled as an exponentially autocorrelated stochastic process, thus avoiding the use of the uncertain spacecraft dynamic model. The new formulation facilitates the use of aiding vector observations in a uni-

fied filtering algorithm, which can enhance the method's robustness and accuracy. Numerical examples are used to demonstrate the performance of the method.
Author
Global Positioning System; Angular Acceleration; Attitude (Inclination); Dynamic Models; Satellite Control; Satellite Ground Tracks; Satellite Attitude Control

19980203804 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA
Improvements in precise GPS attitude determination using predetect data, gyro data, and redundant antennas
Asher, Mark S., Johns Hopkins Univ., USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 327-328; In English; Also announced as 19980203775
Report No.(s): AAS-98-330; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche; Abstract Only; Abstract Only

The existing paradigm for GPS attitude determination is to track the signals in a conventional tracking loop and use the phase observables as input to the attitude determination process. The dominant error sources limiting the accuracy of this process are the differential phase pattern of the antennas and multipath. These error sources are essentially indistinguishable and currently limit the accuracy of the GPS attitude determination process to about 0.1 degree for a 1 m baseline. For higher accuracies one needs to include a high quality Inertial Measurement Unit for accelerating platforms or a star camera for space platforms. This paper describes improvements to GPS attitude determination which may make it competitive with star cameras down to the 0.01 degree level.
Author
Global Positioning System; Space Platforms; Attitude (Inclination); Satellite Communication; Satellite Control

19980203805 NASA Goddard Space Flight Center, Greenbelt, MD USA
Optimal integer resolution for attitude determination using global positioning system signals
Crassidis, John L., Catholic Univ. of America, USA; Markley, F. Landis, NASA Goddard Space Flight Center, USA; Lightsey, E. Glenn, NASA Goddard Space Flight Center, USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 329-343; In English; Also announced as 19980203775
Report No.(s): AAS-98-331; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper, a new motion-based algorithm for GPS integer ambiguity resolution is derived. The first step of this algorithm converts the reference sightline vectors into body frame vectors. This is accomplished by an optimal vectorized transformation of the phase difference measurements. The result of this transformation leads to the conversion of the integer ambiguities to vectorized biases. This essentially converts the problem to the familiar magnetometer-bias determination problem, for which an optimal and efficient solution exists. Also, the formulation in this paper is re-derived to provide a sequential estimate, so that a suitable stopping condition can be found during the vehicle motion. The advantages of the new algorithm include: it does not require an a-priori estimate of the vehicle's attitude; it provides an inherent integrity check using a covariance-type expression; and it can sequentially estimate the ambiguities during the vehicle motion. The only disadvantage of the new algorithm is that it requires at least three non-coplanar baselines. The performance of the new algorithm is tested on a dynamic hardware simulator.
Author
Global Positioning System; Attitude (Inclination); Satellite Ground Support

19980203807 Florida Univ., Dept. of Aerospace Engineering, Mechanics and Engineering Science, Gainesville, FL USA
An efficient algorithm for spacecraft attitude determination with optical sensors
Shuster, Malcolm D., Florida Univ., USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 359-371; In English; Also announced as 19980203775
Report No.(s): AAS-98-333; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

An earlier algorithm for multiple sensors is extended to provide three-axis attitude from multiple line-of-sight observations with a single optical sensor. The algorithm, called SCAD, is simpler computationally than either the QUEST or FOAM algorithms and, although suboptimal, suffers only imperceptible loss of accuracy for typical star cameras with limited fields of view. An approximate covariance analysis of the algorithm is presented.
Author
Satellite Attitude Control; Satellite Guidance; Satellite Ground Support; Optical Measuring Instruments

19980203809 Computer Sciences Corp., Lanham, MD USA

Effects of magnetometer calibration and maneuvers on accuracies of magnetometer-only attitude-and-rate determination

Challa, M., Computer Sciences Corp., USA; Natanson, G., Computer Sciences Corp., USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 389-401; In English; Also announced as 19980203775

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Two different algorithms - a deterministic magnetic-field-only algorithm and a Kalman filter for gyroless spacecraft - are used to estimate the attitude and rates of the Rossi X-Ray Timing Explorer (RXTE) using only measurements from a three-axis magnetometer. The performance of these algorithms is examined using in-flight data from various scenarios. In particular, significant enhancements in accuracies are observed when' the telemetered magnetometer data are accurately calibrated using a recently developed calibration algorithm. Interesting features observed in these studies of the inertial-pointing RXTE include a remarkable sensitivity of the filter to the numerical values of the noise parameters and relatively long convergence time spans. by analogy, the accuracy of the deterministic scheme is noticeably lower as a result of reduced rates of change of the body-fixed geomagnetic field. Preliminary results show the filter-per-axis attitude accuracies ranging between 0.1 and 0.5 deg and rate accuracies between 0.001 deg/sec and 0.005 deg./sec, whereas the deterministic method needs a more sophisticated techniques for smoothing time derivatives of the measured geomagnetic field to clearly distinguish both attitude and rate solutions from the numerical noise. Also included is a new theoretical development in the deterministic algorithm: the transformation of a transcendental equation in the original theory into an 8th-order polynomial equation. It is shown that this 8th-order polynomial reduces to quadratic equations in the two limiting cases-infinitely high wheel momentum, and constant rates-discussed in previous publications.
Author

Magnetometers; Kalman Filters; Attitude (Inclination); Rangefinding

19980203810 NASA Goddard Space Flight Center, Greenbelt, MD USA

Empirical correction for earth sensor horizon radiance variation

Hashmall, Joseph A., Computer Sciences Corp., USA; Sedlak, Joseph, Computer Sciences Corp., USA; Andrews, Daniel, Computer Sciences Corp., USA; Luquette, Richard, NASA Goddard Space Flight Center, USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 403-417; In English; Also announced as 19980203775

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A major limitation on the use of infrared horizon sensors for attitude determination is the variability of the height of the infrared Earth horizon. This variation includes a climatological component and a stochastic component of approximately equal importance. The climatological component shows regular variation with season and latitude. Models based on historical measurements have been used to compensate for these systematic changes. The stochastic component is analogous to tropospheric weather. It can cause extreme, localized changes that for a period of days, overwhelm the climatological variation. An algorithm has been developed to compensate partially for the climatological variation of horizon height and at least to mitigate the stochastic variation. This method uses attitude and horizon sensor data from spacecraft to update a horizon height history as a function of latitude. For spacecraft that depend on horizon sensors for their attitudes (such as the Total Ozone Mapping Spectrometer-Earth Probe-TOMS-EP) a batch least squares attitude determination system is used. It is assumed that minimizing the average sensor residual throughout a full orbit of data results in attitudes that are nearly independent of local horizon height variations. The method depends on the additional assumption that the mean horizon height over all latitudes is approximately independent of season. Using these assumptions, the method yields the latitude dependent portion of local horizon height variations. This paper describes the algorithm used to generate an empirical horizon height. Ideally, an international horizon height database could be established that would rapidly merge data from various spacecraft to provide timely corrections that could be used by all.
Author

Attitude (Inclination); Attitude Control; Infrared Radiation; Troposphere

19980203812 Computer Sciences Corp., Lanham, MD USA

Analysis of earth albedo effect on sun sensor measurements based on theoretical model and mission experience

Brasoveanu, Dan, Computer Sciences Corp., USA; Sedlak, Joseph, Computer Sciences Corp., USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 435-447; In English; Also announced as 19980203775

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Analysis of flight data from previous missions indicates that anomalous Sun sensor readings could be caused by Earth albedo interference. A previous Sun sensor study presented a detailed mathematical model of this effect. The model can be used to study

the effect of both diffusive and specular reflections and to improve Sun angle determination based on perturbed Sun sensor measurements, satellite position, and an approximate knowledge of attitude. The model predicts that diffuse reflected light can cause errors of up to 10 degrees in Coarse Sun Sensor (CSS) measurements and 5 to 10 arc sec in Fine Sun Sensor (FSS) measurements, depending on spacecraft orbit and attitude. The accuracy of these sensors is affected as long as part of the illuminated Earth surface is present in the sensor field of view. Digital Sun Sensors (DSS) respond in a different manner to the Earth albedo interference. Most of the time DSS measurements are not affected, but for brief periods of time the Earth albedo can cause errors which are a multiple of the sensor least significant bit and may exceed one degree. This paper compares model predictions with Tropical Rainfall Measuring Mission (TRMM) CSS measurements in order to validate and refine the model. Methods of reducing and mitigating the impact of Earth albedo are discussed. ne CSS sensor errors are roughly proportional to the Earth albedo coefficient. Photocells that are sensitive only to ultraviolet emissions would reduce the effective Earth albedo by up to a thousand times, virtually eliminating all errors caused by Earth albedo interference.
Author
Earth Albedo; Ultraviolet Emission; Trmm Satellite; Solar Sensors; Photoelectric Cells; Flight Tests; Earth Surface

19980203818 Universidade Estadual de Paulista, Grupo de Dinamica Orbital e Planetologia da UNESP, Guaratingueta, Brazil
Attitude propagation using non-singular canonical variables
Zanardi, Maria Cecilia, Universidade Estadual de Paulista, Brazil; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 511-524; In English; Also announced as 19980203775
Report No.(s): AAS-98-344; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Three sets of non-singular canonical variables for the rotational motion are analyzed. These sets are useful when the angle between z-axis of a coordinate system fixed in artificial satellite (here defined by the directions of principal moments of inertia of the satellite) and the rotational angular momentum vector is zero or when the angle between Z-inertial axis and rotational angular momentum vector is zero. The goal of this paper is to compare all these sets and to determine the benefits of their uses. With this objective, the dynamical equations of each set were derived, when mean hamiltonian associate with the gravity gradient torque is included. For the torque-free rotational motion, analytical solutions are computed for symmetrical satellite for each set of variables. When the gravity gradient torque is included, an analytical solution is shown for one of the sets and a numerical solution is obtained for one of the other sets. by this analysis we can conclude that: the dynamical equation for the first set is simple but it has neither clear geometrical nor physical meaning; the other sets have geometrical and physical meaning but their dynamical equations are more complex.
Author
Artificial Satellites; Attitude (Inclination); Moments of Inertia; Orbital Maneuvers

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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).

19980203814 Aerospace Corp., El Segundo, CA USA
Test of a flexible spacecraft dynamics simulator
Dichmann, Donald, Aerospace Corp., USA; Sedlak, Joseph, Computer Sciences Corp., USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 461-473; In English; Also announced as 19980203775
Contract(s)/Grant(s): GS-35F-4381G; NAS5-31000; NSF IPF- 95-05450
Report No.(s): AAS-98-340; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

There are a number of approaches one can take to modeling the dynamics of a flexible body. While one can attempt to capture the full dynamical behavior subject to disturbances from actuators and environmental torques, such a detailed description often is unnecessary. Simplification is possible either by limiting the amplitude of motion to permit linearization of the dynamics equations or by restricting the types of allowed motion. In this work, we study the nonlinear dynamics of bending deformations of wire booms on spinning spacecraft. The theory allows for large amplitude excursions from equilibrium while enforcing constraints on the dynamics to prohibit those modes that are physically less relevant or are expected to damp out fast. These constraints explicitly remove the acoustic modes (i.e., longitudinal sound waves and shear waves) while allowing for arbitrary bending and twisting, motions which typically are of lower frequency. As a test case, a spin axis reorientation maneuver by the Polar Plasma Laboratory (POLAR) spacecraft has been simulated. POLAR was chosen as a representative spacecraft because it has flexible wire antennas that extend to a length of 65 meters. Bending deformations in these antennas could be quite large and have a significant effect on

the attitude dynamics of the spacecraft body. Summary results from the simulation are presented along, with a comparison with POLAR flight data.
Author
Spacecraft Design; Dynamic Structural Analysis; Flexible Spacecraft; Flexible Bodies; Torque; Actuators

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.

19980203266 Washington Univ., Aerospace and Energetics Research Program, Seattle, WA USA
Investigation of Reactive Gasdynamics Phenomena in the Ram Accelerator ***Final Report, 16 Mar. 1992 - 31 Dec. 1997***
Bruckner, Adam P., Washington Univ., USA; Apr. 15, 1998; 15p; In English
Contract(s)/Grant(s): DAAL03-92-G-0100
Report No.(s): AD-A344367; ARO-29771.10-EG; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The ram accelerator is a launcher concept conceived at the University of Washington that uses chemical energy to accelerate projectiles to hypervelocities, in principle up to 8 km/sec. The device is based on an in-bore ramjet concept in which a subcaliber projectile, shaped like the centerbody of a supersonic ramjet, is propelled down the center of a stationary tube filled with a pressurized propellant mixture of gaseous fuel and oxidizer. This propellant burns near the base of the moving projectile, generating thrust. The highest pressure in the system is always in the vicinity of the projectile base, rather than at the breech as in a gun, making for high propulsive efficiency. Under the subject grant the University of Washington has investigated various gasdynamic phenomena that govern the behavior and performance of the ram accelerator. These include the gasdynamic operating limits, low velocity starting phenomena, real gas effects at high pressures, superdetonative operation, and zero velocity start.
DTIC
Gas Dynamics; Launchers; Ram Accelerators; Projectiles; Gaseous Fuels; Chemical Energy; Ballistics

19980203623 Texas Univ., Dept. of Electrical and Computer Engineering, Austin, TX USA
Electromagnetic Launchers for Space Applications: Coilguns for Repetitive Launching
Driga, M. D., Texas Univ., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 313-324; In English; Also announced as 19980203598
Contract(s)/Grant(s): DAAH04-96-0-0197; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Electromagnetic macroparticle accelerators or electromagnetic launchers (EMLS) are frequently mentioned as a new approach to launching payloads into space from earth, to interplanetary space propulsion or to test facilities for space applications. The advantages of such EMLs are due to the fact that electromagnetic thrust forces are distributed over the entire space of the vehicle being launched, are substantially more controllable, and permit projectile velocities well beyond the ones achievable with explosives, because of the absence of some thermodynamic constraints. This paper considers the idea that a solution to markedly improve the technology is to abandon the simple and coarse d.c. railgun in favor of a.c. polyphase induction coilgun launchers powered by heteropolar compulsators. The theory of such coilgun launchers is presented and an example of their conceptual design is given.
Author
Electromagnetic Propulsion; Propulsion System Performance; Mass Drivers; Gun Launchers

19980203630 Texas Univ., Dept. of Electrical and Computer Engineering, Austin, TX USA
High Power Electrical Machines for Space Applications Electromagnetic Launchers (Quality Functions and Goodness Factors)
Driga, M. D., Texas Univ., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 409-423; In English; Also announced as 19980203598
Contract(s)/Grant(s): DAAH04-96-0-0197; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In order to drastically increase the power and energy densities of the pulsed electrical machines for space applications electromagnetic launchers a ”system approach” of the entire electromechanical and electrodynamical chain must be adapted. A unified treatment and optimization of both rotating power supplies and accelerators leads to a set of goodness functions and quality factors exploring the relative merits of the system. Such quality indicators must be based on a rigorous theoretical foundation from both electrodynamical and electromechanical points of view. For electromechanical aspects, the general theory of electrical machines,

together with Kron's tensorial formulations for transient and pulsed conversion lead to a quality indication as a "goodness factor" or "goodness function" generalized from steady state to pulsed electrical machines and, further, to systems of machines (rotating power supply, self-excitation system, accelerator). by using Maxwell's equations for moving media and the notion of flux derivative, three different formulations for electromagnetic forces in electrical machines are introduced and interrelated leading to an assessment for the electromagnetic recoil and for the distribution of forces in air core and iron core advanced machines and electromagnetic accelerators.
Author
Electromagnetic Propulsion; Maxwell Equation; Goodness of Fit; Mathematical Models; Electromechanical Devices; Ram Accelerators

19980203650 Naval Postgraduate School, Monterey, CA USA
Space Based Radar and Its Impact on Aircraft Susceptibility
Ricks, W. A., Naval Postgraduate School, USA; Dec. 1997; 69p; In English
Report No.(s): AD-A343426; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Since the U.S. does not have the largest military force in the world, it relies on force multipliers to achieve victory. One of these force multipliers is stealth technology. However, when stealth technology is used in modern military aircraft, usually only the forward sector of the aircraft is treated and/or shaped. This forward sector treatment is effective against static, ground based radars. However, the aircraft may be very susceptible to a look-down type of radar. This thesis addresses the viability of using space-based radar to detect stealth aircraft. Many papers have been written on how to use space-based radar to detect and track targets. However, these papers neglect to develop the satellite constellation that would be necessary to provide continuous radar coverage. These papers also do not address how susceptible stealth aircraft would be to space-based radar. The approach of this thesis was to select a target area, in this case Iraq, and develop two satellite constellations that could provide the required radar coverage. The next step was to determine if the system would be able to detect and track stealth targets. Based on the analysis, one satellite in geosynchronous orbit can detect stealth aircraft. However, because the satellite is 35,786 km away, the power requirements, as well as the spot size are too large to track stealth aircraft. On the other hand, a constellation of 32 satellites in low earth orbit (1000 km) can both detect and track stealth aircraft. In conclusion, if the U.S. does not start applying stealth technology to the upper surface of stealth aircraft, they will be susceptible to space-based radar.
DTIC
Radar; Space Based Radar; Constellations; Spacecraft Defense; B-2 Aircraft

19980206199 Jacksonville State Univ., Dept. of Finance and Statistics, AL USA
Technology Transfer External Metrics, Research, Success Stories, and Participation on Evaluation Team for the Reusable Launch Vehicle (RLV)
Trivoli, George W., Jacksonville State Univ., USA; Oct. 1996; 10p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This research report is divided into four sections. The first section is related to participation on the team that evaluated the proposals for the X-33 project and the Reusable Launch Vehicle (RLV) during mid-May; prior to beginning the 1996 Summer Faculty Fellowship. The second section discusses the various meetings attended related to the technology evaluation process. The third section is related to various research and evaluation activities engaged in by this researcher. The final section discusses several success stories this researcher aided in preparing. Despite the fact that this researcher is not an engineer or science faculty, invaluable knowledge and experience have been gained at MSFC. Although related to the previous summer's research, the research has been new, varied, and challenging. This researcher was fortunate to have had maximum interaction with NASA colleague, David Cockrell. It would be a privilege and honor to continue a relationship with the Technology Transfer Office. In addition, we will attempt to aid in the establishment of a continuous formalized relationship between MSFC and Jacksonville State University. Dr. David Watts, Vice President for Academic Affairs, J.S.U., is interested in having the Technology Division cooperating with MSFC in sharing information and working tech transfer inquiries. The principal benefits gained by this researcher include the opportunity to conduct research in a non-academic, real world environment. In addition, the opportunity to be involved in aiding with the decision process for the choice of the next generation of space transportation system was a once in a lifetime experience. This researcher has gained enhanced respect and understanding of MSFC/NASA staff and facilities.
Author
X-33 Reusable Launch Vehicle; NASA Programs; Research and Development; Aerospace Technology Transfer; Universities

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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

19980203956 NASA Langley Research Center, Hampton, VA USA
Development of the Materials in Devices as Superconductors (MIDAS) Experiment
Amundsen, R. M., NASA Langley Research Center, USA; Hickman, J. C., NASA Langley Research Center, USA; Hopson, P., Jr., NASA Langley Research Center, USA; Kist, E. H., Jr., NASA Langley Research Center, USA; Marlowe, J. M., NASA Langley Research Center, USA; Siman-Tov, E., NASA Langley Research Center, USA; Turner, C. P., NASA Langley Research Center, USA; Tyler, C. J., NASA Langley Research Center, USA; Wells, J. E., NASA Langley Research Center, USA; Wise, S. A., NASA Langley Research Center, USA; Dickson, R., Computer Sciences Corp., USA; Hooker, M. W., Lockheed Martin Corp., USA; May 1998; 58p; In English
Contract(s)/Grant(s): RTOP 956-17-00-01
Report No.(s): NASA/TM-1998-208440; NAS 1.15:208440; L-17711; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Materials In Devices As Superconductors (NUDAS) spaceflight experiment is a NASA payload which launched in September 1996 on the Shuttle Atlantis (STS-79), and was transferred to the Mr Space Station for several months of operation. NUDAS was developed and built at NASA Langley Research Center (LaRC). The primary objective of the experiment was to determine the effects of microgravity and spaceflight on the electrical properties of high-temperature superconductive (HTS) materials. Cooling was provided by a tactical cryocooler, which maintained the specimens at or below 80 K. The superconductive specimens and the coldfinger of the cryocooler were mounted in a vacuum chamber. The entire experiment was mounted for operation in a stowage locker inside Mir. Three separate cycles of the experiment were performed autonomously after circuit breaker activation by the astronaut. Issues discussed include some of the experiment historical background, such as the different spacecraft that were to be the carrier at different times, the selection of components such as the cryocooler and ion pump, and the entire development through design, testing and flight. Some of the many challenges faced by project personnel were maintaining the HTS samples at cryogenic temperatures and in a vacuum, preparation and bonding of the samples, meeting the mass and volume limits imposed by the Shuttle and Mir, and performing all necessary testing to meet required performance standards.
Author
Superconductors (Materials); Experimentation; Microgravity; High Temperature Superconductors; Refractory Materials

19980206159 Tennessee Univ., Dept. of Computer Science and Electrical Engineering, Chattanooga, TN USA
Integration of the Shuttle RMS/CBM Positioning Virtual Environment Simulation
Dumas, Joseph D., Tennessee Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Constructing the International Space Station, or other structures, in space presents a number of problems. In particular, payload restrictions for the Space Shuttle and other launch mechanisms prohibit assembly of large space-based structures on Earth. Instead, a number of smaller modules must be boosted into orbit separately and then assembled to form the final structure. The assembly process is difficult, as docking interfaces such as Common Berthing Mechanisms (CBMS) must be precisely positioned relative to each other to be within the ”capture envelope” (approximately +/- 1 inch and +/- 0.3 degrees from the nominal position) and attach properly. In the case of the Space Station, the docking mechanisms are to be positioned robotically by an astronaut using the 55-foot-long Remote Manipulator System (RMS) robot arm. Unfortunately, direct visual or video observation of the placement process is difficult or impossible in many scenarios. One method that has been tested for aligning the CBMs uses a boresighted camera mounted on one CBM to view a standard target on the opposing CBM. While this method might be sufficient to achieve proper positioning with considerable effort, it does not provide a high level of confidence that the mechanisms have been placed within capture range of each other. It also does nothing to address the risk of inadvertent contact between the CBMS, which could result in RMS control software errors. In general, constraining the operator to a single viewpoint with few, if any, depth cues makes the task much more difficult than it would be if the target could be viewed in three-dimensional space from various viewpoints. The actual work area could be viewed by an astronaut during EVA; however, it would be extremely impractical to have an astronaut control the RMS while spacewalking. On the other hand, a view of the RMS and CBMs to be positioned in a virtual environment aboard the Space Shuttle orbiter or Space Station could provide similar benefits more safely and conveniently with little additional cost. In order to render and view the RMS and CBMs in a virtual world, the position and orientation of the end effector in three-dimensional space must be known with a high degree of accuracy. A precision video alignment sensor has been

developed which can determine the position and orientation of the controlled element relative to the target CBM within approximately one-sixteenth inch and 0.07 angular degrees. Such a sensor could replace or augment the boresighted camera mentioned above. The computer system used to render the virtual world and the position tracking systems which might be used to monitor the user's movements (in order to adjust the viewpoint in virtual space) are small enough to carry to orbit. Thus, such a system would be feasible for use in constructing structures in space.
Derived from text
Remote Manipulator System; Computer Programs; Alignment; Visual Observation; Virtual Reality; Space Environment Simulation; Orbital Assembly; Space Station Structures

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

19980203800 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, German Space Operations Center, Wessling, Germany
GPS performance for GEO's and HEO's the Equator-S spacecraft mission
Enderle, Werner, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Schmidhuber, Michael, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Gill, Eberhard, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Montenbruck, Oliver, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Braun, Armin, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Eisfeller, Bernd, Federal Armed Forces Univ., Germany; Balbach, Oliver, Federal Armed Forces Univ., Germany; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 287-296; In English; Also announced as 19980203775
Report No.(s): AAS-98-324; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The successfully usage of spaceborne GPS receivers for orbit- and attitude determination has in the past mainly been applied for spacecraft in near-circular Low Earth Orbits (LEO), e.g. TOPEX/POSEIDON, RADCAL. However, no experience exists of using GPS signals for spacecraft navigation in altitudes above the GPS (20000 km), such as the Geostationary Orbit (GEO) or the Geo Transfer Orbit (GTO). In this context, EQUATOR-S with it's highly elliptical orbit offers a unique possibility in order to increases significantly the experience concerning GPS visibility, signal reception and GPS based navigation The application of GPS based spacecraft navigation in GEO's and HEO's will bring advantages in many aspects. Besides orbit/attitude determination, GPS offers a potential for increasing command capabilities and decreasing ground station support. This will lead to a reduction of mission cost especially for LEOP phase of geostationary satellites. This paper describes first experiences in operating a GPS receiver in a highly elliptical orbit and presents first results of GPS visibility and signal reception conditions within this orbit.
Author
Global Positioning System; Geosynchronous Orbits; Heos Satellites; Low Earth Orbits; Poseidon Satellite; Space Navigation; Transfer Orbits; Topex

19980203801 European Space Agency. European Space Operations Center, Darmstadt, Germany
Data analysis of space based relative GPS experiments
Mur, T. J. Martin, European Space Agency. European Space Operations Center, Germany; Martinez, C. Garcia, European Space Agency. European Space Operations Center, Germany; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 297; In English; Also announced as 19980203775
Report No.(s): AAS-98-325; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Three ground-breaking experiments involving simultaneous collection of OPS data by spacecraft took place between November 1996 and October 1997. These experiments had the goal of demonstrating the feasibility of using GPS for relative navigation of spacecraft. The experiments took place within ESA's ATV (Automated Transfer Vehicle) Rendezvous Pro-development (ARP) program. This program aims to validate rendezvous technologies that will be used in ATV for its proximity operations around the International Space Station. The spacecraft involved were NASA's Shuttle and the US/German retrievable Astrospas satellite for ft first flight demonstration that took place during the STS-80 flight at the end of 1996 and the Shuttle and ft Russian MIR space station during the STS-84 and 86 flights. GPS receivers were installed in the spacecraft involved and GPS data were collected for several intervals during the rendezvous and separation phases. ESOC Flight Dynamics was entrusted with the challenge of providing the most accurate trajectories that could be computed using the on-board collected OPS data in combination with ground collected data. These precise trajectories were required in order to validate the algorithms to be used in the ATV for relative navigation. The baseline for ATV is that the GPS data collected on-board the ATV and the ISS will be processed in real

time on-board the ATV to obtain a relative navigation solution. ESOC routinely produces precise orbits and clocks for the GPS satellites as part of its involvement as Analysis Centre in the International GPS Service for Geodynamics. With those precise products it is possible to correct in post-processing for the errors introduced by Selective Availability. For these experiments the GPS measurements are corrected and then used to calculate the absolute position of each of the two spacecraft. The biggest sources of error that have to be deal with are the ionospheric delay, because only L1 frequency data are being collected, the pseudo range noise and the cycle slips in the carrier phase. So far the data for the first Flight Demonstration have been processed, with results that compare well with those derived from the Shuttle TCS laser ranging system and we are currently waiting for the availability of the data for Flight Demos 2 and 3. For these last two Right Demos there is a delay in the retrieval of data because some of them have to be down-linked from the MIR space station, but they should be available soon and ft is expected that data processing will be completed before the end of the year. This paper wfli present the strategy used to obtain the best estimated trajectories, the problems found during the analysis of the data and the results obtained, induding comparisons with trajectories obtained using other tracking systems or algorithms.
Author
Global Positioning System; Navigation Satellites; Laser Range Finders; Automated Transfer Vehicle; Data Acquisition

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.

19980203598 NASA Langley Research Center, Hampton, VA USA
Fourth International Symposium on Magnetic Suspension Technology
Groom, Nelson J., Editor, NASA Langley Research Center, USA; Britcher, Colin P., Editor, Old Dominion Univ., USA; May 1998; 445p; In English; 4th; Magnetic Suspension Technology, 30 Oct. - 1 Nov. 1997, Gifu, Japan; Sponsored by NASA, USA; Also announced as 19980203599 through 19980203633
Contract(s)/Grant(s): RTOP 522-24-21-04
Report No.(s): NASA/CP-1998-207654; L-17735; NAS 1.55:207654; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

In order to examine the state of technology of all areas of magnetic suspension and to review recent developments in sensors, controls, superconducting magnet technology, and design/implementation practices, the Fourth International Symposium on Magnetic Suspension Technology was held at The Nagaragawa Convention Center in Gifu, Japan, on October 30 - November 1, 1997. The symposium included 13 sessions in which a total of 35 papers were presented. The technical sessions covered the areas of maglev, controls, high critical temperature (T(sub c)) superconductivity, bearings, magnetic suspension and balance systems (MSBS), levitation, modeling, and applications. A list of attendees is included in the document.
Author
Conferences; Levitation; Magnetic Suspension; Superconducting Magnets; Superconductivity; Permanent Magnets; Magnetic Bearings

19980203776 Centre National d'Etudes Spatiales, Space Mathematics Div., Toulouse, France
Skybridge station keeping strategy
Brousse, Pascal, Centre National d'Etudes Spatiales, France; Rozanes, Pierre, Centre National d'Etudes Spatiales, France; Lansard, Erick, Alcatel Telecom, France; Martinot, Vincent, Alcatel Telecom, France; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 1-15; In English; Also announced as 19980203775
Report No.(s): AAS-98-300; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper gives the results of a study which was conducted on the SkyBridge constellation station keeping within an Alcatel and CNES partnership framework. The first step consisted in proving the feasibility of the station keeping on the candidate orbits taking into account a relatively new and stringent station keeping criterion. Then, once the mission orbit choice had been made, the study enabled us to detail the perturbations on the real orbit and to define the type of station keeping maneuver to be performed. The last part consisted in imagining the best possible station keeping strategy for a constellation in terms of robustness and ground

workload. The SkyBridge station keeping definition is not complete; the results presented here are not final and may still change according to choice of system or satellite.
Author
Stationkeeping; Orbital Mechanics; Satellite Constellations; Spacecraft Control; Earth Orbital Rendezvous; Flight Mechanics; Flight Optimization; Lagrangian Equilibrium Points; Orbit Calculation; Space Navigation

19980203778 Centre National de la Recherche Scientifique, Toulouse, France
Models and algorithms for constellation station keeping strategies and satellites replacement
Brochet, C., Centre National de la Recherche Scientifique, France; Garcia, J. M., Centre National de la Recherche Scientifique, France; Enjalbert, J. M., Centre National de la Recherche Scientifique, France; Ceolin, T., Centre National de la Recherche Scientifique, France; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 29-43; In English; Also announced as 19980203775
Report No.(s): AAS-98-302; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

During the mission of a constellation, maneuvers must be introduced periodically to reset the drifted satellites. Moreover some satellites may fail during the life of the constellation, and maneuvers have to be done to ensure the desired coverage. In this paper, we propose several optimization models for this problem. For each model we present the most efficient resolution algorithm. Each model consists in minimizing the total consumption due to maneuvers. It takes into account the trajectory of each satellite and constraints on their relative positions. An additional constraint is introduced to limit the number of satellites that can be simultaneously controlled. Such an optimization problem is a Mixed Integer Non Linear Programming (MINLP). It contains boolean and real variables. Boolean variables determine which satellites can be thrusted, and real variables correspond to the value of maneuvers. The global problem is splitted on the basis of the generalized Bender's decomposition method (projection on the boolean variables space). The first model is linear and differential (relative satellite positions). The sub-problem (calculation of the impulsive thrusts) is solved by a dual approach that finds the solution in a finite number of steps. It provides the global optimum in a very short computing time. This model is interesting in the case where the phasing of the constellation is not far from nominal conditions. The second model is nonlinear and non differential. It represents the real problem without simplifications. The resolution of the sub-problem is done using a direct search approach (Hooke and Jeeves algorithm) to determine real variables in the sub-problem. This model is used to solve the station keeping problem and to determine optimal maneuvers to replace satellites in case of failure. Numerical experiments and comparison between the two approaches are presented for various constellation configuration parameters.
Author
Stationkeeping; Spacecraft Control; Satellite Constellations; Orbital Mechanics

19980203780 NASA Goddard Space Flight Center, Greenbelt, MD USA
Design and implementation of satellite formations and constellations
Folta, David, NASA Goddard Space Flight Center, USA; Newman, Lauri Kraft, NASA Goddard Space Flight Center, USA; Quinn, David, NASA Goddard Space Flight Center, USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 55-68; In English; Also announced as 19980203775
Report No.(s): AAS-98-304; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The direction to develop small low cost spacecraft has led many scientists to recognize the advantage of flying spacecraft in constellations and formations to achieve the correlated instrument measurements formerly possible only by flying many instruments on a single large platform. Yet, constellations and formation flying impose additional complications on orbit selection and orbit maintenance, especially when each spacecraft has its own orbit or science requirements. The purpose of this paper is to develop an operational control method for maintenance of these missions. Examples will be taken from the Earth Observing-1 (EO-1) spacecraft that is part of the New Millennium Program (NMP) and from proposed Earth System Science Program Office (ESSPO) constellations. Results can be used to determine the appropriateness of constellations and formation flying for a particular case as well as the operational impacts. Applications to the ESSPO and NMP are highly considered in analysis and applications. After constellation and formation analysis is completed, implementation of a maneuver maintenance strategy becomes the driver. Advances in technology and automation by GSFC's Guidance, Navigation, and Control Center allow more of the burden of the orbit selection and maneuver maintenance to be automated and ultimately placed onboard the spacecraft, mitigating most of the associated operational concerns. This paper presents the GSFC closed-loop control method to fly in either constellations or formations through the use of an autonomous closed loop three-axis navigation control and innovative orbit maintenance support. Simulation results using AutoCon(TM) and FreeFlyer(TM) with various fidelity levels of modeling and algorithms are presented.
Author
Satellite Constellations; Feedback Control; Autonomous Navigation; Low Cost

19980203781 NASA Goddard Space Flight Center, Greenbelt, MD USA

NanoSat constellation mission design

Concha, Marco, NASA Goddard Space Flight Center, USA; DeFazio, Robert, NASA Goddard Space Flight Center, USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 69; In English; Also announced as 19980203775

Report No.(s): AAS-98-305; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche; Abstract Only; Abstract Only

The NanoSat constellation concept mission proposes simultaneous operation of multiple swarms of as many as 22 identical 10 kg spacecraft per swarm. The various orbits in a NanoSat swarm vary from 3x5 to 3x42 R(sub e) in geometry. In this report the unique flight dynamics issues of this constellation satellite mission design are addressed. Studies include orbit design, orbit determination, and error analysis. A preliminary survey determined the orbital parameters that would yield a 100 minute shadow condition maximum while providing adequate ground station access for three ground stations.

Author

Satellite Constellations; Satellite Control; Communication Satellites; Satellite Ground Tracks; Satellite Navigation Systems; Orbital Mechanics

19980203783 National Commission of Space Activities, Buenos Aires, Argentina

SAC-A satellite control design

Alonso, Roberto, National Commission of Space Activities, Argentina; Anigstein, Pablo, National Commission of Space Activities, Argentina; Pena, Ricardo Sanchez, National Commission of Space Activities, Argentina; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 87-88; In English; Also announced as 19980203775

Report No.(s): AAS-98-307; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The SAC-A is a Low Cost - Short Schedule - Small Bus dedicated to test equipment and new technologies which may be used in operational or scientific missions with more immunity to failures. This satellite is planned to be launched in July, 1998 as part of the STS 88 mission. The opportunity to fly in a low orbit for a reasonable period of time (at least I year), allows the characterization of the behavior of this new instrumentation in real world applications and also to compute performance. The 68 kg satellite will have an almost octagonal configuration to be fitted within the Hitchhiker Motorized Door Canister with Hitchhiker Ejection System (HES) envelope. This volume is approximately a cylinder of 19 inches diameter by 20.5 inches maximum height.

Author

Satellite Design; Satellite Ground Tracks; Low Cost; Scientific Satellites

19980203784 Fachhochschule, Fachbereich Mathematik, Naturwissenschaften, Datenverarbeitung und Umwelttechnik, Wiesbaden, Germany

New methods in on-board attitude control

Spindler, Karlheinz, Fachhochschule, Germany; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 89-102; In English; Also announced as 19980203775

Report No.(s): AAS-98-308; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper we will derive control laws to perform attitude maneuvers which automatically avoid the pointing of a specified spacecraft axis into forbidden directions. These laws will be found by a control-theoretical approach using methods from differential geometry. We will start by deriving a particularly simple control law maneuvering a spacecraft from rest to rest between prescribed attitudes in the absence of pointing constraints. Subsequently, we will show how maneuvers of this type can be concatenated in such a way that prescribed forbidden directions are guaranteed to be avoided. The control law obtained in this way does not take recourse to numerical methods and hence can be easily implemented in an on-board attitude control system, possibly for performing maneuvers in an emergency mode. Finally, we will propose an iterative scheme to optimize the solution.

Author

Attitude Control; Satellite Design; Satellite Control; Control Theory; Orbital Mechanics

19980203785 NASA Goddard Space Flight Center, Greenbelt, MD USA

An approach to the design and implementation of spacecraft attitude control systems

ODonnell, James R., Jr., NASA Goddard Space Flight Center, USA; Mangus, David J., NASA Goddard Space Flight Center, USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 103-117; In English; Also announced as 19980203775

Report No.(s): AAS-98-309; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Over 39 years and a long list of missions, the guidance, navigation, and control (GN&C) groups at the Goddard Space Flight Center have gradually developed approaches to the design and implementation of successful spacecraft attitude control systems.

With the recent creation of the Guidance, Navigation, and Control Center at Goddard, there is a desire to document some of these design practices to help to ensure their consistent application in the future. In this paper, we will discuss the beginnings of this effort, drawing primarily on the experience of one of the past attitude control system (ACS) groups at Goddard (what was formerly known as Code 712, the Guidance, Navigation, and Control Branch). We will discuss the analysis and design methods and criteria used, including guidelines for linear and nonlinear analysis, as well as the use of low- and high-fidelity simulation for system design and verification of performance. Descriptions of typical ACS sensor and actuator hardware will be shown, and typical sensor/actuator suites for a variety of mission types detailed. A description of the software and hardware test effort will be given, along with an attempt to make some qualitative estimates on how much effort is involved. The spacecraft and GN&C subsystem review cycles will be discussed, giving an outline of what design reviews are typically held and what information should be presented at each stage. Finally, we will point out some of the lessons learned at Goddard.
Author
Spacecraft Control; Attitude Control; Guidance (Motion); Satellite Design; Satellite Guidance; Satellite Attitude Control; Satellite Navigation Systems; Communication Satellites

19980203786 Catholic Univ. of America, Dept. of Mechanical Engineering, Washington, DC USA
Disturbance accommodating sliding mode controller for spacecraft attitude maneuvers
Kim, Jongrae, Catholic Univ. of America, USA; Kim, Jinho, Inha Univ., Korea, Republic of; Crassidis, John L., Catholic Univ. of America, USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 119-131; In English; Also announced as 19980203775
Report No.(s): AAS-98-310; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In the absence of an external disturbance and uncertainty, sliding mode (variable structure) control is guaranteed to asymptotically stabilize a system, which is provided by using a correction control input calculated using a Lyapunov-type condition i.e., sliding mode existence condition. When bounded unmodeled external torques are added, the closed-loop system is no longer globally asymptotically stable since steady-state errors are present. The error can be minimized by increasing the correction control gain or decreasing the thickness of boundary layer of sliding mode control. But for limited actuator capability the maximum control gain and the minimum thickness of boundary layer being allowed may be restricted. Disturbance accommodating control is a signal synthesis adaptive control. For a short time interval the disturbance is assumed to be modeled by a linear combination of previously selected basis functions. A disturbance accommodating observer can be used to identify unmeasurable internal and external disturbances. In this paper, sliding mode control is combined with disturbance accommodating control (i.e., Disturbance Accommodating Sliding Mode Control) in terms of modified Rodrigues parameters for a spacecraft attitude regulation and tracking maneuvers. The presented disturbance accommodating sliding mode control has the following advantages: 1) the design procedure is more effective than the traditional sliding surface stabilizing problem since steady-state errors are reduced, 2) the designed disturbance accommodating observer is linear, and 3) the robustness of sliding mode is guaranteed in the range of actuator capability. Simulation results are shown that use the disturbance accommodating sliding mode control to reduce steady-state errors in the case of applied external disturbances.
Author
Spacecraft Maneuvers; Spacecraft Control; Feedback Control; Adaptive Control; Attitude (Inclination)

19980203787 Analytical Mechanics Associates, Inc., Hampton, VA USA
Globally asymptotically stable reorientation controller with control constraint and slew rate limit
Seywald, Hans, Analytical Mechanics Associates, Inc., USA; Kumar, Renjith, Analytical Mechanics Associates, Inc., USA; Qu, Min, Analytical Mechanics Associates, Inc., USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 133; In English; Also announced as 19980203775
Report No.(s): AAS-98-311; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche; Abstract Only; Abstract Only

This paper introduces a nonlinear reorientation and attitude controller based on feedback linearization. Besides user-prescribed maximum and minimum gain values, the controller requires no tuning, and is applicable to arbitrary rigid spacecraft configurations. The user needs to input only data pertaining to the physical problem setup, such as the spacecraft's inertia matrix, initial conditions, target orientation, target angular velocity, control constraint, and slew rate limit. Global asymptotic stability is guaranteed. The controller is computationally inexpensive, and numerical tests show excellent performance in terms of transient behavior and overall maneuver time.
Author
Spacecraft Configurations; Asymptotic Properties; Spacecraft Control; Attitude (Inclination); Spacecraft Design

19980203790 European Space Agency. European Space Operations Center, Darmstadt, Germany

High-Precision altimetry products from Envisat-1

Fadrique, F. M. Martinez, European Space Agency. European Space Operations Center, Germany; Zandbergen, R. C. A., European Space Agency. European Space Operations Center, Germany; Reyes, D. Navarro, European Space Agency. European Space Operations Center, Germany; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 163-177; In English; Also announced as 19980203775

Report No.(s): AAS-98-314; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Earth observation satellite Envisat-1 will be controlled by the European Space Operations Centre (ESOC). This paper addresses ESOC's orbit determination activities for Envisat, and more particularly the possibility of obtaining high-precision altimetry products for near-real-time ocean surface topography monitoring. First, this paper presents the current ESOC capabilities in the area of Precise Orbit Determination (POD) and ocean surface model computation, based on the most recent ERS-2 data. A detailed analysis of the models used for ERS and the possibilities of implementing newly developed ones is discussed in order to identify potential improvements. Since the precise tracking devices on board Envisat provide further sources of improvement compared to ERS, this paper also presents the advantages which may be expected from Envisat for obtaining better orbits and models. Finally, the new Navigation Package for Earth Observation Satellites (Napeos), which will perform both the operational and precise orbit determination, will be described in a few words.

Author

Altimetry; Earth Observations (From Space); Orbit Calculation; Satellite Observation; Satellite Guidance; Satellite Imagery

19980203806 NASA Goddard Space Flight Center, Greenbelt, MD USA

Initial flight results of the TRMM Kalman filter

Andrews, Stephen F., NASA Goddard Space Flight Center, USA; Morgenstern, Wendy M., NASA Goddard Space Flight Center, USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 345-358; In English; Also announced as 19980203775

Report No.(s): AAS-98-332; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Tropical Rainfall Measuring Mission (TRMM) spacecraft is a nadir pointing spacecraft that nominally controls attitude based on the Earth Sensor Assembly (ESA) output. After a potential single point failure in the ESA was identified, the contingency attitude determination method chosen to backup the ESA-based system was a sixth-order extended Kalman filter that uses magnetometer and digital sun sensor measurements. A brief description of the TRMM Kalman filter will be given, including some implementation issues and algorithm heritage. Operational aspects of the Kalman filter and some failure detection and correction will be described. The Kalman filter was tested in a sun pointing attitude and in a nadir pointing attitude during the in-orbit checkout period, and results from those tests will be presented. This paper will describe some lessons learned from the experience of the TRMM team.

Author

Trmm Satellite; Kalman Filters; Magnetometers; Scientific Satellites

19980203811 Societe Anonyme d'Etudes et Realisations Nucleaires, Limeil-Brevannes, France

New accurate infrared earth radiance model for pointing accuracy improvement of LEO platforms

Sallard, S., Societe Anonyme d'Etudes et Realisations Nucleaires, France; Samson, G., Societe Anonyme d'Etudes et Realisations Nucleaires, France; Krebs, J. P., Societe Anonyme d'Etudes et Realisations Nucleaires, France; Faucher-Lagracie, P., Centre National d'Etudes Spatiales, France; Prieur, P., Centre National d'Etudes Spatiales, France; Burello, M., Centre National d'Etudes Spatiales, France; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 419-433; In English; Also announced as 19980203775

Report No.(s): AAS-98-337; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The accurate orientation of a spacecraft with respect to the Earth is generally achieved through a passive infrared electro-optical sensor as a part of attitude control subsystem : an Earth sensor. The spatial and temporal Earth radiance non-uniformities make up the main limitation of LEO Earth sensor accuracy. Then recent investigations have been performed with CNES (the French National Space Agency) collaboration on a better understanding and on a characterization of Earth radiance fluctuations, in order to update compensation laws used to improve the satellite pointing accuracy. In fact several analyses have been engaged on in-flight Earth sensor radiance telemetry data from French LEO satellites (SPOT 1, 2, 3) oriented by Earth sensors and rate gyro systems. From these in-flight data a first step has consisted of a radiance variations modelling versus Earth coordinates and seasons, and has led to separate deterministic variations from random fluctuations and attitude measurements. However without absolute measurement reference the software modelling accuracy is limited by the gyro one. Now, thanks to the presence of both accurate SED 12 star-trackers and scanning infrared Earth sensors STD 16 on the French satellite HELIOS 1, it is possible to

compare the Earth sensor in-flight output data to almost absolute angular references. It is then possible, by analysing these data over a long period of time, to deduce the Earth sensor error and how this error changes versus the satellite motion and the season. The purpose of this paper is to present the analyses performed with CNES specialists from the STD16 sensor transitions and radiance telemetries on board HELIOS]in order to improve the knowledge of the infrared Earth radiance mapping and consequently to significantly decrease the radiance error terms of infrared earth sensors. The opportunity to work on one and a half year period telemetry data has allowed at one hand to optimize the deterministic radiance fluctuations modelling and at the other hand to update our software model of Earth sensor radiance errors. After a brief recall of the sensor operating principle and telemetry characteristics, radiance variations according to spatial and temporal references are analyzed on about 8000 observations. Existing seasonal compensations laws have been updated from Earth radiance errors modelling and results in terms of performances are discussed. So with these new compensation laws the radiance error can be largely decreased by a factor 50 up to 100% (mainly depending on the season) compared to the previous laws by which the error was only reduced by a maximum factor of 50%. This new model should improve the prediction of the infrared sensor radiance error and could be used by the AOCS of LEO satellites to compensate the in-flight radiance error whatever the altitude and the orbit parameters.
Author
French Satellites; Infrared Radiation; Star Trackers; Low Earth Orbits; Control Systems Design; Attitude Control; Attitude (Inclination)

19980203815 Science Systems Space Ltd., UK
XMM: Slew performance calibration and assessment
Tuttlebee, M. J., Science Systems Space Ltd., UK; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 475-486; In English; Also announced as 19980203775
Report No.(s): AAS-98-341; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

During slew maneuvers between scientific observations, the XMM Inertial Pointing, and Slew (EPS) mode control laws compute profiled momentum demands to the reaction wheels in order to achieve the desired chance in three-axis attitude. These momentum profiles are computed on-board, together with the demanded Sun position in the Fine Sun Sensor (FSS) field-of-view, such that the change in attitude is about the eigenaxis. The outputs of the FSS along with the demanded sun position are used to provide closed-loop attitude control about the roll and pitch axes during the slew, with the yaw axis being open-loop. C, This implies that a number or a combination of system model parameters must be calibrated, in order to limit the size of the attitude error with respect to the planned target attitude due to the lack of yaw control. A description of the IPS mode control law and the principal contributors to slew errors is presented and an algorithm based on an Extended Kalman Filter is used to estimate 15 states (3 spacecraft rates, 3 external torques, and 9 components of the 'effective' normalised inertia matrix), during a series of small offset maneuvers separated by stable pointing phases used to estimate the environmental disturbance torques. The performance of the algorithm has been assessed by a complete simulation of the XNM dynamics, kinematics, sensors (Star Tracker and Fine Sun Sensor), control laws and actuators (Reaction Wheel Unit) and the results are presented. Finally, a series of tests on ISO, which uses the same Star Tracker (STR) and FSS, are planned at the end of it's operational life. This data will be processed on-ground using the proposed algorithm.
Author
Scientific Satellites; Star Trackers; Solar Sensors; Reaction Wheels; Kalman Filters; Field of View; Feedback Control; Control Theory; Attitude Control

19980203816 Analytical Engineering Corp., Boulder, CO USA
Deep space passive sun tracking
Sonnabend, David, Analytical Engineering Corp., USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 487-500; In English; Also announced as 19980203775
Report No.(s): AAS-98-342; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

For the Rosetta mission to orbit a comet, due to launch in 2003, and spend about a decade en route, the European Space Agency contemplates the use of a series of 'hibernation' periods. This is both to conserve resources, and to reduce expensive ground operations. The general idea is to point the solar arrays at the sun, spin the spacecraft at a low rate about the sun line, suspend communications with the ground, and turn off most spacecraft equipment. A factor tending to limit the value of this idea is that, as Rosetta moves in its orbit, the direction to the sun changes, reducing the available power from the array. The worst case from this standpoint is a final hibernation period between a 2nd asteroid flyby and the comet approach phase; because the spacecraft is then most distant from the sun. This hibernation could be as long as 3 years, and the sun direction (true anomaly) could change as much as 70 deg. Even biasing the initial direction of the spin axis to favor the later, more distant part of the orbit, would still lead to a maximum array offset of around 30 deg, when the loss of power would be about 13%, worse if various asymmetries and external disturbances

are taken into account. This paper advances a passive technique for using radiation pressure to cause the spin axis to track the sun. A fairly complete analysis is presented, along with calculations of the performance.
Author
Deep Space; Spacecraft Tracking; Sun; Solar Arrays; Rosetta Mission; Ground Operational Support System

19980203817 Instituto Nacional de Pesquisas Espacias, Space Mechanics and Controls Div., Sao Jose dos Campos, Brazil
Control system and flexible satellite interaction during orbit transfer maneuver
daSilva, Adenilson Roberto, Instituto Nacional de Pesquisas Espacias, Brazil; deSouza, Luiz Carlos Gadelha, Instituto Nacional de Pesquisas Espacias, Brazil; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 501-510; In English; Also announced as 19980203775
Contract(s)/Grant(s): CNPq-520182/93-6
Report No.(s): AAS-98-343; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In this paper the interaction between the attitude control system and the flexible structure of an artificial satellite during orbit transfer maneuver has been investigated. The satellite was modeled by a rigid central body with one or more flexible appendages. The dynamics equations were obtained by Lagragean approach. The flexible appendages were treated as clamped-free beam and its displacement was discretized by assumed-mode method. In order to transfer the satellite, a typical Hohmann transfer and a burn-coast-burn strategy were used and the attitude was controlled by an on-off controller. During transfer procedure a global analysis of satellite has been done, such as: performance of control system, influence of elastic response in control system, thruster firing frequency, fuel consumption and variation of orbital elements. In order to avoid the interaction with structure motion, a control system with bandwidth of one decade bellow the fundamental frequency was used. In the simulations the firing frequency was evaluated in an approximately way but kept below the fundamental frequency of the structure. The control system has kept the attitude below the specifications. As a result, the orbit transfer maneuvering has been done correctly without excessive excitation of flexible appendage.
Author
Attitude Control; Flexible Spacecraft; Fuel Consumption; Artificial Satellites; Flight Control; Automatic Control; Orbital Maneuvers

19980203819 Instituto Nacional de Pesquisas Espacias, MCT, Sao Jose dos Campos, Brazil
Satellite attitude control using multilayer perceptron neural networks
Carrara, Valdemir, Instituto Nacional de Pesquisas Espacias, Brazil; Varotto, Sabastiao Eduarto Corsatto, Instituto Nacional de Pesquisas Espacias, Brazil; Neto, Atair Rios, Paraiba Univ., Brazil; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 525-539; In English; Also announced as 19980203775
Report No.(s): AAS-98-345; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This work simulates and tests the use of artificial neural networks for satellite attitude dynamics identification and control. In order to exemplify this application, a satellite with a rigid main body, three reaction wheels and three flexible solar panels was chosen (lay-out similar to Brazilian Remote Sensing Satellite). The main objective is to test the neural control and analyze its interaction with the elastic motion and variable geometry of the satellite. Two control schemes are used, the Internal Model Control (IMC) and the Feedback Learning Control (FLC). The identification of neural nets parameters is performed by a Kalman filtering algorithm with a local parallel processing version in the IMC scheme and by the steepest descent method in the FLC scheme.
Author
Satellite Attitude Control; Neural Nets; Artificial Satellites; Attitude (Inclination); Kalman Filters; Reaction Wheels; Satellite Observation

19980203845 Naval Postgraduate School, Monterey, CA USA
Environmental Testing of the Petite Amateur Navy Satellite (PANSAT)
Overstreet, Paul J., Naval Postgraduate School, USA; Dec. 1997; 80p; In English
Report No.(s): AD-A342298; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Any complex and expensive system requires testing to ensure adequate performance. Communications satellites require extensive testing for two additional reasons: (1) they operate in an environment considerably different from that in which they were built, and (2) after launch, they are inaccessible to routine maintenance and repair. The objectives of testing is not necessarily to duplicate the space environment but to approach it sufficiently so that any spacecraft that passes the tests will operate successfully in its designed space environment. The major features of the space environment that are difficult to simulate exactly are zero gravity, high vacuum, solar radiation, particle radiation and extreme temperatures. This document describes the environmental test program and test results for the PANSAT program. PANSAT is the acronym for the Petite Amateur Navy Satellite, which is

a small communications satellite under development by the Space Systems Academic Group at the Naval Postgraduate School. PANSAT subsystems were subjected to thermal vacuum and random vibration testing as part of the overall environmental test program. Satellite launch, as a Shuttle secondary payload via the Space Transportation System (STS) Small Self-contained Payload (SSCP) program, is planned for October, 1998.
DTIC
Environmental Tests; Communication Satellites; Space Transportation System

19980204846 NASA Johnson Space Center, Houston, TX USA
Method and Apparatus for Coupling Space Vehicles
Schneider, William C., Inventor, NASA Johnson Space Center, USA; Apr. 07, 1998; 7p; In English
Patent Info.: Filed 28 May 1996; NASA-Case-MSC-22745-1; US-Patent-5,735,488; US-Patent-Appl-SN-654460; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A first space vehicle is attached with a second space vehicle which includes a rocket propulsion nozzle having a combustion chamber upstream from the nozzle throat. Apparatus 10 includes an elongate grappling arm 12 extending from the first space vehicle, a pair of inflatable bladders 16, 18 positioned about the grappling arm for engaging an inner surface of the combustion chamber upon inflation. and a pair of rear bladders 20, 22 positioned about the grappling arm for engaging an inner surface of the nozzle downstream from the combustion chamber upon inflation for aligning the grappling arm and the rocket propulsion nozzle. A pressurized fluid source 24 is provided on the first space vehicle for supplying fluid pressure to the inflatable bladders. and a fluid control valve manifold 30 selectively controls the release of pressurized fluid to the bladders. According to the method of the invention. the grappling arm is inserted into the rocket propulsion nozzle. and the control valves are actuated to first inflate the front bladders and thereby interconnect the grappling arm and the rocket propulsion nozzle. The rear bladders are subsequently inflated to align a central axis of the grappling arm with a central axis of the rocket propulsion nozzle. Inflation of the rear bladders provides an axial reaction load to balance the axial load provided by the front bladders. Attaching the vehicles in space may be controlled from the earth by activating the control valves to inflate the bladders. The cost of attaching space vehicles is significantly reduced by attaching a grappling arm on one vehicle with the existing rocket propulsion nozzle of another vehicle.
Author
Couplings; Rocket Nozzles; Propulsion; Fluid Pressure; Spacecraft

19980206177 Alabama Univ., Dept. of Electrical and Computer Engineering, Huntsville, AL USA
SEDSAT 1 Technologies
Maier, Mark W., Alabama Univ., USA; Research Reports: 1996 NASA/ASEE Summer Faculty Fellowship Program; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The original goals of this project were to support the development of SEDSAT 1 for a tethered launch in July of 1997. This specifically required: (1) Monitoring development progress against a comprehensive delivery plan; (2) Incremental development and release of CDS and SEASIS software; (3) Supporting the integration of version 1.0 SEASIS software that will allow minimal autonomous operation without a software reload. These algorithms would include image quality evaluation, attitude determination, and autonomous earth imaging; and (4) Developing software requirements and design for ground segment software, concentrating on command and data download capability; and interface to external development efforts for a more comprehensive software suite to be used after the initial mission. Because of an unfavorable space shuttle safety review of the SEDS-3 tether deployer, and cost and schedule problems in upgrading the deployer, the mission was changed to an independent launch of SEDSAT. The original plan was to do a tether-less deployment from the space shuttle. Since this would have resulted in an unacceptable orbital lifetime, the mission was changed again to a tethered launch from a Delta II in June 1998. As a result of Marshall Space Flight Center's redirection of the SEDS-3 mission away from a tether launch, the whole question of a tether endmass had to be reconsidered. The net result of these multiple changes was twofold. First, we completed work needed to define some aspects of ground software on SEDSAT 1 that would remain constant no matter the launch mode. Second, we developed a set of concepts for using SEDSAT 1 technology to support alternative endmass missions on SEDS-3. Both of these are included.
Derived from text
Satellites; Satellite Communication; Launching; Tethering; Computer Programs; Ground-Air-Ground Communication; Software Development Tools

19980206189 Pittsburgh State Univ., Dept. of Engineering Technology, KS USA
What Drives Spacecraft Cost: A Look Into How Material Characteristics Relate to the Material Complexity Multipliers
Rosmait, Russell L., Pittsburgh State Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Today a variety of engineered materials are used to build the space vehicles and satellites that NASA, DOD and the aerospace community will use in future projects. These materials can be a significant part of the cost when designing and building these systems. Current cost models such as NASCOM, SEER-H and PRICE allow the cost analysis to select materials requirements during the development of the cost model. It should be noted however that some of these models do not always give the most detailed information with respect to material specifications for the given cost model. Instead the materials are defined within broad classification, giving questionable data with regard to specific material cost. It is the objective of this paper to present a summary of basic information on materials to assist the cost analyst in the development of their models. Specifically, this paper will compare materials and their complexity multipliers to some specific material properties.
Author
Cost Analysis; Production Costs; Design to Cost; Cost Estimates; Spacecraft Construction Materials; Spacecraft Design; Economic Factors

19980206193 Alabama Univ., Dept. of Physics, Huntsville, AL USA
Comments on SEE: Comparative Advantages and and Experimental Consequences
Smalley, Larry L., Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Satellite Energy Exchange experiment measures the periodic, near-miss encounters between a sheppard satellite and a small test body (satellite) in approximately the same orbit about a primary. Several important experimental requirements have been chosen to enhance capabilities: (a) The satellite be flown in a sun-synchronous orbit at an altitude of about 1350 Km, (b) Passive temperature system stabilized by spacecraft axial rotation with sunshade baffles at the end of the spacecraft, (c) Test bodies with different material composition be available for experiments, (d) The containment spacecraft fly about the sheppard mass in a zero-g environment whereas the test bodies, experience average zero-g environment over an orbital period, (e) Primary attitude and station-keeping uses magnetic field alignment plus micro-Newton thrusters such as Field Emission Electric Propulsion, and (f) Very low power (nW) laser tracking systems minimize impulse delivered to test bodies. With the above conditions, SEE has the capabilities: (1) Long duration (several years life-time) flight experiment (2) Long-term, active (with historical time record), self-calibration of satellite mass distribution (capsule geodesy) over lifetime of the spacecraft. (3) Novel passive thermal stabilization systems designed to attain cryogenic temperatures around 78K. (4) Novel spacecraft stabilization systems. (5) Ability to measure G to 1 part in 10(exp 6-7) depending on ultimate duration of experiment. (6) Ability to place limits on both temporal and spacial variations on G. (7) Ability to set experimental limits on the Post Newtonian parameters (PPN) alpha(2) and zeta(2). (8) Ability to measure (or place limits on) the non Einsteinian eccentricity of the Earth-Sun system (and the parameter alpha(1)) for long duration flight. (9) Ability to measure Delta((dot)-G)/G to 1 part in 10(exp 12-13). The MiniSTEP, competes in a limited way with Project SEE. It is designed to improve the measurement of the equivalence principle by seven orders of magnitude using active, low temperature (1.8 K) cooling for SQUID based, differential superconducting circuits. The experiment consists of a small cylinder concentrically located within a larger cylinder at its null gravitational point. The satellite is operated in zero-g mode using four differential accelerometers consisting to two test bodies of different material composition. The SQUIDS are needed to measure test body motion to precisions of 10(exp -18) over a four orbit period. The entire satellite moves in a very precise zero-g mode since the accelerometers are rigidly attached to the satellite. This limits the experiment to an approximately six month due to limitations on helium storage used in cryogenic cooling and thrust control to maintain the zero-g operation.
Derived from text
Artificial Satellites; Satellite Orbits; Equations of Motion; Orbital Mechanics; Two Body Problem; Satellite Observation; Satellite-Borne Instruments; Squid (Detectors)

19980206370 Los Alamos National Lab., NM USA
ALEXIS, the little satellite that could -- 4 years later
Roussel-Dupre, D., Los Alamos National Lab., USA; Bloch, J., Los Alamos National Lab., USA; Little, C., Los Alamos National Lab., USA; 1997; 20p; In English; 11th; Conference on Small Satellites, 15 - 18 Sep. 1997, Logan, UT, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3430; CONF-970991; DE98-000276; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The 113-kg Array of Low Energy X-ray Imaging Sensors (ALEXIS) satellite was launched from the fourth flight of Pegasus on 25 April, 1993 into a 750 x 850 km, 70 degree inclination orbit. Due to damage sustained at the time of launch, ground controllers did not make contact with the satellite until late June. by late July, full satellite operations had been restored through the implementation of new procedures for attitude control. Science operations with the two onboard experiments began at that time. Now

4 years later is still collecting more than 100 MB of mission data per day. ALEXIS was originally designed to be a high risk, single string.'Smarter-Faster-Cheaper' satellite, with a 1 year nominal and a 3 year design limit. This paper will discuss how well the various satellite and experiment subsystems are surviving a variety of low and high radiation environments and what improvements have been made to make operations more autonomous.
DOE
Attitude Control; Launching; Autonomy; Controllers; Collection

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SPACECRAFT INSTRUMENTATION

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

19980203813 Korolev Rocket-Cosmic Corp. Energia, Russia
MOMS-2P equipment adjustment by angular velocity measurement data and optical star sensor readings
Beliaev, M. Y., Korolev Rocket-Cosmic Corp. Energia, Russia; Stazhkov, V. M., Korolev Rocket-Cosmic Corp. Energia, Russia; Efimov, N. I., Korolev Rocket-Cosmic Corp. Energia, Russia; Sazonov, V. V., Academy of Sciences (USSR), USSR; Frank, H., Deutsche Gesellschaft fuer Luft- und Raumfahrt, Germany; Schneller, M., Deutsche Gesellschaft fuer Luft- und Raumfahrt, Germany; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 449-460; In English; Also announced as 19980203775
Report No.(s): AAS-98-339; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The adjustment procedure of the MOMS-2P German hardware accommodated on the Priroda module integrated with the Mir orbital station is described. This hardware consists of three separate cameras installed in a special manner for surveying the Earth's surface, and angular velocity sensors for attitude determination. The proper interpretation of the observation results requires precise reference of the MOMS-2P coordinate system with respect to the Astro-1 optical star sensor coordinate system. Adjustment is made as a result of the joint processing of measurements of the star sensor and angular velocity sensors. Measurements are made while maintaining the fixed attitude of the station in the orbital coordinate system. Measurements made when maintaining only one attitude state are not sufficient for the adjustment as by these measurements one can determine only two of three angles characterizing mutual arrangement of the MOMS-2P and star sensor coordinate systems. The joint processing of the measurement data obtained when maintaining two and more different attitudes of the station allows to solve this problem. Examples of actual data processing and results of mathematical modeling are given.
Author
Priroda Module; Mir Space Station; Optical Measuring Instruments

19980203951 Canopus Systems, Inc., Ann Arbor, MI USA
OARE STS-94 (MSL-1R) ***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-1998-207933; NAS 1.26:207933; E-11205; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report is organized into sections representing the phases of work performed in analyzing the STS-94 (MSL-IR) results. STS-94 (MSL1R) is a reflight of the STS-83 (MSL-1) mission which was terminated early because of a fuel cell problem. Section I briefly outlines the OARE system features, coordinates, and measurement parameters. Section 2 describes the results from STS-94. The mission description, data calibration, and representative data obtained on STS-94 are presented. Also, the anomalous performance of OARE on STS-94 is discussed. Finally, Section 3 presents a discussion of accuracy achieved and achievable with OARE. Appendix A discuss the calibration and data processing methodology in detail.
Author
Spaceborne Experiments; Data Processing; Space Transportation System; Accuracy

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SPACECRAFT PROPULSION AND POWER

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

19980203952 NASA Marshall Space Flight Center, Huntsville, AL USA
Electrodynamic Tether Propulsion and Power Generation at Jupiter
Gallagher, D. L., NASA Marshall Space Flight Center, USA; Johnson, L., NASA Marshall Space Flight Center, USA; Moore, J., Spectra Research Systems, Inc., USA; Bagenal, F., Colorado Univ., USA; Jun. 1998; 32p; In English
Report No.(s): NASA/TP-1998-208475; NAS 1.60:208475; M-876; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The results of a study performed to evaluate the feasibility and merits of using an electrodynamic tether for propulsion and power generation for a spacecraft in the Jovian system are presented. The environment of the Jovian system has properties which are particularly favorable for utilization of an electrodynamic tether. Specifically, the planet has a strong magnetic field and the mass of the planet dictates high orbital velocities which, when combined with the planet's rapid rotation rate, can produce very large relative velocities between the magnetic field and the spacecraft. In a circular orbit close to the planet, tether propulsive forces are found to be as high as 50 N and power levels as high as 1 MW.
Author
Evaluation; Feasibility Analysis; Tethering; Jupiter (Planet); Propulsion System Performance

19980204857 NASA Lewis Research Center, Cleveland, OH USA
Ion Thruster Support and Positioning System
Haag, Thomas W., Inventor, NASA Lewis Research Center, USA; Apr. 14, 1998; 12p; In English
Patent Info.: Filed 24 Jun. 1996; NASA-Case-LEW-16104-1; US-Patent-5,738,308; US-Patent-Appl-SN-695685; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A system for supporting and selectively positioning an ion thruster relative to a surface of a spacecraft includes three angularly spaced thruster support assemblies. Each thruster support assembly includes a frame which has a rotary actuator mounted thereon. The rotary actuator is connected to an actuator member which is rotatably connected to a thruster attachment member connected to a body of the thruster. A stabilizer member is rotatably mounted to the frame and to the thruster attachment member. The thruster is selectively movable in the pitch and yaw directions responsive to movement of the actuator members by the actuators on the thruster support assemblies. A failure of any one actuator on a thruster support assembly will generally still enable limited thruster positioning capability in two directions. In a retracted position the thruster attachment members are held in nested relation in saddles supported on the frames of the thruster support assemblies. The thruster is securely held in the retracted position during periods of high loading such as during launch of the spacecraft.
Official Gazette of the U.S. Patent and Trademark
Ion Engines; Support Systems; Rocket Engines

19980206029 Arnold Engineering Development Center, Arnold AFS, TN USA
Application of Laser-Induced Fluorescence (LIF) to Liquid-Propellant Rocket Engine Testing
Brasier, C. W., Sverdrup Technology, Inc., USA; Drakes, J. A., Sverdrup Technology, Inc., USA; Simmons, M. A., Sverdrup Technology, Inc., USA; May 1998; 10p; In English; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Combustion exhausts present a challenging problem for researchers due to the extremely harsh environment, and nonintrusive diagnostics are often sought to provide flow property information. 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 the application of LIF to the combustion exhausts of several full-scale liquid-propellant rocket engines spanning a wide range of operational parameters. 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 A. 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, static temperature, and fuel distribution. It was found that the LIF technique provides quality data in most cases. Certain stressing situations were also found in which data on the flow properties were not obtainable. Also, computational fluid dynamics (CFD) modeling of the plumes was

used to provide baseline estimates of the exhaust flow properties. The model reasonably predicted the gross behavior of the flow as determined by the LIF technique, although some items of fine spatial structure were not reproduced very well.
Author
Laser Induced Fluorescence; Liquid Rocket Propellants; Test Stands; Flow Characteristics; Flow Velocity; Temperature Distribution; Plumes; Sodium

19980206167 Alabama Univ., Dept. of Aerospace Engineering, Tuscaloosa, AL USA
SSME Condition Monitoring Using Neural Networks and Plume Spectral Signatures
Hopkins, Randall, Alabama Univ., USA; Benzing, Daniel, Alabama Univ., USA; Oct. 1996; 6p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

For a variety of reasons, condition monitoring of the Space Shuttle Main Engine (SSME) has become an important concern for both ground tests and in-flight operation. The complexities of the SSME suggest that active, real-time condition monitoring should be performed to avoid large-scale or catastrophic failure of the engine. In 1986, the SSME became the subject of a plume emission spectroscopy project at NASA's Marshall Space Flight Center (MSFC). Since then, plume emission spectroscopy has recorded many nominal tests and the qualitative spectral features of the SSME plume are now well established. Significant discoveries made with both wide-band and narrow-band plume emission spectroscopy systems led MSFC to develop the Optical Plume Anomaly Detection (OPAD) system. The OPAD system is designed to provide condition monitoring of the SSME during ground-level testing. The operational health of the engine is achieved through the acquisition of spectrally resolved plume emissions and the subsequent identification of abnormal emission levels in the plume indicative of engine erosion or component failure. Eventually, OPAD, or a derivative of the technology, could find its way on to an actual space vehicle and provide in-flight engine condition monitoring. This technology step, however, will require miniaturized hardware capable of processing plume spectral data in real-time. An objective of OPAD condition monitoring is to determine how much of an element is present in the SSME plume. The basic premise is that by knowing the element and its concentration, this could be related back to the health of components within the engine. For example, an abnormal amount of silver in the plume might signify increased wear or deterioration of a particular bearing in the engine. Once an anomaly is identified, the engine could be shut down before catastrophic failure occurs. Currently, element concentrations in the plume are determined iteratively with the help of a non-linear computer code called SPECTRA, developed at the USAF Arnold Engineering Development Center. Ostensibly, the code produces intensity versus wavelength plots (i.e., spectra) when inputs such as element concentrations, reaction temperature, and reaction pressure are provided. However, in order to provide a higher-level analysis, element concentration is not specified explicitly as an input. Instead, two quantum variables, number density and broadening parameter, are used. Past experience with OPAD data analysis has revealed that the region of primary interest in any SSME plume spectrum lies in the wavelength band of 3300 A to 4330 A. Experience has also revealed that some elements, such as iron, cobalt and nickel, cause multiple peaks over the chosen wavelength range whereas other elements (magnesium, for example) have a few, relatively isolated peaks in the chosen wavelength range. Iteration with SPECTRA as a part of OPAD data analysis is an incredibly labor intensive task and not one to be performed by hand. What is really needed is the ”inverse” of the computer code but the mathematical model for the inverse mapping is tenuous at best. However, building generalized models based upon known input/output mappings while ignoring details of the governing physical model is possible using neural networks. Thus the objective of the research project described herein was to quickly and accurately predict combustion temperature and element concentrations (i.e., number density and broadening parameter) from a given spectrum using a neural network. In other words, a neural network had to be developed that would provide a generalized ”inverse” of the computer code SPECTRA.
Author
Systems Health Monitoring; Engine Monitoring Instruments; Space Shuttle Main Engine; Fault Detection; Neural Nets; Exhaust Emission; Rocket Exhaust; Chemical Elements; Exhaust Gases

19980206169 Missouri Univ., Dept. of Mechanical and Aerospace Engineering and Engineering Mechanics, Rolla, MO USA
Spray Diagnostics in Rocket Engines Using Phase Doppler Analyzer
Isaac, Kakkattukuzhy M., Missouri Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Characteristics such as drop velocity, drop size, number density, volume flow rate, volume flux, and evaporation rate of the fuel spray in a rocket engine are directly related to engine performance. Several studies of shear coaxial atomization have been done in the past. However, additional work related to sprays at supercritical and transcritical conditions would be useful. The author undertook a study of the feasibility of using a phase Doppler particle analyzer (PDPA) for spray measurements in rocket engines as a part of the Summer Faculty Fellowship Program at the NASA Marshall Space Flight Center. The PDPA is a single particle counter (SPC) system based on light scattering from spherical particles. The PDPA instrument is based on refractive and

reflective scattering as opposed to other instruments based on diffractive scattering. The main advantage of the PDPA instrument is its ability to provide point-wise information. The following sections describe the principle of operation of the PDPA system and the data obtained using a PDPA instrument in a spray formed by a commercially available fuel injection nozzle.
Author
Light Scattering; Counters; Refractivity; Reflectance; Fuel Sprays; Fuel Injection; Rocket Engines

19980206172 Alabama Univ., Dept. of Electrical and Computer Engineering, Huntsville, AL USA
Development of a Computer Architecture to Support the Optical Plume Anomaly Detection (OPAD) System
Katsinis, Constantine, Alabama Univ., USA; Oct. 1996; 6p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The NASA OPAD spectrometer system relies heavily on extensive software which repetitively extracts spectral information from the engine plume and reports the amounts of metals which are present in the plume. The development of this software is at a sufficiently advanced stage where it can be used in actual engine tests to provide valuable data on engine operation and health. This activity will continue and, in addition, the OPAD system is planned to be used in flight aboard space vehicles. The two implementations, test-stand and in-flight, may have some differing requirements. For example, the data stored during a test-stand experiment are much more extensive than in the in-flight case. In both cases though, the majority of the requirements are similar. New data from the spectrograph is generated at a rate of once every 0.5 sec or faster. All processing must be completed within this period of time to maintain real-time performance. Every 0.5 sec, the OPAD system must report the amounts of specific metals within the engine plume, given the spectral data. At present, the software in the OPAD system performs this function by solving the inverse problem. It uses powerful physics-based computational models (the SPECTRA code), which receive amounts of metals as inputs to produce the spectral data that would have been observed, had the same metal amounts been present in the engine plume. During the experiment, for every spectrum that is observed, an initial approximation is performed using neural networks to establish an initial metal composition which approximates as accurately as possible the real one. Then, using optimization techniques, the SPECTRA code is repetitively used to produce a fit to the data, by adjusting the metal input amounts until the produced spectrum matches the observed one to within a given level of tolerance. This iterative solution to the original problem of determining the metal composition in the plume requires a relatively long period of time to execute the software in a modern single-processor workstation, and therefore real-time operation is currently not possible. A different number of iterations may be required to perform spectral data fitting per spectral sample. Yet, the OPAD system must be designed to maintain real-time performance in all cases. Although faster single-processor workstations are available for execution of the fitting and SPECTRA software, this option is unattractive due to the excessive cost associated with very fast workstations and also due to the fact that such hardware is not easily expandable to accommodate future versions of the software which may require more processing power. Initial research has already demonstrated that the OPAD software can take advantage of a parallel computer architecture to achieve the necessary speedup. Current work has improved the software by converting it into a form which is easily parallelizable. Timing experiments have been performed to establish the computational complexity and execution speed of major components of the software. This work provides the foundation of future work which will create a fully parallel version of the software executing in a shared-memory multiprocessor system.
Author
Architecture (Computers); Real Time Operation; Mathematical Models; Iterative Solution; Parallel Processing (Computers); Parallel Programming; Systems Health Monitoring; Engine Analyzers

19980206179 Alabama Univ., Dept. of Mechanical Engineering, Huntsville, AL USA
Cooling Duct Analysis for Transpiration/Film Cooled Liquid Propellant Rocket Engines
Micklow, Gerald J., Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The development of a low cost space transportation system requires that the propulsion system be reusable, have long life, with good performance and use low cost propellants. Improved performance can be achieved by operating the engine at higher pressure and temperature levels than previous designs. Increasing the chamber pressure and temperature, however, will increase wall heating rates. This necessitates the need for active cooling methods such as film cooling or transpiration cooling. But active cooling can reduce the net thrust of the engine and add considerably to the design complexity. Recently, a metal drawing process has been patented where it is possible to fabricate plates with very small holes with high uniformity with a closely specified porosity. Such a metal plate could be used for an inexpensive transpiration/film cooled liner to meet the demands of advanced reusable rocket engines, if coolant mass flow rates could be controlled to satisfy wall cooling requirements and performance. The present study investigates the possibility of controlling the coolant mass flow rate through the porous material by simple non-active fluid

dynamic means. The coolant will be supplied to the porous material by series of constant geometry slots machined on the exterior of the engine.
Derived from text
Liquid Propellant Rocket Engines; Reusable Rocket Engines; Low Cost; Transpiration; Film Cooling; Space Transportation System

19980206197 State Coll. of Western Oregon, Dept. of Physical and Earth Sciences, Monmouth, OR USA
Augmentation of Rocket Propulsion: Physical Limits
Taylor, Charles R., State Coll. of Western Oregon, USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Rocket propulsion is not ideal when the propellant is not ejected at a unique velocity in an inertial frame. An ideal velocity distribution requires that the exhaust velocity vary linearly with the velocity of the vehicle in an inertial frame. It also requires that the velocity distribution variance as a thermodynamic quantity be minimized. A rocket vehicle with an inert propellant is not optimal, because it does not take advantage of the propellant mass for energy storage. Nor is it logical to provide another energy storage device in order to realize variable exhaust velocity, because it would have to be partly unfilled at the beginning of the mission. Performance is enhanced by pushing on the surrounding because it increases the reaction mass and decreases the reaction jet velocity. This decreases the fraction of the energy taken away by the propellant and increases the share taken by the payload. For an optimal model with the propellant used as fuel, the augmentation realized by pushing on air is greatest for vehicles with a low initial/final mass ratio. For a typical vehicle in the Earth's atmosphere, the augmentation is seen mainly at altitudes below about 80 km. When drag is taken into account, there is a well-defined optimum size for the air intake. Pushing on air has the potential to increase the performance of rockets which pass through the atmosphere. This is apart from benefits derived from "air breathing", or using the oxygen in the atmosphere to reduce the mass of an on-board oxidizer. Because of the potential of these measures, it is vital to model these effects more carefully and explore technology that may realize their advantages.
Derived from text
Spacecraft Propulsion; Exhaust Velocity; Propulsion System Performance; Propulsive Efficiency; Thrust Augmentation; Optimization

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CHEMISTRY AND MATERIALS (GENERAL)

19980203242 Carnegie-Mellon Univ., Pittsburgh, PA USA
Synthesis, Characterization, and Potential Applications of New Materials from Functionalized Polyphosphazenes ***Final Report, 1 Mar. 1995 - 28 Feb. 1998***
Matyjaszewski, Krzysztof, Carnegie-Mellon Univ., USA; Mar. 20, 1998; 5p; In English
Contract(s)/Grant(s): DAAH04-95-1-0110
Report No.(s): AD-A344430; ARO-33110.16-CH; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Polyphosphazenes are a new polymers with unique properties which include a combination of high temperature stability, low temperature flexibility, low surface energy, biofriendliness, and inflammability. We focused our research on polymerization of phosphoranimines catalyzed by Lewis acids and Lewis bases and synthesis of poly(diarylphosphazenes) by silyl azide intermediates and characterized the new polymers and copolymers using various techniques. The catalyzed polymerization of phosphoranimineshas been successfully used for the synthesis of random copolymers and the first block copolymers between two different polyphosphazenes. Additionally, we prepared polyphosphazene-organic polymer diblock structures using macromolecular phosphoranimines. The second part of the research was devoted to the preparation of new branched and hyperbranched polymers by controlled radical polymerization. We used atom transfer radical polymerization (ATRP) to prepare hyperbranched polystyrenes and polyacrylates. In addition, the novel class of compounds being simultaneously monomers and initiators (AB* monomers or inimers) were used successfully to design and prepare polymers and copolymers with novel topologies, compositions and functionalities. We prepared first molecular bottle-brush structures, multi arm star block and star diblock copolymers and also novel polar thermoplastic elastomers by entirely radical processes.
DTIC
Polymerization; Phosphazene; Synthesis (Chemistry); Monomers; Block Copolymers; Elastomers

19980203664 California Inst. of Tech., Pasadena, CA USA

Mechanistic Studies of C-H Activation Catalysts for Direct Organic Fuel Cell Applications ***Final Report, 1 Jan. - 31 Dec. 1996***

Gray, H. B., California Inst. of Tech., USA; Bercaw, J. E., California Inst. of Tech., USA; Labinger, J. A., California Inst. of Tech., USA; Winkler, J., California Inst. of Tech., USA; Mar. 25, 1998; 6p; In English

Contract(s)/Grant(s): DAAH04-95-1-0125

Report No.(s): AD-A344433; ARO-33954.5-CH; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of this program is to obtain fundamental understanding that will lead to design of catalysts or catalyst systems for C-H bond activation that can function in direct organic fuel cells, and that are based upon molecular species, rather than metal surfaces. In studying C-H activation by platinum complexes, we have used the results of prior mechanistic studies to design complexes that effect C-H activation under milder conditions, and are working on incorporating these concepts into systems for catalytic alkane oxidation. In the area of metal oxo complexes, we have discovered a complex that efficiently oxidizes alcohols at significantly lower reduction potentials than previously observed, apparently by avoiding a undesirable high energy one-electron mechanism. Our investigations are directed at extending this discovery to the design of catalysts that can operate at fuel-cell-relevant potentials.

DTIC

Catalysts; Alkanes; Fuel Cells; Atmospheric Chemistry

19980203826 Los Alamos National Lab., NM USA

Microwave processing improvements for methane conversion to ethylene

Stringfield, R., Los Alamos National Lab., USA; Ott, K., Los Alamos National Lab., USA; Nelson, E., Los Alamos National Lab., USA; Anderson, G., Los Alamos National Lab., USA; Chen, Dye-Zone, Los Alamos National Lab., USA; Dyer, T., Los Alamos National Lab., USA; Thomas, J., Virginia Polytechnic Inst. and State Univ., USA; [1997]; 7p; In English

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

Report No.(s): LA-UR-97-2167; DE97-008592; 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 objective was to investigate microwave enhanced catalysis. Published work by others had demonstrated improved selectivity in microwave-driven catalytic conversion of 2-methylpentane to its isomers. We reproduced their experiment, discovering that there is no improvement in selectivity using microwaves. The selectivity at a given conversion was the same for both microwave heated and conventionally heated catalyst beds. Meetings with the authors of the previously published work led to the conjecture that their catalyst was not being prepared properly, leading to anomalously low selectivity for their conventional heating runs. An optical temperature diagnostic suitable for use on a microwave applicator was developed and characterized in this project. This pyrometer can measure the temperature of small scale features on the catalyst bed, and it has a fast response that can follow the rapid heating often encountered in a microwave processing system. The behavior of the microwave applicator system was studied, and theoretical models were developed to yield insight about the stability and control of the system.

DOE

Catalysis; Methane; Ethylene; Microwaves; Isomerization; Heating

19980204848 NASA Langley Research Center, Hampton, VA USA

Imide Oligomers Endcapped with Phenylethynl Phthalic Anhydrides and Polymers Therefrom

Hergenrother, Paul M., Inventor, NASA Langley Research Center, USA; Smith, Joseph G., Jr., Inventor, NASA Langley Research Center, USA; Jun. 02, 1998; 16p; In English; Continuation of US-Patent-Appl-SN-330773, filed 28 Oct. 1994

Patent Info.: Filed 21 Oct. 1996; NASA-Case-LAR-15176-4-CU; US-Patent-5,760,168; US-Patent-Appl-SN-734286; US-Patent-Appl-SN-330773; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Controlled molecular weight phenylethynyl terminated imide oligomers (PETIs) have been prepared by the cyclodehydration of precursor phenylethynyl terminated amic acid oligomers. Amino terminated amic acid oligomers are prepared from the reaction of dianhydride(s) with an excess of diamine(s) and subsequently endcapped with phenylethynyl phthalic anhydride(s) (PEPA). The polymerizations are carried out in polar aprotic solvents such as N-methyl-2-pyrrolidinone or N.N-dimethylacetamide under nitrogen at room temperature. The amic acid oligomers are subsequently cyclodehydrated either thermally or cheznicauy to the corresponding imide oligomers. Direct preparation of PETIs from the reaction of dianhydxide(s) with an excess of diamine(s) and endcapped with phenylethynyl phthalic anhydride(s) has been performed in m-cresol. Phenylethynyl phthalic anhydrides are synthesized by the palladium catalyzed reaction of phenylacetylene with bromo substituted phthalic anhydrides in triethylamine.

These new materials exhibit excellent properties and are potentially useful as adhesives, coatings, films, moldings and composite matrices.
Author
Amino Acids; Anhydrides; Cresols; Matrix Materials; Methyl Compounds; Molecular Weight; Cyclic Compounds

19980204998 University of South Florida, Tampa, FL USA
Decontamination by Water-Soluble Unimolecular Metallopolymers ***Final Report, 1 Sep. 1993 - 6 Jun. 1997***
Newkcome, George R., University of South Florida, USA; Apr. 30, 1998; 12p; In English
Contract(s)/Grant(s): DAAH04-93-G-0448
Report No.(s): AD-A344195; ARO-31392.22-CH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Center for Molecular Design & Recognition (CMDR) has developed and utilized novel synthetic approaches toward (”internally”) functional dendrimers, as well as branched reagents that facilitate variation of surface (end group) functionality. Accomplishments include: the preparation of dendrimers possessing site-specific molecular recognition or metal coordinating moieties (e.g., diaminopyridine, bipyridine, or piperazine); the development of branched monomers and branched quaternary ammonium capping reagents, which offered a novel entree to supramolecular chemistry within unimolecular systems. We have prepared ”stable,” commercially viable, branched isocyanate reagents. These isocyanate monomers permit rapid dendrimer synthesis and are useful for the facile addition of branching to any (poly)functional, especially poly(protic), containing material (e.g., dendrimers, hyperbranched polymers, polymers or surfaces). Variation of the (protected) branched monomer end group allows facile modification of the resulting macromolecular properties. Such functional diversity on the macromolecular surface has permitted the tailoring of the solubility characteristics such that their incorporation in polymeric blends de facto incorporate the catalytic interior; recent evidence supports their hydrolytic properties and functional modifications will improve their efficacy.
DTIC
Decontamination; Polymers; Molecular Structure; Monomers; Macromolecules; Hydrolysis

19980205014 Purdue Univ., Dept. of Chemistry, West Lafayette, IN USA
Super-Hydrides ***Final Report, 1 Aug. 1994 - 31 Jul. 1997***
Brown, Herbert C., Purdue Univ., USA; Dec. 22, 1997; 22p; In English
Contract(s)/Grant(s): DAAH04-94-G-0313
Report No.(s): AD-A344666; ARO-32658.23-CH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In accordance with the specific aims of the project our main focus has been on the asymmetric reduction of prochiral ketones. We further explored the capability of our reducing agent, B-chiorodiisopinocampheylborane (Ipc2BCl), for asymmetric reductions. We studied the kinetic resolution of alpha-tertiary monocyclic and bicyclic ketone and developed optimum conditions to obtain the product alcohol, or the ketone, or both, in very high yields. Ipc2BCl controls the stereochemical outcome in double asymmetric reduction. This reagent provides C2-symmetric diols from the corresponding diketones in very high diastereomeric and enantiomeric excess.
DTIC
Hydrides; Ketones; Boranes

19980206096 Duke Univ., Dept. of Chemistry, Durham, NC USA
Synthesis and Characterization of Sterically Hindered Alkylaluminum-Phosphorus and -Arsenic Compounds. X-Ray Crystal Structures of (Me3ECH2)3Al E’(SiMe3)3 (E = Si, E’ = As; E = C, E’ = P, As), (Me3SiCH2)2(Br)Al P(SiMe3)3, and (Me3SiCH2)(X)AlE(SiMe3)2
Wells, R. L., Duke Univ., USA; Foos, J. E., Duke Univ., USA; Rheingold, Arnold L., Delaware Univ., USA; Yap, Glenn P. A., Delaware Univ., USA; Liable-Sands, Louise M., Delaware Univ., USA; May 23, 1998; 37p; In English; Prepared in collaboration with University of Delaware, Dept. of Chemistry, Newark, DE; University of North Carolina at Chapel Hill, Dept. of Chemistry, Chapel Hill, NC. Accepted for publication in Organometallics.
Contract(s)/Grant(s): N00014-95-1-0194
Report No.(s): AD-A345451; DU/DC/TR-77; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Reaction of (Me3SiCH2)3Al with E(SiMe3)3 (E = P, As) in a 1:1 mole ratio affords the Lewis acid-base adducts (Me3SiCH2)3Al.P(SiMe3)3 (1) and (Me3SiCH2)3Al.As(SiMe3)3 (2). Similarly, the 1:1 mole ratio reaction of (Me3CCH2)3Al with E(SiMe3)3 (E = P, As) leads to the isolation of (Me3CCH2)3Al.P(SiMe3)3 (3) and (Me3CCH2)3Al.As(SiMe3)3 (4). The adduct (Me3SiCH2)2(Br)Al.P(SiMe3)3 (5) was obtained from the 1:1 mole ratio reaction of (Me3SiCH2)2AlBr with P(SiMe3)3. The dimers (Me3SiCH2)(Br)AlP(SiMe3)22 (6) and (Me3SiCH2)(Br)AlAs(SiMe3)22 (7) were isolated as products of the lithium halide elimination reactions of (Me3SiCH2)AlBr2 (10) with LiE(SiMe3)2 (E = P, As), while reaction of (Me3SiCH2)2AlBr with

these same lithium pnictide salts leads to the isolation of (Me3SiCH2)2AlP(SiMe3)22 (8) and (Me3SiCH2)2AlAs(SiMe3)22 (9). Various physical and spectroscopic data, including a variable temperature NMR study of the dimeric compounds 6 through 9, are presented for the above compounds, as are the single crystal X-ray structures of 2 through 7 and 9.
DTIC
Organometallic Compounds; X Rays; Aluminum; Phosphorus; Arsenic Compounds; Synthesis (Chemistry); Alkyl Compounds

19980206268 North Carolina State Univ., Raleigh, NC USA
Growth, Characterization and Device Development in Monocrystalline Diamond Films ***Final Report, 1 Jan - 31 Mar. 1998***
Davis, R. F., North Carolina State Univ., USA; Nemanich, R. J., North Carolina State Univ., USA; Sitar, Z., North Carolina State Univ., USA; Mar. 1998; 37p; In English
Contract(s)/Grant(s): N00014-93-I-0437
Report No.(s): AD-A345423; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Surfaces of diamond and GaN have been characterized using UV photoemission spectroscopy (UPS), position dependent field emission and photo-electron emission microscopy (FEEM and PEEM). Electron affinity is a critical limiting aspect for field emission from conducting p-type diamond and Si doped GaN. Emission from p-type diamond originates from the valence band of the material; field emission from Si-doped GaN originates from electrons in the conduction band. Particle detectors for high electron flux applications have been fabricated based on Highly Oriented Diamond (HOD) films. Relatively thick HOD films were achieved by combining the bias enhanced nucleation in a microwave plasma chemical vapor deposition reactor and high rate growth process in a low pressure combustion flame reactor. The detector performance was measured using the energy spectra of alpha-particles emitted from an Am-241 source. The HOD detector showed a three to four fold improvement in performance which was close to that obtained for single crystalline diamond detectors. Voltage-dependent field emission energy distribution and I-V measurements were performed on Mo tips coated with intrinsic c-BN to determine the origin of the field-emitted electrons. Spectra were collected from the Mo emitters under UHV conditions before and after being coated. In some instances multiple FEED peaks were observed in the collected spectra. These corresponded to multiple emission sites on the emitter. The energy of the field-emitted electrons from the c-BN-coated emitters usually depended linearly upon the applied voltage and could be explained using a simplified band-bending model. However, at higher voltages the FEED measured from the c-BN-coated emitters departed from this linear behavior. These nonlinearities were attributed to contact resistance at the Mo/c-BN interface.
DTIC
Single Crystals; Crystal Growth; Diamond Films; N-Type Semiconductors; P-Type Semiconductors

24
COMPOSITE MATERIALS

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

19980203398 Advanced Cerametrics, Inc., Lambertville, NJ USA
Proposal to Develop Multi-Functional Composites for Sensor and Actuator Applications ***Final Report, 26 Apr. 1996 - 26 Apr 1998***
French, Jonathan D., Advanced Cerametrics, Inc., USA; Cass, Richard B., Advanced Cerametrics, Inc., USA; Weitz, Gregory, Advanced Cerametrics, Inc., USA; May 11, 1998; 29p; In English; Prepared in collaboration with Rutgers Univ., New Brunswick, NJ.
Contract(s)/Grant(s): N00014-95-C-0426
Report No.(s): AD-A343746; ACI-0003Z; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The intent of this research was to develop a procedure to produce piezoelectric fiber composites for use in ultrasound transducers, under water hydrophones and preliminary actuator designs. All facets of the proposed research were successfully addressed with performance results exceeding expectations. Ultrasound transducers have been built for a range of frequencies that are equal to the best ”dice and fill” composite transducers but without any lateral wave interference providing clean signals up to 40 MHz. Recently a 20 MHz transducer was built which compared with the best results seen previously. Before the end of this STTR work was completed, products of this technical breakthrough were commercialized and are the subject of an exclusive supply agreement with the largest manufacturer of NDE equipment in the U.S. Hydrophones were constructed using ACI’s PZT fiber composite transducers which compare favorably with the best commercial units and are an order of magnitude more sensitive than state of the art injection molded transducers. Discussions with Northrop-Grumman are underway for a Phase III effort to

develop hydrophone/sonar transducers for the next generation submarine. The first test actuators were constructed using ACI's PZT fiber performance rivalling the best devices available.
DTIC
Procedures; Fiber Composites; Ceramic Matrix Composites

19980203444 Dayton Univ. Research Inst., OH USA
Mechanics of Brittle-Matrix Composites ***Final Report, 15 Sep. 1995 - 3 Jun. 1997***
Kim, Ran Y., Dayton Univ. Research Inst., USA; Aug. 1997; 58p; In English
Contract(s)/Grant(s): F33615-95-D-5029; AF Proj. 4347
Report No.(s): AD-A343686; UDR-TR-97-127; WL-TR-97-4107; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Model brittle matrix composites (SiC fibers and borosilicate glass) demonstrated that good matrix cracking stress is achievable only when a good matrix interfacial bond exists. Improvement in this matrix cracking stress can be seen with increasing fiber volume and lowered radial residual compressive stress. The ability to measure the fiber-matrix normal interfacial strength in a composite was demonstrated using a model system in a cruciform sample geometry. An analytical model of ceramic composites based on observed damage progression was developed based on simultaneous stress application and microscopic observations. The damage state of the ceramic composite was successfully incorporated into the model to generate changes in the mechanical behavior. The measurement of coating modulus in BMCs was demonstrated using a micro indentor technique.
DTIC
Matrix Materials; Brittleness; Micromechanics; Borosilicate Glass; Ceramic Matrix Composites; Microcracks; Debonding (Materials); Brittle Materials; Microhardness

19980203449 North Carolina Agricultural and Technical State Univ., Greensboro, NC USA
Research in Advanced Materials Processing and Process Modeling ***Final Report, 29 Jul. 1993 - 30 Apr. 1997***
Owusu-Ofori, Samuel P., North Carolina Agricultural and Technical State Univ., USA; Pai, Devdas M., North Carolina Agricultural and Technical State Univ., USA; Sadler, Robert L., North Carolina Agricultural and Technical State Univ., USA; May 1997; 219p; In English
Contract(s)/Grant(s): F33615-93-C-5337; AF Proj. 2419
Report No.(s): AD-A343689; WL-TR-97-4057; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

In resin transfer molding (RTM), the liquid matrix is pumped into the mold to infiltrate a preform assembled in the mold and under compressive stresses. The matrix tends to flow around the preform periphery, along the path(s) of least resistance and arrive at the vents before the entire preform is impregnated, causing the part to be defective. This phenomenon is known as 'race tracking.' A preform-mold misfit could waste an entire part since recovery from a non-fill is not possible. The primary goal of this research was to develop and demonstrate a practical quantitative method for evaluating the preform-mold fit with the mold closed before the matrix is injected. The preform-mold fit is determined by probing the ready-to-inject mold assembly with nitrogen and collecting the exhaust gas through a series of flow meters located along the periphery of the mold. Experiments have been developed to test the instrumentation and the methodology for the prediction of the characteristics of the resin flow front with satisfactory results.
DTIC
Resin Transfer Molding; Resins; Mold; Monitors; Resin Matrix Composites; Process Control (Industry)

19980203473 Delaware Univ., Center for Composite Materials, Newark, DE USA
Rapid Placement Technology for Affordable Composites Manufacturing ***Final Report, 15 Sep. 1994 - 31 Dec. 1997***
Gillespie, J. W., Delaware Univ., USA; Kukich, D. S., Delaware Univ., USA; Jan. 29, 1998; 19p; In English
Contract(s)/Grant(s): DAAH04-94-G-0285
Report No.(s): AD-A344689; ARO-33482.1-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The RAPTECH-ACM program yielded the following research accomplishments: (1) Development of process models governing heat transfer, consolidation, crystallization, intimate contact, healing, and residual stress and warpage. These models have been incorporated into a real-time neural-network-based simulation. (2) Incorporation of advanced model-based control on line and optimization to establish setpoints for heat input, velocity, and pressure to achieve the desired quality (i.e., bonding, void content). (3) Integration of infrared sensors for feedback control. (4) Successful demonstration on lab-scale robotic workcell. (5) Transition of technology to industrial partners. (6) Mounting of DuPont Generation 3 head onto Cincinnati Milacron's gantry tape

layer, where it is being used to make high-quality parts for HSR (less than 1% void content, mechanical properties approaching autoclave baseline).
DTIC
Heat Transfer; Models; Procedures; Manufacturing; Crystallization; Consolidation; Computerized Simulation

19980203965 Sandia National Labs., Albuquerque, NM USA
Structure-property relationships in silica-siloxane nanocomposite materials
Ulibarri, T. A., Sandia National Labs., USA; Derzon, D. K., Sandia National Labs., USA; Wang, L. C., Sandia National Labs., USA; [1997]; 5p; In English, 27 Apr. 1997, Toronto, Canada
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-2990C; CONF-970471-1; DE97-001882; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The simultaneous formation of a filler phase and a polymer matrix via in situ sol-gel techniques provides silica-siloxane nanocomposite materials of high strength. This study concentrates on the effects of temperature and relative humidity on a trimodal polymer system in an attempt to accelerate the reaction as well as evaluate subtle process- structure-property relations. It was found that successful process acceleration is only viable for high humidity systems when using the tin(IV) catalyst dibutyltin dilaurate. Processes involving low humidity were found to be very temperature and time dependent. Bimodal systems were investigated and demonstrated that the presence of a short-chain component led to enhanced material strength. This part of the study also revealed a link between the particle size and population density and the optimization of material properties.
DOE
Sol-Gel Processes; Siloxanes; Silicon Dioxide; Mechanical Properties; Composite Materials; Fillers

19980204870 Rensselaer Polytechnic Inst., Troy, NY USA
Interdisciplinary Basic Research in Smart Materials and Structures ***Final Report, 1 Jul. 1992 - 31 Dec. 1997***
Craig, Kevin C., Rensselaer Polytechnic Inst., USA; Wen, J., Rensselaer Polytechnic Inst., USA; Tiersten, H., Rensselaer Polytechnic Inst., USA; Lagoudas, D., Rensselaer Polytechnic Inst., USA; May 1998; 27p; In English
Contract(s)/Grant(s): DAAL03-92-G-0123
Report No.(s): AD-A344676; ARO-30378.38-EG-URI; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Key contributions include the following: (1) The adaptation and specialization of multi-channel vibration control techniques based on the characteristic vibration disturbance; (2) Demonstrated the importance of using combinations of multi-channel controller formulations for transient and steady-state vibration disturbance suppression and rejection; (3) Developed a new Hybrid Active Control Formulation which incorporates combination of a Nonlinear-rate feedback scheme and the Filtered-x adaptive feedforward controller for transient and steady-state disturbance suppression and rejection; (4) Developed a novel model-independent Total Energy Absorption (TEA) active control scheme for active vibration control in structures with vibration response characterized by standing and propagating waveforms. (5) Developed a new Dual Active Control Scheme which incorporates a fuzzy adaptive leaning rate with the Filtered-x algorithm for separate/combined vibration and acoustic radiation reduction.
DTIC
Composite Materials; Composite Structures; Smart Structures; Smart Materials; Vibration; Control Systems Design; Procedures; Active Control

19980205808 Sandia National Labs., Albuquerque, NM USA
Electrical and chemical characterization of FIB-deposited insulators
Campbell, A. N., Sandia National Labs., USA; Tanner, D. M., Sandia National Labs., USA; Soden, J. M., Sandia National Labs., USA; Adams, E., International Business Machines Corp., USA; Gibson, M., International Business Machines Corp., USA; Abramo, M., International Business Machines Corp., USA; Doyle, A., Micrion Corp., USA; Stewart, D. K., Micrion Corp., USA; [1997]; 8p; In English; Testing and Failure Analysis, 27 - 31 Oct. 1997, Santa Clara, CA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-1965C; CONF-971037-1; DE97-008362; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The electrical and chemical properties of insulators produced by codeposition of siloxane compounds or TEOS with oxygen in a focused ion beam (FIB) system were investigated. Metal-insulator-metal capacitor structures were fabricated and tested. Specifically, leakage current and breakdown voltage were measured and used to calculate the effective resistance and breakdown field. Capacitance measurements were performed on a subset of the structures. It was found that the siloxane-based FIB-insulators had superior electrical properties to those based on TEOS. Microbeam Rutherford backscattering spectrometry analysis and Four-

ier transform infrared spectroscopy were used to characterize the films and to help understand the differences in electrical behavior as a function of gas chemistry and deposition conditions. Finally, a comparison is made between the results presented here, previous results for FIB-deposited insulators, and typical thermally-grown gate oxides and interlevel dielectric SiO2 insulators.
DOE
Chemical Properties; Electrical Properties; Capacitors; Electrical Insulation; Deposition; Ion Beams; Microbeams; Mim (Semiconductors); Microanalysis; Fabrication

19980206100 Thueringisches Inst. fuer Textil- und Kunststoff- Forschung e.V., Rudolstadt-Schwarza, Germany
CFRP materials reinforced with LCP fibres for applications in vehicle and aircraft engineering ***Final Report Faserverbundkunststoffe mit einer LCP-Faserverstaerkung fuer Anwendungen im Fahrzeug- und Flugzeugbau. Abschlussbericht***
Feb. 11, 1997; 46p; In German
Contract(s)/Grant(s): BMWi 173/95
Report No.(s): ETDE-DE-556; DE98-704415; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

CFRP materials reinforced with liquid crystalline polyester (LCP) fibres were produced and characterized with regard to their physical and mechanical characteristics. Compared with non-reinforced plastics, polypropylene/LCP fibre-UD laminates produced by filmstacking, epoxy resin/LCP fibre-UD laminates produced by spooling and epoxy resin composites with internal LCP fibre fleece had significantly higher strength and stiffness as well as high thermoforming resistance and waterproofness.
DOE
Resin Matrix Composites; Reinforced Plastics; Polypropylene; Polyesters; Mechanical Properties; Fibers

19980206125 Los Alamos National Lab., NM USA
Advancing the technology base for high-temperature membranes
Dye, R. C., Los Alamos National Lab., USA; Birdsell, S. A., Los Alamos National Lab., USA; Snow, R. C., Los Alamos National Lab., USA; [1997]; 14p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3375; DE98-000093; 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 the Los Alamos National Laboratory (LANL). This project addresses the major issues confronting the implementation of high-temperature membranes for separations and catalysis. We are pursuing high-temperature membrane systems that can have a large impact for DOE and be industrially relevant. A major obstacle for increased use of membranes is that most applications require the membrane material to withstand temperatures above those acceptable for polymer-based systems. Advances made by this project have helped industry and DOE move toward high-temperature membrane applications to improve overall energy efficiency.
DOE
Research and Development; High Temperature; Membrane Structures; Composite Materials; Diffusion; Acee Program

19980206156 Union Coll., Dept. of Mechanical Engineering, Schenectady, NY USA
Finite Element Modeling of the Thermographic Inspection for Composite Materials
Bucinell, Ronald B., Union Coll., USA; Research Reports: 1996 NASA/ASEE Summer Faculty Fellowship Program; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The performance of composite materials is dependent on the constituent materials selected, material structural geometry, and the fabrication process. Flaws can form in composite materials as a result of the fabrication process, handling in the manufacturing environment, and exposure in the service environment to anomalous activity. Often these flaws show no indication on the surface of the material while having the potential of substantially degrading the integrity of the composite structure. For this reason it is important to have available inspection techniques that can reliably detect sub-surface defects such as inter-ply disbonds, inter-ply cracks, porosity, and density changes caused by variations in fiber volume content. Many non-destructive evaluation techniques (NDE) are capable of detecting sub-surface flaws in composite materials. These include shearography, video image correlation, ultrasonic, acoustic emissions, and X-ray. The difficulty with most of these techniques is that they are time consuming and often difficult to apply to full scale structures. An NDE technique that appears to have the capability to quickly and easily detect flaws in composite structure is thermography. This technique uses heat to detect flaws. Heat is applied to the surface of a structure with the use of a heat lamp or heat gun. A thermographic camera is then pointed at the surface and records the surface temperature as the composite structure cools. Flaws in the material will cause the thermal-mechanical material response to change. Thus, the surface over an area where a flaw is present will cool differently than regions where flaws do not exist. This paper discusses the effort

made to thermo-mechanically model the thermography process. First the material properties and physical parameters used in the model will be explained. This will be followed by a detailed discussion of the finite element model used. Finally, the result of the model will be summarized along with recommendations for future work.
Derived from text
Nondestructive Tests; Thermography; Finite Element Method; Composite Structures; Cracks; Mathematical Models; Fault Detection; Surface Defects

19980206313 Los Alamos National Lab., NM USA
New perspectives on the fracture of Nicalon fibers
Taylor, S. T., California Univ., USA; Lowe, T. C., Los Alamos National Lab., USA; Butt, D. P., Los Alamos National Lab., USA; 1997; 13p; In English; 29th; Fatigue and Fracture Mechanics, 24 - 26 Jun. 1997, Stanford, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2427; CONF-9706167; DE97-008835; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Experimental studies have been conducted to examine the strength and fracture behavior of monofiliment Nicalon(sup 3) SiC fibers ranging in diameter from 8 to 22 micro-m. The effects of varying fiber diameter, flaw location, and flaw population on the tensile behavior of individual fibers were investigated using fractography. Results indicate that variations in fiber diameter influence the apparent fiber fracture toughness K(sub 1c), with higher K(sub 1c) values observed for decreasing fiber diameters. Observations also suggest that the location of the critical flaw may play a role in the fracture of Nicalon fibers. In addition to surface flaws, three distinct internal flaw populations are seen to cause fracture in Nicalon fibers.
DOE
Silicon Carbides; Fracturing; Surface Defects; Fibers; Fracture Mechanics

19980206321 Los Alamos National Lab., NM USA
Strength distribution and size effects for the fracture of fibrous composite materials
Phoenix, S. L., Cornell Univ., USA; Beyerlein, I. J., Los Alamos National Lab., USA; 1997; 14p; In English; International Mechanical Engineering Congress and Exposition, 16 - 21 Nov. 1997, Dallas, TX, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3496; CONF-971115; DE98-000345; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Random network models have recently been developed in the physics literature to explain the strength and size effect in heterogeneous materials. Applications have included the breakdown and brittle fracture. Unfortunately, conventional scaling approaches of statistical mechanics have yielded incorrect predictions, and new approaches have been proposed which build on field enhancement occurring near the tips of critical, random clusters together with the statistical theory of extremes. New distributions and size scalings for strength have been proposed and supported through Monte Carlo simulation. Here we consider an idealized, one-dimensional model for the failure of such networks where elements of constant strength may be initially present or absent at random. Our idealized rule for local stress redistribution near breaks reflects features we find in a discrete mechanics model that has limiting forms consistent with continuum theories for cracks. We obtain rigorous asymptotic results for the strength distribution and size effect with constants and exponents that are known. The validity of various analytical approximations in the literature is then discussed.
DOE
Fiber Composites; Statistical Analysis; Stress Distribution; Statistical Mechanics; Fracturing; Cracks

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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.

19980203239 Purdue Univ., Dept. of Chemistry, West Lafayette, IN USA
The Synthesis and Hydrogen-Storage Chemistry of Polyhydridoferrates ***Final Report, 10 Aug. 1994 - 31 Dec. 1997***
Linn, Donald E., Purdue Univ., USA; Mar. 31, 1998; 10p; In English
Contract(s)/Grant(s): DAAH04-94-G-0312
Report No.(s): AD-A344392; ARO-33042.2-CH; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The reactions to prepare the complex hydride [FeH6](4-) have been surveyed and it has been determined that the high pressure sintering method is the most efficient. The complex hydride Mg2FeH6 has little tendency to release hydrogen under ordinary conditions. Electrophilic species were not successful in producing a ”reversible” form of hydrogen-storage, in situ. Reactions of soluble complex species prepared by solution synthetic techniques have some fascinating properties. These species are formulated as [FeH6]{MgY(THF)n}4, Y = halide or alkoxide. The more important findings include: (1) The position of hydride in the spectrochemical series has been unambiguously determined for the first time; (2) The thermodynamic (i.e. equilibrium constant) and kinetic parameters for the ion pairing in these species, where X = halide, have been characterized; (3) Highly soluble species have been prepared, where Y = alkoxide, and their solvatochromism has been characterized; and (4) Catalysis of hydrogen-transfer reactions in hydrocarbons has been observed in solutions of [FeH6](4-).
DTIC
Synthesis (Chemistry); Hydrides; Hydrogen; Iron Compounds; Chemical Analysis; Catalysis

19980203263 City Coll. of the City Univ. of New York, NY USA
Vibrational and Electronic Dynamics of Tetravalent Chromium Ions in Dielectric Crystals ***Final Report, 15 Sep. 1995 - 14 Sep 1997***
Alfano, R. R., City Coll. of the City Univ. of New York, USA; Calistru, Dana M., City Coll. of the City Univ. of New York, USA; Demos, S. G., City Coll. of the City Univ. of New York, USA; Kremerman, V., City Coll. of the City Univ. of New York, USA; Petricevic, V., City Coll. of the City Univ. of New York, USA; Lax, M., City Coll. of the City Univ. of New York, USA; Jan. 22, 1998; 7p; In English
Contract(s)/Grant(s): DAAHO4-95-1-0591
Report No.(s): AD-A344346; ARO-33651.6-PH; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The research program demonstrated that the overall nonradiative deexcitation’ taking place in impurity-doped laser crystals can be broken down into three distinct steps: generation of local mode population due to transition through electronic bottleneck, energy transfer from local into select phonon modes via local-phonon mode coupling and return of the system to thermal equilibrium via interaction of the active phonons with the phonon bath. The mechanism of the nonradiative decay is investigated for each step using three experimental techniques: resonance Raman scattering for the identification of Cr sub 4+ local modes, and up-converted hot luminescence and time resolved Raman scattering for the identification of the phonons involved in the nonradiative decay. The dynamics of the phonon modes involved in the nonradiative relaxation was analyzed using a newly developed theoretical model which provided characteristic relaxation time parameters. This work provided the first step in understanding how to alter and control the flow of nonradiative energy.
DTIC
Vibration; Dynamic Characteristics; Chromium Isotopes; Crystals; Raman Spectra; Dielectrics; Metal Ions

19980203346 Florida Univ., Quantum Theory Project, Gainesville, FL USA
Metastable Molecules and Other Energetic Structures: The Contribution of Theory ***Final Report, 1 Feb. 1995 - 31 Jan. 1998***
Bartlett, Rodney J., Florida Univ., USA; May 05, 1998; 21p; In English
Contract(s)/Grant(s): F49620-95-1-0130
Report No.(s): AD-A343513; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We have emphasized a rational theoretical design of new energetic metastable molecules that is based on highly accurate electron correlated coupled-cluster theory and directed toward a search of ’synthesizable’ species that have a high heat of formation (large specific impulse) and can be reasonably stable. We have investigated the molecular mechanisms of the initial steps in exothermic decomposition (initial steps of ignition and explosion), as well as possible synthetic roots in the synthesis of the desired metastable isomers. Based on the goal of developing theoretical methods that can provide sufficiently high accuracy (to be competitive with what experimental methods can achieve for the characterization of molecular structure and properties), we have formulated and implemented in the ACES II program the following new ’tools’: (1) ROHF-CC and ROHF-MBPT methods for the treatment of open-shell systems that might be subject to spin contamination in UHF; (2) analytical gradients for ROHF-CC and ROHF-MBPT; (3) the equation of motion coupled-cluster (EOM-CC) approach for excited, electron attached, and ionized states; (4) triple excitation’s for excited-state energies; (5) simplified (partitioned) EOM-CC methods for application to large molecules; and (6) EOM-CC method for computations of properties, including NMR coupling constants.
DTIC
Quantum Chemistry; Explosives; Metastable State; Computational Chemistry; Equations of Motion; Molecular Structure; Molecules; Decomposition

19980203352 Florida State Univ., Dept. of Chemistry, Tallahassee, FL USA

Octanol-Water Partition Coefficients by Capillary Electrophoresis ***Final Report, 1 Jul. 1994 - 30 Jun. 1997***

Dorsey, John G., Florida State Univ., USA; Jun. 30, 1997; 4p; In English

Contract(s)/Grant(s): F49620-94-1-0208; AF Proj. 3484/YS

Report No.(s): AD-A339212; AFRL-SR-BL-TR-98-0235; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have investigated the use of capillary electrophoresis (CE) for the modeling of octanol-water partition coefficients. Reversed-phase liquid chromatography (RPLC) is likely the most used method for estimation of octanol-water partition coefficients, with correlations from approximately 0.5 to 0.000, depending on the column and compounds tested. RPLC will never be a reliable method, however, because of variability in the chemistry of the stationary phase from column to column. Capillary electrophoresis is a much simpler system, as there is no true stationary phase, and there should be dramatically less variation from laboratory to laboratory. We have shown that CE can give a single point estimate of the octanol-water partition coefficient. Specifically, micellar electrokinetic capillary chromatography (MEKC), the micellar variant of the CE experiment, was evaluated as an a priori predictor of n-octanol-water partition coefficients (log Ko/w).

DTIC

Chromatography; Electrokinetics; Liquid Chromatography

19980203413 Oak Ridge National Lab., TN USA

Uranium isotope ratio measurements in field settings

Shaw, R. W., Oak Ridge National Lab., USA; Barshick, C. M., Oak Ridge National Lab., USA; Young, J. P., Oak Ridge National Lab., USA; Ramsey, J. M., Oak Ridge National Lab., USA; 1997; 8p; In English; Decontamination, Decommissioning and Reutilization of Commercial and Government Facilities, 7 - 12 Sep. 1997, Knoxville, TN, USA

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

Report No.(s): CONF-970952-2; DE97-007494; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors have developed a technique for uranium isotope ratio measurements of powder samples in field settings. Such a method will be invaluable for environmental studies, radioactive waste operations, and decommissioning and decontamination operations. Immediate field data can help guide an ongoing sampling campaign. The measurement encompasses glow discharge sputtering from pressed sample hollow cathodes, high resolution laser spectroscopy using conveniently tunable diode lasers, and optogalvanic detection. At 10% (sup 235)U enrichment and above, the measurement precision for (sup 235)U/((sup 235)U+(sup 238)U) isotope ratios was (+-)3%; it declined to (+-)15% for 0.3% (i.e., depleted) samples. A prototype instrument was constructed and is described.

DOE

Uranium Isotopes; Tunable Lasers; Semiconductor Lasers; Radioactive Wastes; Laser Spectroscopy; Isotope Ratios

19980203454 Rice Univ., Dept. of Chemistry, Houston, TX USA

Density Functional Theory for Large Molecular Systems and Application to Metcars ***Final Report, 1 May 1995 - 28 Feb. 1998***

Scuseria, Gustavo E., Rice Univ., USA; Feb. 1998; 7p; In English

Contract(s)/Grant(s): F49620-95-1-0203

Report No.(s): AD-A343733; AFRL-SR-BL-TR-98-0429; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the grant period, we developed a major improvement in the calculation of the Coulomb term appearing in ab initio electronic structure methods based on Gaussian orbitals. Our efficient implementation of the Gaussian very Fast Multipole Method (GvFMM) combines speed, accuracy, and linear scaling properties. The method is clearly superior to state-or-the-art analytic integration techniques of Gaussian functions. Our benchmarks on graphitic sheets containing more than 400 atoms and 3,500 basis functions showed that the GvFMM dramatically reduces the computational requirements of the Coulomb problem. We implemented analytic first and second ho derivatives of the energy with respect to nuclear displacements using our GvFMM method for the efficient calculation of forces and frequencies in large molecules. We developed and implemented a linear scaling exchange correlation quadrature which dramatically speeds up another of the computational bottlenecks of state-of-the-art DFT programs. The combination of fast quadratures and GvFMM yielded substantial improvements in the calculation of harmonic frequencies. In order to obtain linear scaling with the Hartree-Fock method, we developed and implemented a linear scaling method termed 'near-field exchange' for exact exchange calculations of large molecules.

DTIC

Metals; Quantum Chemistry; Molecular Structure; Molecules; Orbitals

19980203480 Hunter Coll., Dept. of Physics and Astronomy, New York, NY USA

Lithium Ion Transport Across and Between Phase Boundaries in Heterogeneous Polymer Electrolytes, Based on PVdF ***Final Report, 27 Feb. 1997 - 26 Feb 1998***

Greenbaum, Steven G., Hunter Coll., USA; Feb. 26, 1998; 5p; In English

Contract(s)/Grant(s): DAAG55-97-1-0392; DAAB07-97-1-G019

Report No.(s): AD-A344887; ARO-37793.2-CH; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Initial investigations of polymer electrolytes based on PVdF-HFP and LiPF6 dissolved in either EC/PC or EC/DMC mixtures have been carried out via high pressure complex impedance methods and 7Li NMR. All results indicate that the polymer matrix, while effectively immobilizing the liquid component, does not significantly affect the ion transport mechanism inherent to liquid electrolytes. In the first reported attempt to exploit 17O NMR to study lithium battery electrolytes, we have prepared 17O-enriched Li triflate and several electrolytes containing the isotopically enriched salt dissolved in DEC, DMC, and mixtures of DMC/EC. Line widths were measured as a function of electrolyte solvent and temperature, and suggest that EC inhibits the formation of ion pairs, when added to DMC.

DTIC

Electric Batteries; Electrolytes; Lithium Sulfur Batteries; Ferroelectric Materials

19980203530 Ames Lab., IA USA

Speciation of chromium and manganese using pneumatically assisted electrospray mass spectrometry

Gwizdala, A. B., III, Ames Lab., USA; [1997]; 46p; In English

Contract(s)/Grant(s): W-7405-eng-82

Report No.(s): IS-T--1799; DE97-002921; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

It is not an exaggeration to say that much of chemistry involves ions in solution. A technique which allows for ions to be transferred from solution into the gas phase and subsequently analyzed by mass spectrometric detection would be of importance. If structural information, representative of the solution chemistry could be gained from these gas-phase ions, this would also be important. Electrospray mass spectrometry is such a technique.

DOE

Mass Spectroscopy; Vapor Phases; Ions

19980203639 Stanford Univ., Sponsored Projects Office, Stanford, CA USA

Advanced Superconducting Materials and Device Concepts ***Final Report, 1 Nov. 1994 - 30 Apr. 1998***

Beasley, M. R., Stanford Univ., USA; Geballe, T. H., Stanford Univ., USA; Kapitulnik, A., Stanford Univ., USA; Apr. 1998; 14p; In English

Contract(s)/Grant(s): F49620-95-1-0039

Report No.(s): AD-A343722; AFRL-SR-BL-TR-98-0430; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Various materials and physical processes relevant to the electronic applications of high-Tc superconductivity have been studied. The materials include 123 YBaCuO, 2212 BiSRCaCuO, SRRuO3, SRCuO2, (La-Ca)MnO3, and related complex oxides. The results include: (1) evidence for and practical consequences of the novel d-wave pairing symmetry of the high-Tc superconductors; (2) the thin film growth and physical behavior of various potential barrier materials for high-Tc superconductor/normal/superconductor (SNS) Josephson junctions, including evidence of the breakdown of the conventional Boltzmann theory of transport in SRRuO3; and (3) the demonstration of a ferroelectric field effect in ultrathin films of SRCuO2 and SRRuO3 on PZT, including read/write operations using a scanning probe on submicron scales. The origin of the colossal magneto-resistance in the maganites was also clarified. The transient nonlinear dynamics of series arrays of Josephson junctions operating as a large-signal output amplifier between superconducting electronics and conventional semiconductor circuits were analyzed and practical design issues identified.

DTIC

Ferroelectric Materials; Superconductivity; Lead Zirconate Titanates; YBCO Superconductors; Nonlinearity; Josephson Junctions; Semiconductors (Materials)

19980203640 Washington Univ., Seattle, WA USA

Fabrication of AlN Thin Film Substrates by 'Van Der Waals Lift-Off Technique' ***Final Report, 1 Feb. 1995 - 31 Jan. 1998***

Ohuchi, Fumio S., Washington Univ., USA; Apr. 29, 1998; 51p; In English

Contract(s)/Grant(s): F49620-95-1-0142; AF Proj. 2305/ES

Report No.(s): AD-A343699; AFRL-SR-BL-TR-98-0426; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The goal of the project was to develop a method to fabricate a free aluminum nitride (AlN) thin films. This was developed by growing AlN thin films on top of layered tungsten sulfide (WS2) thin films which were deposited on a mechanically rigid substrate material such as Si and Al2O3, followed by mechanical separation of AlN thin films thorough the inter-layers of WS2. This project involved the design and construction of a cold wall metal organic chemical vapor deposition (MOCVD) for WS2 thin films, and the AlN thin film deposition by atomic layer growth (ALG) process. WS2 thin films were deposited using the reaction of H2S with W(CO)6. Microstructure for WS2 thin films is generally characterized by the formation of crystallites with basal planes parallel to the interface for the first few tens of nanometers, followed by the formation of crystallites with their basal planes non-parallel to the substrate. Process conditions to grow AlN thin films via ALG using dimethylamine-alane (DMEAA) and ammonia (NH3) were investigated. Close proximity of the lattice constant of WS2 to those of AlN lead to a potential application of this materials as a substrate for subsequent growth of AlN, however, the lift-off process was severely dependent on the microstructure of WS2 interlayers.
DTIC
Thin Films; Fabrication; Substrates; Van Der Waals Forces; Aluminum Nitrides; Atomic Layer Epitaxy

19980203685 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
An X-ray photoelectron spectroscopic study of the B-N-Ti system
Seal, S., California Univ., Lawrence Berkeley Lab., USA; Barr, T. L., Wisconsin Univ., USA; Sobczak, N., Foundry Research Inst., Poland; Benko, E., Institute of Metal Cutting, Poland; Morgiel, J., Polish Academy of Sciences, Poland; Mar. 1997; 9p; In English, 31 Mar. - 4 Apr. 1997, San Francisco, CA, USA
Contract(s)/Grant(s): DE-AC03-76SF-00098
Report No.(s): LBNL-40396; LSBL-384; CONF-970302-19; DE97-007896; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Composite nitrides (such as BN, TiN) are widely used in various industrial applications because of their extreme wear and corrosion resistance, thermal and electrical properties. In order to obtain composite materials with these optimal properties, it is important to elucidate whether any chemical reactions occur at nitride/metal interfaces, e.g., those involving BN-Ti/TiN. Materials of interest include the deposition by PVD of Ti and TiN on BN substrates. Some of these systems were then subjected to varying degrees of physical and thermal alteration. Detailed X-ray photoelectron spectroscopy (XPS) has therefore been rendered of these interfaces using cross-sectional display and sputter etching. Resulting structural and morphological features have been investigated with Transmission Electron Microscopy (TEM) and X-ray diffraction (XRD). Diffusion of the nitridation, oxynitride formation and interfacial growth are of general interest.
DOE
Boron Nitrides; Photoelectron Spectroscopy; Titanium Nitrides; X Ray Spectroscopy; Corrosion Resistance; Deposition

19980203740 Argonne National Lab., IL USA
Solution spectroelectrochemical cell for in situ X-ray absorption fine structure
Antonio, M. R., Argonne National Lab., USA; Soderholm, L., Argonne National Lab., USA; Song, I., Case Western Reserve Univ., USA; Jun. 12, 1995; 24p; In English
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/CHM/PP-86827; DE97-008532; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A purpose-built spectroelectrochemical cell for in situ fluorescence XAFS (X-ray Absorption Fine Structure) measurements of bulk solution species during constant-potential electrolysis is described. The cell performance was demonstrated by the collection of europium L(sub 3)-edge XANES (X-ray Absorption Near Edge Structure) throughout the course of electrolysis of an aqueous solution of EuCl3.6H2O in 1 M H2SO4. The europium L(sub 3)-edge resonances reported here for the Eu(III) and Eu(II) ions demonstrate that their 2p(sub 3/2) yields 5d electronic transition probabilities are not the same.
DOE
Absorption Spectroscopy; Aqueous Solutions; Electrochemical Cells; Electrolysis; Europium Compounds; X Ray Absorption; X Ray Spectroscopy

19980203861 Oak Ridge National Lab., TN USA
Solubility of, and hydrogen ion adsorption on, some metal oxides in aqueous solutions to high temperatures
Palmer, D. A., Oak Ridge National Lab., USA; Benezeth, P., Oak Ridge National Lab., USA; Wesolowski, D. J., Oak Ridge National Lab., USA; Anovitz, L. M., Oak Ridge National Lab., USA; Machesky, M. L., Illinois State Water Survey, USA; Hayashi, Ken-Ichiro, Tohoku Univ., Japan; Hyde, K. E., State Univ. of New York, USA; [1997]; 15p; In English; 5th; Cycle Chemistry

In Fossil Plants, 10-12 Jun. 1997, Charlotte, NC, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-970623-1; DE97-008238; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Solubility of boehmite (AlOOH), ferrous hydroxide (Fe(OH)2)/magnetite (Fe3O4), zincite (ZnO), and brucite (Mg(OH)2) were measured over a range of temperatures (AlOOH, 100-290 C; Fe(OH)2/Fe3O4, 100-250 C; ZnO, 50-290 C; Mg(OH)2, 60-200 C) using in situ pH measurements. A hydrogen-electrode concentration cell was used; the pH range depended on the oxide. The solubility results for boehmite mainly demonstrate the method viability, while those for zincite are mainly restricted to mildly acidic to neutral pH where Zn(sup 2+) predominates in solution. The magnetite (presumably coated with Fe(OH)2) solubilities extend from pHs greater than 5 and, because of relevance to water/steam cycles of power plants, are compared in detail with previous studies. The same cell was used to investigate the surface adsorption-desorption thermodynamics of H ions on rutile (TiO2) and zincite to 290 C. Behavior of pH at zero-point-of-charge as function of temperature and application of the Stern-3-layer model were determined for this solid. The zincite study is still incomplete; preliminary results show trends that can be rationalized only qualitatively now with the zero- point-of-charge being apparently affected by hydration of the surface in basic solutions and specific adsorption of Na ions under the same conditions.
DOE
Metal Oxides; High Temperature; Solubility; Hydrogen Ions; Adsorption; Aluminum Oxides

19980203869 Los Alamos National Lab., NM USA
Characterizing the dealumination of environmentally relevant zeolites using IR, NMR and neutron diffraction techniques
Paffett, M. T., Los Alamos National Lab., USA; Szanyi, J., Los Alamos National Lab., USA; Jacubinas, R. M., Los Alamos National Lab., USA; Ott, K. C., Los Alamos National Lab., USA; VonDreele, R., Los Alamos National Lab., USA; Hughes, C. D., Los Alamos National Lab., USA; Earl, W. L., Los Alamos National Lab., USA; [1997]; 9p; In English; 7th; Catalyst Deactivation, 7-11 Oct. 1997, Cancun, Mexico
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-765; CONF-971058-1; DE97-007177; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Results of characterization studies monitoring the sequential chemical bond breaking events, local site symmetry, and long range structural modifications of specific zeolites (H-ZSM-5, TS-1) during hydrothermal treatment of these catalyst materials are described. These characterization techniques include infrared spectroscopy of selected probe molecules, magic angle spinning NMR spectroscopy, and powder neutron diffraction. Information regarding selected examples from each of these techniques is presented and the inherent strengths of each is discussed. The experimental insight into the chemical and structural modifications of high surface area microporous catalyst materials as a function of deactivation conditions (hydrothermal conditioning) is highlighted.
DOE
Chemical Bonds; Deactivation; Zeolites; Metallizing; Monitors; Broken Symmetry; Neutron Diffraction

19980203871 Los Alamos National Lab., NM USA
Seventh International Conference on Time-Resolved Vibrational Spectroscopy
Dyer, R. B., Compiler, Los Alamos National Lab., USA; Martinez, M. A .D., Compiler, Los Alamos National Lab., USA; Shreve, A., Compiler, Los Alamos National Lab., USA; Woodruff, W. H., Compiler, Los Alamos National Lab., USA; Apr. 1997; 354p; In English; 7th; Time-Resolved Vibrational Spectroscopy, 11-16 Jun. 1995, Santa Fe, NM, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-13290-C; CONF-9506172; DE97-006919; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The International Conference on Time-Resolved Vibrational Spectroscopy (TRVS) is widely recognized as the major international forum for the discussion of advances in this rapidly growing field. The 1995 conference was the seventh in a series that began at Lake Placid, New York, 1982. Santa Fe, New Mexico, was the site of the Seventh International Conference on Time-Resolved Vibrational Spectroscopy, held from June 11 to 16, 1995. TRVS-7 was attended by 157 participants from 16 countries and 85 institutions, and research ranging across the full breadth of the field of time-resolved vibrational spectroscopy was presented. Advances in both experimental capabilities for time-resolved vibrational measurements and in theoretical descriptions of time-resolved vibrational methods continue to occur, and several sessions of the conference were devoted to discussion of these advances and the associated new directions in TRVS. Continuing the interdisciplinary tradition of the TRVS meetings, applications of time-

resolved vibrational methods to problems in physics, biology, materials science, and chemistry comprised a large portion of the papers presented at the conference.
DOE
Conferences; Vibration; Molecules; Spectroscopy; Vibration Effects; Time Functions

19980203875 Argonne National Lab., IL USA
Recent advances in magnetic resonance microscopy to the physical structure characterization of carbonaceous and inorganic materials
Gregory, D. M., Argonne National Lab., USA; Gerald, R. E., Argonne National Lab., USA; Cody, G. D., Argonne National Lab., USA; Botto, R. E., Argonne National Lab., USA; 1997; 9p; In English; 213th, 13-17 Apr. 1997, San Francisco, CA, USA
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/CHM/CP-91358; CONF-970443-17; DE97-004691; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
Magnetic Resonance Microscopy (MRM) techniques have been employed to study the molecular architectures and properties of structural polymers, fossil fuels, microporous carbons and inorganic catalysts.
DOE
Molecular Dynamics; Porous Materials; Carbon; Carbonaceous Materials; Microstructure; Ferroelectric Materials

19980203899 Alabama Univ., Research Administration, Huntsville, AL USA
Combustion Diagnostics and Flow Visualization of Hypergolic Combustion and Gelled Mixing Behavior
Feikema, Douglas A., Alabama Univ., USA; Smith, James, Alabama Univ., USA; Dec. 19, 1997; 17p; In English
Contract(s)/Grant(s): DAAH04-94-G-0265
Report No.(s): AD-A344468; ARO-33155.3-EG-DPS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The combustion of Hypergolic bipropellants in missile systems where the oxidizer and fuel are gelled involve important areas of research: ignition time delay, chemical kinetics, atomization, and liquid phase mixing. Measurements of the total ignition time delay for Hydrazine and Red Fuming Nitric Acid (RFNA) and UDMH/RFNA have been accurately measured using a droplet contact technique. The results show the effect of fuel/oxidizer ratio an the total ignition time delay involves initial contact, quiescent mixing in the liquid phase, gas evolution and combustion in the vapor phase. The liquid phase mixing and the gas evolution comprise the most significant fraction of the total ignition time delay in comparison to the chemical ignition time delay.
DTIC
Flow Visualization; Combustion; Diagnosis; Gels; Hypergolic Rocket Propellants; Gelled Rocket Propellants

19980203902 Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD USA
Applications of a High Pressure Soxhlet Extractor Using Liquid CO2 for the Extraction of Organic Phosphonates from Solid Adsorbents ***Final Report, Aug. 1993 - Sep. 1997***
Pleva, Stephen G., Edgewood Research Development and Engineering Center, USA; Ellzy, Michael W., Edgewood Research Development and Engineering Center, USA; Mar. 1998; 25p; In English
Contract(s)/Grant(s): Proj. 10162622A553
Report No.(s): AD-A344480; ERDEC-TR-482; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The feasibility and efficiency of extraction of various organic phosphonates from different adsorbents was studied using a soxhlet extractor enclosed in a stainless steel canister. Liquid CO2 was used as the solvent The CO2 was introduced into the sealable cylinder, and the entire unit was pressurized by vaporizing the CO2 with slight heating, and condensing the vaporized CO2 on a cold finger.
DTIC
Carbon Dioxide; Organic Phosphorus Compounds; Organic Chemistry; Charcoal; Polymers; Triethyl Compounds; High Pressure; Adsorbents; Organic Solids; Solvents

19980203905 Dayton Univ., Research Inst., OH USA
Advanced Fuel Development and Fuel Combustion ***Final Report, 1 Jun. 1992 - 1 Jun. 1997***
Swartzbaugh, Joseph, Dayton Univ., USA; Aug. 1997; 46p; In English
Contract(s)/Grant(s): F33615-92-C-2218; AF Proj. 3048
Report No.(s): AD-A344488; WL-TR-97-2084; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This final report summarizes the efforts performed over the last five years on Contract F336l5-92-C-22l8. This report represents a collection of research programs, varying broadly in size and complexity with many authors and principal investigators.

The objective of this task order contract was to support long-term basic and applied research for problems related to aviation turbine fuels and related materials and combustion of these fuels in advanced systems. Some research and development efforts aimed at evaluating advanced lubricants and lubrication systems were also performed in this contract.
DTIC
Research Management; Fuel Combustion; Aircraft Fuels

19980203920 Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD USA
Experimental Measurement of Flow Rates for a Dry Aerosol Flow Cell ***Final Report, 1-31 Aug. 1997***
Wong, Anna, Edgewood Research Development and Engineering Center, USA; Mar. 1998; 19p; In English
Report No.(s): AD-A343472; ERDEC-TR-485; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This technical report describes the design and testing of a dry aerosol cell. It includes a description of a cell that was made from commercially available components and the experimental procedures for measuring the proper flow rate to confine a stream of dry aerosol particles.
DTIC
Flow Measurement; Dry Cells; Design Analysis; Performance Tests

19980203921 New Orleans Univ., Dept. of Chemistry, LA USA
A Comparative Analysis of Hartree-Fock and Kohn-Sham Orbital Energies
Politzer, Peter, New Orleans Univ., USA; Abu-Awwad, Fakher, New Orleans Univ., USA; Apr. 27, 1998; 15p; In English
Contract(s)/Grant(s): N00014-97-1-0066
Report No.(s): AD-A343475; TR-106; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Hartree-Fock and Kohn-Sham orbital energies, the latter computed with several different exchange correlation functionals are compared and analyzed for twelve molecules. The Kohn-Sham energies differ significantly from experimental ionization energies, but by amounts that are, for a given molecule and exchange correlation functional, roughly the same for all of the valence orbitals. With the exchange correlation functionals used, the energy of the highest occupied Kohn-Sham orbital does not approximate the corresponding ionization potential any better than do the other orbital energies.
DTIC
Ionization Potentials; Hartree Approximation; Computation; Orbitals

19980203972 Los Alamos National Lab., NM USA
Isentropic compression of argon
Veeser, L. R., Los Alamos National Lab., USA; Ekdahl, C. A., Los Alamos National Lab., USA; Oona, H., Los Alamos National Lab., USA; Jun. 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-97-2342; CONF-9706113-18; DE97-008669; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche
The compression was done in an MC-1 flux compression (explosive) generator, in order to study the transition from an insulator to a conductor. Since conductivity signals were observed in all the experiments (except when the probe is removed), both the Teflon and the argon are becoming conductive. The conductivity could not be determined (Teflon insulation properties unknown), but it could be bounded as being sigma = 1/rho less than or equal 8 (Omega-cm)(exp -1), because when the Teflon breaks down, the dielectric constant is reduced. The Teflon insulator problem remains, and other ways to better insulate the probe or to measure the conductivity without a probe is being sought.
DOE
Argon; Compressing; Conductors; Electrical Resistivity; Compressibility Effects

19980204000 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany
Rotational and Vibrational Temperature and Density Measurements by Planar Laser Induced NO-Fluorescence Spectroscopy in a Nonequilibrium High Enthalpy Flow
Koch, U., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Guelhan, A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Esser, B., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Grisch, F., Office National d'Etudes et de Recherches Aerospatiales, France; Bouchardy, P., Office National d'Etudes et de Recherches Aerospatiales, France; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

LIF experiments were performed in the flow field of the high enthalpy facility L2K. This arc heated facility, which is mainly used for testing thermal protection materials, offers a wide choice of flow conditions to simulate the stagnation conditions during shuttle re-entry. The flow conditions are dominated by non equilibrium effects. For the operation conditions of L2K, translational and rotational temperature are assumed to be in equilibrium, but large differences between rotational, vibrational, and electronic temperature occur. Laser induced fluorescence is used to determine rotational and vibrational temperature and the density of NO in the free stream and behind a bow shock upstream of a blunt body. The flow is modelled numerically using a quasi 1D-code. Good agreement is achieved between the experimental and numerical data in the free stream. The data are also compared with the CARS measurements performed at the same flow conditions in the same facility. Differences in the free stream vibrational temperature of N2 and NO are due to the faster vibrational relaxation of NO-molecules.
Author
Reentry Shielding; Thermal Protection; Density Measurement; Reentry Vehicles; Vibration

19980204691 Lawrence Livermore National Lab., Livermore, CA USA
Two new methods for simulating photolithography development in 3D
Helmsen, J., Lawrence Livermore National Lab., USA; Colella, P., Lawrence Livermore National Lab., USA; Dorr, M., Lawrence Livermore National Lab., USA; Puckett, E. G., California Univ., USA; Jan. 30, 1997; 12p; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-ID-126403; DE97-053437; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Two methods are presented for simulating the development of photolithographic profiles during the resist dissolution phase. These algorithms are the volume-of-fluid algorithm, and the steady level-set algorithm. They are compared with the ray-trace, cell, and level-set techniques employed in SAMPLE-3D. The volume-of-fluid algorithm employs an Euclidean Grid with volume fractions. At each time step, the surface is reconstructed by computing an approximation of the tangent plane of the surface in each cell that contains a value between 0 and 1. The geometry constructed in this manner is used to determine flow velocity vectors and the flux across each edge. The material is then advanced by a split advection scheme. The steady Level Set algorithm is an extension of the Iterative Level Set algorithm. The steady Level Set algorithm combines Fast Level Set concepts and a technique for finding zero residual solutions to the ( ) function. The etch time for each cell is calculated in a time ordered manner. Use of heap sorting data structures allows the algorithm to execute extremely quickly. Comparisons of the methods have been performed and results shown.
DOE
Algorithms; Concentration (Composition); Dissolving; Masking

19980204720 Factory Mutual Research Corp., Norwood, MA USA
Critical Mass Pyrolysis Rates for Extinction in Fires Over Solid Materials
Delichatsios, M. A., Factory Mutual Research Corp., USA; Apr. 1998; 52p; In English
Report No.(s): PB98-146137; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

New flame extinction conditions for the critical mass pyrolysis rate are developed when extinction occurs by interaction of flames with the pyrolyzing surface of a condensed material. The extinction conditions provide the critical mass pyrolysis rate and the corresponding convective heat flux to the surface. A novel chemistry based formulation for extinction is provided which shows that the sum of fuel mass fraction near the surface and the ambient oxygen mass fraction (corrected for stoichiometry and combustion efficiency) is constant. The extinction conditions are derived from simple analysis of combustion and heat transfer, and they are shown to be applicable for various experimental conditions such as fuel dilution by inert gas, oxygen dilution by inert gas, effects of external heat flux, material preheating, transient (charring) pyrolysis, including geometric effects which influence the critical mass pyrolysis rate through an effective heat transfer coefficient. Additional validation of the proposed extinction conditions is provided by numerical simulation reported in literature in the regime of low straining rates for a stagnation flow on a cylinder. The present approach can be used to measure critical extinction conditions in a flammability apparatus and allow them to be applied in other conditions such as in microgravity.
NTIS
Pyrolysis; Fires; Burning Rate; Critical Mass; Extinction; Technologies; Fire Fighting; Solid Phases

19980205596 California Univ., Dept. of Physics, Riverside, CA USA
Etching Chemistry of III-V Semiconductors and the Development of Surface Roughness ***Final Report, 29 Sep. 1994 - 29 Sep 1997***
Yarmoff, Jory A., California Univ., USA; Feb. 13, 1998; 9p; In English

Contract(s)/Grant(s): DAAH04-94-G-0410
Report No.(s): AD-A344525; ARO-32572.10-PH; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This research addresses the need for fundamental information concerning halogen etching of III-V semiconductors. The reactions of halogens with semiconductor surfaces are the fundamental chemical interactions in processes employed for device manufacture. In this work, the reactions of XeF2, Cl2 and I2 with III-V semiconductor surfaces were investigated with synchrotron-based soft x-ray photoelectron spectroscopy, low energy electron diffraction and scanning tunneling microscopy. Fluorine reaction grows films of group III fluorides, which can be used as dielectric materials. Chlorine is the most widely used halogen for dry etching, while iodine has been proposed for use as a ”gentle” etchant. We found that, for all of the halogen reactions, the initial adsorption depends on the surface reconstruction, stoichiometry and condition. Some surfaces passivate, while others spontaneously etch at room temperature. The passivated surfaces are well-ordered and covered with approximately one monolayer of adsorbed halogen. The etched surfaces, on the other hand, are considerably rough and atomically disordered. A microscopic model is proposed which assumes that halogen atoms preferentially adsorb onto a group III atom if the surface is initially well-ordered. This microscopic model can explain why certain surfaces etch, while others form ordered overlayers.
DTIC
Surface Roughness; Etching; Chemical Reactions; Halogens; Surface Roughness Effects

19980205704 Pennsylvania State Univ., University Park, PA USA
Carbon deposition and deactivation of metallic catalysts ***Final Report***
Baker, R. T. K., Pennsylvania State Univ., USA; [1997]; 13p; In English
Contract(s)/Grant(s): DE-FG02-93ER-14358
Report No.(s): DOE/ER/14358-T1; DE97-009405; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Attention in this project has been focused on the following: the effect of selected metal adatoms on the carbon deposition characteristics of iron and cobalt during interaction with hydrocarbons; the influence of selected non-metallic adatoms on the carbon formation activity of both these metals when treated in hydrocarbons; and the relationship between the structural and morphological characteristics of the carbon deposits and that of the modified metal particles.
DOE
Carbon; Deposition; Deactivation; Catalysts; Cobalt; Iron; Time Dependence; Surface Properties

19980205828 Duke Univ., Dept. of Chemistry, Durham, NC USA
Nanocrystalline Aluminum Nitride and Aluminum/Gallium Nitride Nanocompositesvia Transamination of M(NMe2)32, M = Al, Al/Ga (1/1)
Janik, J. F., Duke Univ., USA; Wells, R. L., Duke Univ., USA; Coffer, J. L., Duke Univ., USA; St. John, J. V., Duke Univ., USA; Pennington, W. T., Duke Univ., USA; May 23, 1998; 35p; In English
Report No.(s): AD-A345603; DU/DC-TR-75; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Reactions of Al(NMe2)32 with NH3, mimicking the case of the related Ga-derivative, provided an Al-amide-imide precursor that was pyrolyzed to pure nanocrystalline AlN. Based on that chemistry, a mixed Al/Ga precursor system was designed to lead to the bimetallic nitride composites. A prototype study included equilibration in hexane or toluene of the dimers M(NMe2)32, M = Al, Ga, which resulted in the formation of homoleptic four-membered ring compound (Me2N)2Al(mu-NMe2)2Ga(NMe2)2. Crystalline M(NMe2)32, M = Al/Ga (1/1), obtained from this equilibration was structurally characterized. Transamination/deamination reactions carried out with liquid NH3 in the pre-equilibrated bimetallic system M(NMe2)32/Ga(NMe2)32, Al/Ga = 1/1, resulted in the mixed M-amide-imide precursors that were converted at 700 to 1100 deg C to aluminum/gallium nitride nanocomposite materials. The nature of these bulk nanocomposites has been elucidated by XRD, TEM/EDS, IR, and PL techniques.
DTIC
Aluminum Compounds; Nitrides; Composite Materials; Gallium Compounds

19980206003 Instituto Superior Tecnico, Dept. of Mechanical Engineering, Lisbon, Portugal
On the Aerothermochemistry of Recirculating Premixed Flames With and Without Swirl
Duarte, D., Instituto Superior Tecnico, Portugal; Ferrao, P., Instituto Superior Tecnico, Portugal; Heitor, M. V., Instituto Superior Tecnico, Portugal; Advanced Non-Intrusive Instrumentation for Propulsion Engines; May 1998; 12p; In English; Also announced as 19980206002
Contract(s)/Grant(s): CEC-CT-95-0106; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes recent progress in the analysis of the nature of turbulent premixed flames stabilised behind an axisymmetric baffle, which are of fundamental interest in the development of new and cleaner propulsion combustion systems. The work

includes the use of laser-based diagnostics for velocity and temperature measurements, which are extended to the analysis of turbulence statistics, including the energy spectrum and typical length scales in a reacting shear layer. The results provided experimental evidence of the extension of the flamelet regime beyond the Klimov-Wiliams criterion. Arguments based on the shape of the weighted joint probability distributions of axial velocity and temperature fluctuations show that the counter-gradient nature of heat flux is derived from large departures from the local mean values. The influence of swirl in strongly sheared disc-stabilised flames is analysed and the results obtained show that swirl attenuates the rate of turbulent heat transfer due to the decrease of the temperature gradients across the reacting zone, but does not alter the existence of a large zone of flame characterized by non-gradient scalar fluxes.
Author
Aerothermochemistry; Premixed Flames; Turbulent Wakes; Temperature Measurement; Velocity Measurement; Turbulent Flames; Baffles; Turbulent Combustion

19980206004 Instituto Superior Tecnico, Mechanical Engineering Dept., Lisbon, Portugal
The Simultaneous Measurements of Velocity, Pressure, Temperature, and Heat Release in an Oscillating Flame
Fernandes, E. C., Instituto Superior Tecnico, Portugal; Heitor, M. V., Instituto Superior Tecnico, Portugal; Advanced Non-Intrusive Instrumentation for Propulsion Engines; May 1998; 12p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Optical and probe techniques are used for the analysis of the coupling mechanisms between pressure, velocity, and heat release fluctuations typical of pulsed flames, through the combination of laser velocimetry, digitally-compensated thermocouples, chemiluminiscent emissions of free radicals in the flames, and the pressure oscillations upstream flows. The results quantify the periodic nature of the mixing process and characterize the momentum and heat flux fluctuations along a cycle of oscillation.
Author
Pressure Oscillations; Turbulent Combustion; Pressure Measurement; Temperature Measurement; Velocity Measurement; Turbulent Flames; Flame Stability; Oscillating Flow

19980206010 Reading Univ., Dept. of Physics, UK
Application of FTIR Spectroscopy to Measurement of Gas Turbine Engine Exhaust Emissions
Hilton, M., Reading Univ., UK; Lettington, A. H., Reading Univ., UK; May 1998; 6p; In English; Also announced as 19980206002
Contract(s)/Grant(s): CEC-BRPR-CT96-0142; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Fourier Transform Infrared (FTIR) spectroscopy has been used to study the exhaust emissions from a static Rolls Royce Avon gas turbine engine. The thermal infrared emission from the hot exhaust gases was monitored non-intrusively from a distance of 5 meters using a high spectral resolution FTIR spectrometer fitted with a 16 cm aperture telescope. The gas temperatures were determined by comparing the intensity of the measured saturated CO2 emission band with the radiance of a black body radiation source at known temperatures. CO and CO2 gas concentrations were determined by comparison with modelled spectra taking into account instrument effects. The results were compared with earlier extractive gas analysis and non-intrusive measurements made on the same engine prior to its recent refurbishment. Improvements in the equipment used for non-intrusive measurements and in the analytical procedures have improved the sensitivity and the confidence with which such quantitative measurements may be made.
Author
Exhaust Emission; Gas Turbine Engines; Nonintrusive Measurement; Gas Temperature; Fourier Transformation; Infrared Spectroscopy; Gas Composition; Exhaust Gases

19980206042 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Optical Diagnostics for Cryogenic Liquid Propellants Combustion
Vingert, L., Office National d'Etudes et de Recherches Aerospatiales, France; Habiballah, M., Office National d'Etudes et de Recherches Aerospatiales, France; Gicquel, P., Office National d'Etudes et de Recherches Aerospatiales, France; Brisson, E., Office National d'Etudes et de Recherches Aerospatiales, France; Candel, S., Centre National de la Recherche Scientifique, France; Herding, G., Centre National de la Recherche Scientifique, France; Snyder, R., Centre National de la Recherche Scientifique, France; Scouflaire, P., Centre National de la Recherche Scientifique, France; Rolon, C., Centre National de la Recherche Scientifique, France; Stepowski, D., Centre National de la Recherche Scientifique, France; Cessou, A., Centre National de la Recherche Scientifique, France; Bazile, R., Centre National de la Recherche Scientifique, France; Colin, P., Centre National de la Recherche Scientifique, France; Guerre, S., Centre National de la Recherche Scientifique, France; Pealat, M., Office National d'Etudes et de Recherches Aerospatiales, France; Grisch, F., Office National d'Etudes et de Recherches Aerospatiales, France; Bouchardy,

P., Office National d'Etudes et de Recherches Aerospatiales, France; May 1998; 12p; In English; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Detailed experimental studies of cryogenic propellant combustion are needed to improve design and optimization of high performance liquid rocket engines. A test facility called MASCOTTE has been built up by ONERA to study elementary processes (atomization, droplet vaporization, turbulent combustion...) that are involved in the combustion of liquid oxygen (LOX) and gaseous hydrogen (GH2). This article reports results from experiments carried-out on MASCOTTE under a consortium of laboratories and manufacturers associating ONERA, CNRS, CNES and SEP, on the jet flame issued from a single coaxial injector. This device fed with liquid oxygen and gaseous hydrogen is placed in a chamber equipped with quartz windows. The spray and the flame are observed with a set of optical methods: high speed cinematography, light emission from OH radicals, laser induced fluorescence of OH and O2, and elastic scattering from the LOX jet. These techniques are used to obtain images of the spray and of the flame zone. It is then possible to deduce the flame location with respect to the liquid jet from simultaneous elastic scattering of the LOX jet and LIF of OH measurements or from average emission images treated with Abel's transform. The images obtained by exciting the fluorescence of O2 provide complementary information on the flame shape and they may be used to estimate the local reaction rate. Quantitative temperature measurements based on Coherent Anti-Stokes Raman Scattering from H2 and LOX droplets size and velocity measurements by means of a Phase Doppler Particle Analyzer give additional clues on the spray and the combustion zone.

Author

Cryogenic Rocket Propellants; Liquid Propellant Rocket Engines; Propellant Combustion; Turbulent Combustion; Injectors; Optical Measuring Instruments; Liquid Rocket Propellants; Jet Flow; Liquid Oxygen; Hydrogen; Flames

19980206046 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Propulsion Technology, Cologne, Germany

Using the Laser Light Sheet Technique in Combustion Research

Voigt, P., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Schodl, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A two dimensional Mie-Scattering technique has been optimised for concentration measurements inside isothermal mixing fields. A couple of corrections will be given, some of which concern the optical setup, others can only be computational. A detailed description of an algorithm for extinction correction is demonstrated for arbitrary particle distributions.

Author

Gas Mixtures; Turbulent Combustion; Concentration (Composition); Optical Measuring Instruments; Light Beams; Mie Scattering; Nonintrusive Measurement; Combustion Chambers

19980206097 Duke Univ., Dept. of Chemistry, Durham, NC USA

Reactions of H3Al NMe3 with E(SiMe3)3 (E = P, As). Structural Characterization of the Trimer H2AlP(SiMe3)23 and Base-Stabilized Adduct H2AlAs(SiMe3)2 NMe3, and Their Thermal Decomposition Toward Nanocrystalline AlP and AlAs, Respectively

Janik, J. F., Duke Univ., USA; Wells, R. L., Duke Univ., USA; White, P. S., North Carolina Univ., USA; May 23, 1998; 28p; In English; Prepared in collaboration with the University of North Carolina at Chapel Hill, Dept. of Chemistry, Chapel Hill, NC

Contract(s)/Grant(s): N00014-95-1-0194

Report No.(s): AD-A345462; DU/DC/TR-76; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dehydrosilylation reactions in diethyl ether between H3Al.NMe3 and E(SiMe3)3 afforded for E = P a high yield of the trimer H2AlP(SiMe3)23 (1) while for E = As a monomeric base-stabilized adduct H2AlAs(SiMe3)2.NMe3 (2) as well as its degradation solid product were obtained. No reaction occurred for E = N. The single-crystal X-ray structure determination for 1 yielded a planar six-membered ring of alternating four-coordinated Al and P centers. The structural solution for 2 revealed the monomeric unit H2AlAs(SiMe3)2 stabilized by coordination of NMe3 at the Al-site. Pyrolysis of 1 at 450 deg C promoted further dehydrosilylation and yielded a product which by XRD spectroscopy showed the onset of AlP crystallinity while at 950 deg C afforded nanocrystalline AlP with 5 nm average particle size. Pyrolysis of 2 at 450 deg C resulted in the formation of nanocrystalline AlAs with 2 nm average particle size. Under applied pyrolysis conditions for 1 and 2, the target elimination-condensation pathwayvia dehydrosilylation was accompanied by other decomposition side reactions and retention of some contaminant residues.

DTIC

Nitrogen; Hydrogen; Silicon; Chemical Reactions; Phosphides; Aluminum Arsenides; Methyl Compounds; Structural Reliability; Elimination

19980206098 Duke Univ., Dept. of Chemistry, Durham, NC USA

Lithium Pnictidoaluminates (Et2O)2LiMU-E(SiMe3)22AlH2 (E = P, As) - New Mixed-Metal Pnicogen-Bridged Four-Memhered Ring Compounds

Janik, J. F., Duke Univ., USA; Wells, R. L., North Carolina Univ., USA; White, P. S., North Carolina Univ., USA; May 23, 1998; 22p; In English; Prepared in collaboration with the University of North Carolina at Chapel Hill, Chapel Hill, NC. Accepted for publication in Organometallics,

Contract(s)/Grant(s): N00014-95-1-0194

Report No.(s): AD-A345467; DU/DC/TR-74; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The lithium pnictidoaluminates, (Et2O)2LiMU-E(SiMe3)22AlH2, E = P (1), As (2), were obtained from the reactions between LiAlH4 and E(SiMe3)3 in diethyl ether following dehydrosilylation chemistry described earlier by us for related gallium derivatives. No reaction was detected for E = N. Single-crystal X-ray diffraction studies for 1 and 2 provided the isomorphous structural solutions featuring the planar four-membered (LiMU-E2Al) cores.

DTIC

Single Crystals; Hydrogen; Aluminum; Silicon; Lithium Compounds; Methyl Compounds; Ethylene Compounds

19980206171 Auburn Univ., Mechanical Engineering Dept., AL USA

Thermal Model of the Promoted Combustion Test

Jones, Peter D., Auburn Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Flammability of metals in high pressure, pure oxygen environments, such as rocket engine turbopumps, is commonly evaluated using the Promoted Combustion Test (PCT). The PCT emphasizes the ability of an ignited material to sustain combustion, as opposed to evaluating the sample's propensity to ignite in the first place. A common arrangement is a rod of the sample material hanging in a chamber in which a high pressure, pure oxygen environment is maintained. An igniter of some energetically combusting material is fixed to the bottom of the rod and fired. This initiates combustion, and the sample burns and melts at its bottom tip. A ball of molten material forms, and this ball detaches when it grows too large to be supported by surface tension with the rod. In materials which do not sustain combustion, the combustion then extinguishes. In materials which do sustain combustion, combustion re-initiates from molten residue left on the bottom of the rod, and the melt ball burns and grows until it detaches again. The purpose of this work is development of a PCT thermal simulation model, detailing phase change, melt detachment, and the several heat transfer modes. Combustion is modeled by a summary rate equation, whose parameters are identified by comparison to PCT results. The sensitivity of PCT results to various physical and geometrical parameters is evaluated. The identified combustion parameters may be used in design of new PCT arrangements, as might be used for flammability assessment in flow-dominated environments. The Haynes 214 nickel-based superalloy, whose PCT results are applied here, burns heterogeneously (fuel and oxidizer are of different phases; combustion takes place on the fuel surface). Heterogeneous combustion is not well understood. (In homogeneous combustion, the metal vaporizes, and combustion takes place in an analytically treatable cloud above the surface). Thermal modeling in heterogeneous combustion settings provides a means for linking test results more directly to detailed combustion mechanics, leading to improved data analysis, and improved understanding of heterogeneous combustion phenomena. Author

Combustion Physics; Thermal Simulation; Heterogeneity; High Pressure Oxygen; Metal Combustion; Mathematical Models

19980206180 Alabama Univ., Dept. of Chemical and Materials Engineering, Huntsville, AL USA

Relationship Between Equilibrium Forms of Lysozyme Crystals and Precipitant Anions

Nadarajah, Arunan, Alabama Univ., USA; Oct. 1996; 12p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Molecular forces, such as electrostatic, hydrophobic, van der Waals and steric forces, are known to be important in determining protein interactions. These forces are affected by the solution conditions and changing the pH, temperature or the ionic strength of the solution can sharply affect protein interactions. Several investigations of protein crystallization have shown that this process is also strongly dependent on solution conditions. As the ionic strength of the solution is increased, the initially soluble protein may either crystallize or form an amorphous precipitate at high ionic strengths. Studies done on the model protein hen egg white lysozyme have shown that different crystal forms can be easily and reproducibly obtained, depending primarily on the anion used to desolubilize the protein. In this study we employ pyranine to probe the effect of various anions on the water structure. Additionally, lysozyme crystallization was carried out at these conditions and the crystal form was determined by X-ray crystallography. The goal of the study was to understand the physico-chemical basis for the effect of changing the anion concentration on the equilibrium form of lysozyme crystals. It will also verify the hypothesis that the anions, by altering the bulk water structure in the

crystallizing solutions, alter the surface energy of the between the crystal faces and the solution and, consequently, the equilibrium form of the crystals.
Derived from text
Lysozyme; Crystals; Anions; Protein Crystal Growth; Electrostatics; Proteins; Amorphous Materials

19980206295 Sandia National Labs., Albuquerque, NM USA
Oriented inorganic thin film channel structures with uni-directional monosize micropores
Cesarano, J., III, Sandia National Labs., USA; Sasaki, D. Y., Sandia National Labs., USA; Singh, S., Sandia National Labs., USA; Brinker, C. J., Sandia National Labs., USA; Oct. 1997; 21p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2397; DE98-001088; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The goal of this project was to develop a novel technology that may be used to eventually manufacture a new generation of inorganic membranes and sensors with oriented, unidirectional monosized pores. The premise is that very thin membranes with oriented channels as pores will have a high flux in addition to being highly selective. Applications include: (1) gas separation membranes for oxygen enrichment, partial oxidation, dehydrogenation, and purification of natural gas; (2) refractory catalytic membrane reactors; and (3) molecular recognition sensors. The methodology for making such membranes was to combine Langmuir - Blodgett (LB) technology with sol-gel chemistry to engineer pore channels within the range 3 to 20 K The channel structure was fabricated of amorphous SiO(sub 2) because of its good thermal, chemical, and mechanical stability. Our approach was to use LB techniques to uniformly place organic molecular spacers throughout a thin silica precursor matrix and apply this film to a substrate. LB films of solid solutions of commercially available silane amphiphiles and organic amphiphiles were fabricated. The siloxane groups were then hydrolyzed to form silica and the organic portions of the amphiphiles removed by thermal decomposition. With the completely fugitive organic spacer amphiphiles removed, a thin silica film with micropores resulted. The pore size was in the range of 6 - 8 (angstrom) and in an ultra-thin configuration. With further development this technique may be useful for fabrication of inorganic membranes which satisfy all the criteria of the ideal membrane.
DOE
Amorphous Materials; Dehydrogenation; Enrichment; Fabrication; Membranes; Thermal Decomposition; Sol-Gel Processes

19980206367 Illinois Univ., Urbana, IL USA
Selective bond scission during alcohol decomposition on transition metals ***Final Report***
[1997]; 15p; In English
Contract(s)/Grant(s): DE-FG02-91ER-14178
Report No.(s): DOE/ER/14178-T2; DE97-008034; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

This is the final report for a project entitled Selective Bond Scission During Alcohol Decomposition on Transition Metals DEFG-07-91ER14178. The objective of the project was to see to what extent surface structure affected reactions on oxygenates on single crystal surfaces. The project did not make as much progress as expected because of the untimely death of the first postdoc on the project, and some questions about the reliability of the data taken by the second postdoc. Still we examined CO, H(sub 2), methanol, ethylene and ethanol adsorption on Pt(110), Pt(210), Pt(511), Pt(331) and Cu(210). The results showed interesting structural sensitivities. Still, the trends we observed we not at all as we expected, and we do not have a logical continuation. Therefore, we are not continuing the work.
DOE
Alcohols; Decomposition; Transition Metals; Surface Reactions; Crystal Surfaces; Single Crystals

19980206384 Sandia National Labs., Albuquerque, NM USA
Report of work done for technical assistance agreement 1269 between Sandia National Laboratories and the Watkins-Johnson Company: Chemical reaction mechanisms for computational models of SiO2 CVD
Ho, P., Sandia National Labs., USA; Johannes, J., Sandia National Labs., USA; Kudriavtsev, V., Watkins-Johnson Co., USA; Oct. 1997; 29p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2328; DE98-001217; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The use of computational modeling to improve equipment and process designs for chemical vapor deposition (CVD) reactors is becoming increasingly common. Commercial codes are available that facilitate the modeling of chemically-reacting flows, but

chemical reaction mechanisms must be separately developed for each system of interest. One f the products of the Watkins-Johnson Company (WJ) is a reactor marketed to semiconductor manufacturers for the atmospheric-pressure chemical vapor deposition (APCVD) of silicon oxide films. In this process, TEOS (tetraethoxysilane, Si(OC(sub 2)H(sub 5))(sub 4)) and ozone (O(sub 3)) are injected (in nitrogen and oxygen carrier gases) over hot silicon wafers that are being carried through the system on a moving belt. As part of their equipment improvement process, WJ is developing computational models of this tool. In this effort, they are collaborating with Sandia National Laboratories (SNL) to draw on Sandia's experience base in understanding and modeling the chemistry of CVD processes.
DOE
Atmospheric Pressure; Chemical Reactions; Reacting Flow; Reaction Kinetics; Semiconductors (Materials)

26
METALLIC MATERIALS

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

19980203238 Stanford Univ., Dept.of Materials Science and Engineering, Stanford, CA USA
High Temperature Deformation and Fracture Resistance of Single Crystals of NiAl and NiAl-Based Intermetallic Alloys ***Final Report, 1 Feb. 1995 - 31 Jan. 1998***
Nix, William D., Stanford Univ., USA; Dauskardt, Reinhold H., Stanford Univ., USA; Mar. 31, 1998; 28p; In English
Contract(s)/Grant(s): F49620-95-1-0163
Report No.(s): AD-A343693; AFRL-SR-BL-TR-98-0438; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The main objective of this research has been to develop a fundamental understanding of the high temperature deformation, fracture, and fatigue crack growth resistance of single crystals of NiAl and NiAl-based intermetallic alloys. The approach we have taken involves high resolution mechanical property studies of well-characterized and well-oriented single crystals of NiAl containing various alloying elements (Ti, Fe, Zr) in the form of both solid solutions and two phase alloys. Our studies of the high temperature deformation of the solid-solution alloy Ni-Al(Ti) revealed a significant solute strengthening effect which we studied, characterized and modeled. The creep rates for these alloys were observed to be independent of crystal orientation and were as much as three to four orders of magnitude lower than for unalloyed NiAl. We have also studied the unusual creep properties of Ni3Al, a related intermetallic alloy, at intermediate temperatures. We have also conducted the first-ever studies of the cyclic fatigue crack-growth behavior of NiAl single crystals at both room temperature and 800 deg C. Room temperature crack growths ranged over two orders of magnitude from 10-8 to 10-10 m/cycle with a fatigue threshold value DKTH of approximately 2.3 MPaOem. Similar crack growths at 800 C required DK of about 8 MPaOem.
DTIC
Nickel Alloys; Aluminum Alloys; High Temperature; Deformation; Single Crystals; Intermetallics; Fractures (Materials)

19980203339 Virginia Polytechnic Inst. and State Univ., Dept. of Engineering Science and Mechanics, Blacksburg, VA USA
Robust Algorithms for Penetration Mechanics Problems ***Final Report, Dec. 1994 - Dec 1997***
Batra, R. C., Virginia Polytechnic Inst. and State Univ., USA; Feb. 1998; 81p; In English
Contract(s)/Grant(s): DAAH04-95-1-0042
Report No.(s): AD-A344460; ARO-33866.19-EG; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

We have investigated the differences in the performance of identical depleted uranium (DU) and tungsten heavy alloy (WHA) rods when deformed in pure torsion, plane strain compression, and during impact at normal incidence onto a smooth rigid block or a deformable steel target. The thermomechanical response of the material has been modeled by the Johnson Cook relation that accounts for strain and strain rate hardening of the material and its thermal softening. The effect of modeling the thermal softening by a power law rather than the affine function has also been delineated. It is found that shear bands form at a lower value of the nominal strain in the WHA rod as compared to that in the DU rod during torsion, plane strain compression and the Taylor impact test. However, in the penetration test, a propensity of shear bands form in the DU penetrator in the region abutting the target penetrator interface and also in the ejecta where the penetrator particles turn to flow backwards. Fewer shear bands form in the WHA rod and they are smeared out resulting in a uniformly deformed zone of intense plastic deformation. Numerical simulation of a ceramic rod impacting a WHA plate showed that at high speeds a ceramic rod will perforate a WHA plate.
DTIC
Tungsten Alloys; Uranium; Penetration; Algorithms; Rods; Impact Tests; Torsion; Plastic Deformation; Thermodynamics

19980203388 Army Research Lab., Aberdeen Proving Ground, MD USA

The Performance and Deformation Behavior of Oriented Columnar-Grained Tungsten Polycrystalline Penetrators ***Final Report, Jan. 1995 - Nov. 1996***

Magness, Lee S., Army Research Lab., USA; Leonard, Wendy A., Army Research Lab., USA; Kapoor, Deepak, Army Research Lab., USA; Chung, Moon, Army Research Lab., USA; Trogolo, Jeffrey, Army Research Lab., USA; May 1998; 69p; In English; Prepared in cooperation with Niche Microstructural Corp.

Report No.(s): AD-A343621; ARL-TR-1666; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The flow and failure of monocrystalline tungsten penetrators, during the penetration of armor targets, has been shown to be anisotropic. The penetration performances of the single-crystal penetrators were found to be a function of the crystallographic orientation of the penetrator axis. The performance of the 100-oriented tungsten penetrators was roughly equivalent to that of depleted uranium penetrators. In this series of ballistic experiments, the performance and deformation behaviors of polycrystalline tungsten penetrators having oriented columnar grains in 100, 110, or 111 directions were examined.

DTIC

Deformation; Performance Prediction; Tungsten; Polycrystals; Penetration; Anisotropy

19980203436 Los Alamos National Lab., NM USA

The influence of texture and impurities on the mechanical behavior of zirconium

Kaschner, G. C., Los Alamos National Lab., USA; Gray, G. T., III, Los Alamos National Lab., USA; Chen, S. R., Los Alamos National Lab., 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): W-7405-ENG-36

Report No.(s): LA-UR-97-2947; CONF-970707-9; DE97-008294; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Development of physically-based constitutive models capable of simultaneously describing slip, twinning, and anisotropy requires knowledge of the coincident influence of each on mechanical response. The effects of interstitial impurities and texture on twinning in zirconium (Zr), in addition to variations in strain rate and temperature are utilized to probe substructure evolution and mechanical behavior. The compressive yield response of high-purity crystal-bar and commercial-purity Zr was found to depend on the loading orientation relative to the h.c.p. c-axis, the applied strain rate, varied between 0.001 and 3500/s, and the test temperature, varied between 76 and 298K. The rate of strain hardening in Zr is seen to depend on the controlling defect storage mechanism as a function of texture, strain rate, and temperature. The substructure evolution of high-purity Zr was observed to depend on the applied strain rate and test temperature; the substructure of high-purity Zr was seen to display a greater incidence of deformation twinning when deformed at high strain rate or quasi-statically at 76K.

DOE

Zirconium; Anisotropy; Mechanical Properties; Interstitials; Crystals

19980203528 Los Alamos National Lab., NM USA

Magnetic phase diagram of Tb(sub 3)Co

Baranov, N. V., Urals A. M. Gorky State Univ., USSR; Markin, P. E., Urals A. M. Gorky State Univ., USSR; Nakotte, H., Los Alamos National Lab., USA; Lacerda, A., Los Alamos National Lab., USA; [1997]; 5p; In English; ICM 1997, Aug. 1997, Ceutus, Australia; Sponsored in part by the Russian Foundation for Basic Research

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

Report No.(s): LA-UR-97-1396; CONF-970872-1; DE97-007194; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The orthorhombic Tb(sub 3)Co compound exhibits both ferromagnetic and antiferromagnetic behavior below the critical temperature T(sub t) = 72 K as evidenced by metamagnetic transitions along the a- and b-axes and ferromagnetic magnetization process along the c-axis. In the temperature interval between T(sub t) and the Neel temperature T(sub N) = 82 field-induced transitions along all three axes are observed. This behavior results from the complex noncomplanar magnetic structure of Tb(sub 3)Co. The metamagnetic transitions are accompanied by a significant magnetoresistance effect. The Tb(sub 3)Co single crystal has permanent magnet properties along the c-axis with the highest energy up to 140 Mg Oe at T less than 4.2 K.

DOE

Ferromagnetic Materials; Magnetic Field Configurations; Magnetization; Magnetoresistivity; Permanent Magnets; Antiferromagnetism

19980203533 Netherlands Energy Research Foundation, Petten, Netherlands

Proceedings of the second workshop on vanadium alloy development for fusion

Osch, E. V. van, Editor, Netherlands Energy Research Foundation, Netherlands; Oct. 1996; 591p; In English; 2nd, 20 - 22 May 1996, Petten, Netherlands

Report No.(s): ECN-R-96-012; CONF-9605288; DE97-637124; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

From 20 to 22 May 1996 the Second IEA Vanadium Alloy Development for Fusion Workshop was held at the Netherlands Energy Research Foundation, ECN in Petten. Twenty three experts from the European Union, Japan, the Russian Federation and the USA exchanged results and analyses of completed experiments and discussed the program planning. The manufacturing of half-finished products and the optimization of subsequent heat treatments were presented and discussed in the first session. The problems and solutions to joining vanadium alloy half-finished products by welding and brazing have been addressed in another session. Corrosion and compatibility properties have been evaluated in a different session together with coating requirements. Several sessions were devoted to the effects of radiation on the mechanical properties, especially toughness, of vanadium alloys. Also the role of the transmutation product helium, in particular its introduction into specimens, was evaluated. The respective plans of the four parties for continuation of the ongoing research and development programs have been discussed with the emphasis on avoiding duplications in the area of radiation experiments. The critical issues were identified and the related priorities discussed in the time frame set by the schedule for the building of ITER test modules and with the long term DEMO requirements in mind.

DOE

Vanadium Alloys; Brazing; Fusion Reactors; Mechanical Properties; Thermonuclear Reactions

19980203536 Max-Planck-Inst. fuer Metallforschung, Stuttgart, Germany

The Structure of the Sigma(3)(111) Grain Boundary in NiAl: Computer Experiments with Three Empirical Potentials ***Struktur der Sigma3 (111)-Korngrenze in NiAl: Computerexperimente mit drei Empirischen Potentialen***

Jul. 1996; 131p; In German

Report No.(s): EDB-360102; DE98-701328; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The aim of this work is the determination of the Sigma(3)(111) grain boundary in NiAl with the aid of computer simulation. The calculation of the grain boundary structures is done by a simple scheme: starting from a start configuration, one calculates the forces acting on the atoms with the aid of a potential. by changing the atom positions, one determines the zero position of the force and therefore the energy minimum. Starting from an experimentally determined composition of 53% nickel atoms, the calculations with Rao's or Yan and Vitek's potentials gave a stochiometric twin grain boundary as the most stable structure. In both cases, aluminium atoms occupy the grain boundary plane. Large hollows or holes occurring in the area of the grain boundary point to possible grain boundary weakness. Widening of the crystal at right angles to the boundary surface is 0.37 A with the Rao potential and 0.50 A for the Yan/Vitek potential. Using the Ludwig and Gumbsch potential, a grain boundary with an excess nickel atom per unit surface is the most stable structure. The additional nickel atoms segregate at the grain boundary, occupy places between grids in the grain boundary plane and therefore produce a dense structure. The widening at right angles to the grain boundary is 0.21 A.

DOE

Aluminum Alloys; Nickel Alloys; Computerized Simulation; Grain Boundaries; Intermetallics

19980203665 Colorado School of Mines, Golden Center for Welding Joining and Coatings Research, Golden, CO USA

High Strength Steel Weldment Reliability: Weld Metal Hydrogen Trapping ***Final Report, 1 Aug. 1994 - 31 Dec. 1997***

Olson, David L., Colorado School of Mines, USA; Feb. 1998; 265p; In English

Contract(s)/Grant(s): DAAH04-94-G-0281

Report No.(s): AD-A344434; ARO-32823.6-MS; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The potential use of weld metal hydrogen getters (traps) to increase the reliability of high strength steel weldments was investigated. This research aimed to establish a fundamental understanding of the trapping mechanisms in weld metal and to evaluate the effectiveness of irreversible traps introduced by specific alloying additions, in comparison to the reversible hydrogen trapping by weld metal constituents and solidification substructure. The work involved: (1) fundamental calculations to select most promising elemental trapping additions to be made through the welding consumable, (2) evaluations of hydrogen-contaminated welds to determine the relative amount of hydrogen trapping, (3) evaluations of the influence of welding parameters and practice (multiple-pass welding) on the effective use of weld metal hydrogen gettering, and (4) demonstrations of the potential of using gettering

additions to welding consumables to control weld metal hydrogen and thus reduce susceptibility to cold cracking in high strength steel weldments.
DTIC
High Strength Alloys; Hydrogen Compounds; Reliability; Trapping; Welding; Hydrogen; Cold Strength; Getters

19980203675 Netherlands Energy Research Foundation, Petten, Netherlands
Experiment R276-6/7/8 (MANIA 6/7/8): Activity calculations
Freudenreich, W. E., Netherlands Energy Research Foundation, Netherlands; Peeters, T. T. J. M., Netherlands Energy Research Foundation, Netherlands; Mar. 1996; 50p; In English
Contract(s)/Grant(s): ECN Proj. 71103.03
Report No.(s): ECN-I-96-006; DE97-637121; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In the irradiation experiment MANIA 6/7/8 different austenitic stainless steel types for advanced nuclear systems will be irradiated at a temperature of 325 C and up to dpa (displacements per atom) levels varying from 0.8 to 3.0 dpa. In this report the results of the activity calculations of the sample holder material and of different types of steel sample materials are presented. The activities of the different types of steel sample materials are given for the vertical maximum of the irradiation position. A relation is given to convert these data to any vertical sample position. Also the changes in chemical composition of the different sample materials due to nuclide transmutation, are given in this report.
DOE
Austenitic Stainless Steels; Irradiation; Transmutation; Displacement

19980203686 Oak Ridge National Lab., TN USA
Mechanical properties of Ni3Al and FeAl: Recent developments
George, E. P., Oak Ridge National Lab., USA; Liu, C. T., Oak Ridge National Lab., USA; [1997]; 10p; In English; 2nd; Structural Intermetallics, 21-26 Sep. 1997, Champion, PA, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-970909-3; DE97-007764; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Recent developments in the understanding of the ductility and fracture behavior of Ni3Al and FeAl are reviewed. Both intrinsic factors (e.g., alloy stoichiometry), and extrinsic factors (e.g., environment) have been shown to affect their mechanical properties. of all the recent developments, perhaps the most significant is the realization that Ni3Al and FeAl are intrinsically ductile (at least on the Al-deficient side of stoichiometry); their brittleness when tested in ambient air is due mainly to environmental embrittlement. Another intriguing discovery is that boron embrittles Ni3Al in gaseous hydrogen (until recently, B was though to have only beneficial, or at most neutral, effects). The authors review these and other recent discoveries and discuss, wherever possible, the underlying physical mechanisms giving rise to the observed mechanical behavior.
DOE
Mechanical Properties; Nickel Alloys; Aluminum Alloys; Nickel Aluminides

19980203691 Westinghouse Savannah River Co., Aiken, SC USA
Metallurgical Evaluation of Recycled Stainless Steel
Imrich, K. J., Westinghouse Savannah River Co., USA; Jan. 22, 1997; 14p; In English
Contract(s)/Grant(s): DE-AC09-89SR-18035
Report No.(s): WSRC-TR-96-0419; DE97-008655; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Recycled Type 304 stainless steel from both Carolina Metals Inc. (CMI) and Manufacturing Science Corporation (MSC) met all the requirements of ASTM A-240 required by Procurement Specification G-SPP-K-00005 Rev. 4. Mechanical strength and corrosion resistance of the material are adequate for service as burial boxes, overpacks, and drums. Inclusion content of both manufacturer's material was high, resulting in a corresponding decrease in the corrosion resistance. Therefore, an evaluation of the service conditions should be performed before this material is approved for other applications. These heats of stainless steel are not suitable for fabricating DWPF glass canisters because the inclusion and carbon contents are high. However, MSC has recently installed a vacuum induction furnace capable of producing L grade material with a low inclusion content. Material produced from this furnace should be suitable for canister material if care is taken during the melting/casting process.
DOE
Stainless Steels; Fabrication; Recycling; Radioactive Wastes

19980203694 Netherlands Energy Research Foundation, Petten, Netherlands

Experiments R287-1/2/3 (CHARIOT 1/2/3): Activity calculations

Freudenreich, W. E., Netherlands Energy Research Foundation, Netherlands; May 1996; 55p; In English

Contract(s)/Grant(s): ECN Proj. 71141.70; ECN Proj. 71139.70; ECN Proj. 71118.70

Report No.(s): ECN-I-96-020; DE97-637122; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In the irradiation experiments CHARIOT 1/2/3 a number of different austenitic stainless steel types and three types of vanadium samples for advanced nuclear systems will be irradiated at a temperature of 300 C up to dpa (displacements per atom) levels of 2.5 dpa for the steel samples and up to 6 dpa for the vanadium samples. In this report the results of the activity calculations of the sample holder material and of the different types of sample materials are presented. The activity of the holder material is calculated for the vertical average of the irradiation position. The activities of the sample materials are given for the vertical maximum of the irradiation position. A relation is given to convert these data to any vertical sample position. Also the changes in chemical composition of the different sample materials, due to nuclide transmutation, are given in this report.

DOE

Austenitic Stainless Steels; Displacement; Transmutation; Vanadium

19980203733 Oak Ridge National Lab., TN USA

Stability of ultrafine lamellar structures during aging in two-phase gamma-TiAl alloys

Maziasz, P. J., Oak Ridge National Lab., USA; Liu, C.T., Oak Ridge National Lab., USA; Wright, J. L., Oak Ridge National Lab., USA; [1997]; 15p; In English; 2nd; Structural Intermetallics, 21-26 Sep. 1997, Champion, PA, USA

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

Report No.(s): CONF-970909-4; DE97-008243; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Two-phase (gamma)-tail alloys such as PM Ti-47Al-2Cr-2Nb or Ti-47Al- 2Cr-1Nb-Ta hot extruded above the (alpha)-transus temperature have unique refined-colony/ultrafine lamellar structures. These lamellar microstructures consist of very fine laths of the (gamma) and (alpha)(sub 2) phases, with average interlamellar spacings of 100 nm and (alpha)(sub 2)-(alpha)(sub 2) spacings of 200 nm, and are dominated by (gamma)/(alpha)(sub 2) interfaces. This ultrafine lamellar structure remains stable during 900 C heat treatment for 2 h, but becomes unstable after 4 h at 982 C. This structure remains stable in both alloys after aging for greater than 5000 h at 800 C but disappears completely at 1000 C. Continuous coarsening begins with dissolution of fine (alpha)(sub 2) lamellea. The aged Ta-modified alloy shows similar lamellar coarsening behavior within the colonies but has more discontinuous coarsening of the intercolony (gamma) with new precipitation of coarse (alpha)(sub 2) and (beta) phase particles. Analytical electron microscopy show that changes in (alpha)(sub 2) phase composition correlate with microstructural instability.

DOE

Microstructure; Phase Stability (Materials); Titanium Alloys; Aging (Materials); Chromium Alloys; Aluminum Alloys

19980203742 Netherlands Energy Research Foundation, Petten, Netherlands

Gamma spectrometry of 285-04 ILAS gamma scan wires

Dassel, G., Netherlands Energy Research Foundation, Netherlands; Buurveld, H. A., Netherlands Energy Research Foundation, Netherlands; Plakman, J. C., Netherlands Energy Research Foundation, Netherlands; Dec. 1996; 197p; In English

Report No.(s): ECN-I-96-053; DE97-637123; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In the frame work of their on-going sustain programme for the material development and characterization of fusion reactors, ECN is investigating the irradiation behaviour of ferritic/martensitic steels. In the fourth irradiation experiment 285-04, 55 steel tensile samples have been irradiated up to 2.5 dpa. Four gamma scan wires from this experiment have been examined by gamma scanning. The results of the measurements have been described in this report.

DOE

Irradiation; Spectrometers; Scanners; Wire; Fusion Reactors

19980203770 Naval Postgraduate School, Monterey, CA USA

The Most Immediate and Cost-Effective Way to Address Vehicle Corrosion in Hawaii

Crabtree, Kenneth L., Naval Postgraduate School, USA; Dec. 1997; 66p; In English

Report No.(s): AD-A343359; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the late 198Os the Marine Corps procured the M9O0 series 5-ton truck. Within four years of this acquisition, a serious corrosion problem developed with the M900 series truck. Efforts to control this corrosion have proven to be unsuccessful. The

current maintenance budget does not adequately fund the corrosion program nor are the facilities and procedures able to handle the workload. The objective of this thesis was to identify the most immediate and cost effective way to handle corrosion control in Hawaii by analyzing the environment in which the Marine Corps units in Hawaii operate and recommend the most reasonable solution given the constraints. Research included an analysis of the background of Marine Corps equipment in service in Hawaii, as well as an identification of alternative measures of corrosion control management. Four alternatives were identified and evaluated in terms of the associated costs, manpower requirements, vehicle turnaround time, throughput capacity, and USMC controls. It was determined that the current corrosion control process is not adequate, and if left unchanged, the Marine Corps will face an overwhelming amount of deadlined vehicles before the replacements are available. The analysis concludes that the current method of corrosion management is inefficient. Alternative recommendations are then provided for more efficient use of the resources.
DTIC
Corrosion; Trucks; Cost Effectiveness; Hawaii

19980203831 Los Alamos National Lab., NM USA
Advanced deformation process modeling
Kocks, U. F., Los Alamos National Lab., USA; Embury, J. D., Los Alamos National Lab., USA; Beaudoin, A.J., Reynolds Metals Co., USA; Dawson, P. R., Cornell Univ., USA; MacEwen, S. R., Alcan International Ltd., Canada; Mecking, H. J., Hamburg Univ., Germany; [1997]; 8p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2563; DE97-008694; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Progress was made in achieving a comprehensive and coherent description of material behavior in deformation processing. The materials included were metals, alloys, intermetallic compounds, arbitrary lattice structure, and metal matrix composites. Aspects of behavior modeled included kinetics of flow and strain hardening, as well as recrystallization and the various anisotropies of strength and compliance. Highlights include a new prediction of the limiting strength of materials at high temperature, a new understanding of the generation of new grain boundaries during forming operations, and a quantitatively verified computer simulation of texture development and the resulting behavioral anisotropies.
DOE
Deformation; Intermetallics; Metal Matrix Composites; Computerized Simulation; Metals

19980203858 Oak Ridge National Lab., TN USA
The microstructure and mechanical reliability of alumina scales and coatings
Alexander, K. B., Oak Ridge National Lab., USA; Pruessner, K., Oak Ridge National Lab., USA; Tortorelli, P. F., Oak Ridge National Lab., USA; [1997]; 13p; In English; 11th; Fossil Energy Materials, 20 - 22 May 1997, Knoxville, TN, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-9705115-3; DE97-008447; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Alumina scales on iron-aluminides (Fe(sub 3)Al-based) and NiCrAl- based alloys were characterized in order to develop the knowledge to control the oxidation performance of alloys by controlling the microstructure and microchemistry of their scales. Plasma-deposited amorphous alumina coatings on iron-aluminides were used to study phase transformations, transport processes in the scales, and S segregation to the scale/metal interface. It was found that during heat treatment in absence of oxidation, amorphous coatings first transform to (gamma)-Al(sub 2)O(sub 3) and eventually (alpha)-Al(sub 2)O(sub 3) nucleates at the scale/metal interface. Sulfur from the Zr- free alloy segregates to the scale/metal interface during heat treatment. Thermally grown scales on Zr-doped iron-aluminides were compared to those formed after oxidation of a specimen with an alumina coating. Microstructural and gravimetric results showed that the primarily amorphous alumina coating promoted the nucleation and growth of metastable alumina phases, which resulted in more rapid oxidation. The thermally grown oxide was found on top of the coating. The NiCrAl-based alloys formed columnar alumina scales underneath a layer of mixed oxides. Segregation of alloying elements like Y, Hf, and At was found at both oxide grain boundaries and scale/metal interfaces.
DOE
Amorphous Materials; Phase Transformations; Plasmas (Physics); Microstructure; Metastable State; Grain Boundaries; Doped Crystals; Alloying; Nucleation

19980203860 Los Alamos National Lab., NM USA
Reports of the measurement of elastic properties of 51XX series steels for the heat treatment distortion project
Darling, T., Los Alamos National Lab., USA; Migliori, A., Los Alamos National Lab., USA; Armstrong, P. E., Los Alamos

National Lab., USA; Vaidya, R., Los Alamos National Lab., USA; Scherer, C., Los Alamos National Lab., USA; Lowe, T., Los Alamos National Lab., USA; [1997]; 64p; In English; Resonance Meeting, 11 - 15 May 1997, Pacific Grove, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1954; CONF-9705151-1; DE97-008344; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We have measured the temperature dependence of the elastic constants of the 51XX series steels [gear steels] for a range of phases. At RT the normalized steel (pearlite) has the highest value of the moduli, the bainite phase the next highest, and martensite the lowest. Extrapolation of the austenite suggests that at RT austenite has lower moduli than martensite. For all the grades and phases of steels examined, the behavior of the elastic constants is similar: a curve could be drawn for each of the moduli from all the phases and all the grades would not deviate by more than (+/-)4%. The normalized phase (100% pearlite in 5180) is stable up to 900 C. Bainite is stable up to 500 C. Martensite starts to change above 150 C as it tempers or strain relieves; once this is complete, the martensite moduli increase to similar values to bainite. Extrapolations are discussed. Behavior in lower carbon steels (5140, 5120) should conform to above; there is no explanation for the anomalous behavior of the quenched 5120 steel.
DOE
Heat Treatment; Carbon Steels; Temperature Dependence; Distortion; Extrapolation

19980203943 Sandia National Labs., Computational Physics and Mechanics Dept., Albuquerque, NM USA
A multi-level code for metallurgical effects in metal-forming processes
Taylor, P. A., Sandia National Labs., USA; Silling, S. A., Sandia National Labs., USA; Hughes, D. A., Sandia National Labs., USA; Bammann, D. J., Sandia National Labs., USA; Chiesa, M. L., Sandia National Labs., USA; Aug. 1997; 37p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2019; DE97-009150; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors present the final report on a Laboratory-Directed Research and Development (LDRD) project, A Multi-level Code for Metallurgical Effects in metal-Forming Processes, performed during the fiscal years 1995 and 1996. The project focused on the development of new modeling capabilities for simulating forging and extrusion processes that typically display phenomenology occurring on two different length scales. In support of model fitting and code validation, ring compression and extrusion experiments were performed on 304L stainless steel, a material of interest in DOE nuclear weapons applications.
DOE
Forming Techniques; Computer Programs; Nuclear Weapons; Metal Working

19980205603 Los Alamos National Lab., NM USA
Enhanced diffusion in shock activated Be-Al interfaces
Staudhammer, K. P., Los Alamos National Lab., USA; 1997; 7p; In English; International Conference on Mechanical and Physical Behavior of Materials Under Dynamic Loading (Euro/dymat), 22 - 26 Sep. 1997, Toledo, Spain
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-UR-97-891; CONF-970944-1; DE97-005036; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Enhanced diffusion of aluminum in shock activated beryllium has been observed. Cylindrical samples of aluminum coated beryllium rods were axisymetrically loaded up to 40 GPa and a total residual strain of up to 6.7%. The defect microstructure produced by both the shock wave and strain enabled the transport of aluminum in beryllium to exceed its equilibrium solid state saturation. This 'super saturated' aluminum, upon heating exsolves out at relatively low temperatures and forms very strong interfaces with pressure mated components.
DOE
Aluminum; Beryllium; Diffusion; Rods; Shock Waves; Bonding

19980205679 Los Alamos National Lab., NM USA
Influence of twinning on the constitutive response of Zr: Experiments and modeling
Chen, Shuh Rong, Los Alamos National Lab., USA; Gray, G. T. III, Los Alamos National Lab., USA; 1997; 7p; In English; International Conference on Mechanical and Physical Behavior of Materials Under Dynamic Loading (Euro/dymat), 22 - 26 Sep. 1997, Toledo, Spain
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-UR-97-906; CONF-970944-7; DE97-005032; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The stress-strain response of Zr due to twinning is distinctly different from that due to slip as a function of temperature and strain rate. When the applied stress is lower than the transition stress, dislocation slip is the dominant deformation mechanism. The traditional MTS model is shown to adequately represent the constitutive behavior of Zr. Above the transition stress twinning becomes the dominant deformation mechanism where the flow stress increases linearly with strain. In this regime the rate-dependent strain hardening can be described by equations based on thermal activation theory that are very similar to the formula used in the MTS model.
DOE
Zirconium; Twinning; Strain Rate; Polyslips; Plastic Deformation

19980205719 Colorado School of Mines, Golden, CO USA
Proceedings of the Joint Seminar; Hydrogen Management in Steel Weldments
Olson, D. L., Colorado School of Mines, USA; Maroef, I., Colorado School of Mines, USA; Lensing, C., Colorado School of Mines, USA; Smith, R. D., Colorado School of Mines, USA; Wang, W. W., Colorado School of Mines, USA; Jan. 1997; 188p; In English, 23 Oct. 1996, Melbourne, Australia; Sponsored by Army Research Office, USA
Contract(s)/Grant(s): DAAH04-94-G-0281
Report No.(s): AD-A344553; ARO-32823.4-MS; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Despite 50 years of research into the prevention of hydrogen induced cracking in weldments, this form of cracking is still the most serious problem facing the steel fabrication industry today. Increased performance for defence platforms requires stronger lighter structures which have largely been obtained using high strength steels. As the strength is increased, so is the risk of hydrogen induced cracking after welding. to address this issue, the management of hydrogen, and the elimination of hydrogen induced cracking during the welding of high strength structural steels, has been made the focus of an international research program between American and Australian defence scientists. As part of this collaborative program, a public seminar was held at the Carlton Crest Hotel in Melbourne on October 23, 1997. The seminar brought together experts in the field of hydrogen cracking from industry, academia, research institutions and defence agencies, to establish the state-of-the-science, to review the progress of the collaborative research project and to address the feasibility of alternative approaches for hydrogen and preheat management. Seminar papers covered a range of topics from safe hydrogen management practice for today, to the science based development of low-hydrogen consumables for the future. Accordingly, this collection of papers provides a unique opportunity for the reader to become aware of the current directions of hydrogen management in high strength steel weldments.
DTIC
Welding; Hydrogen; Conferences; Crack Initiation; Industries

19980206196 Wichita State Univ., Dept. of Mechanical Engineering, Wichita, KS USA
High Temperature Analysis of Aluminum-Lithium 2195 Alloy to Aid in the Design of Improved Welding Techniques
Talia, George E., Wichita State Univ., USA; Widener, Christian, Wichita State Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Aluminum-lithium alloys have extraordinary properties. The addition of lithium to an aluminum alloy decreases its density, while making large increases in its strength and hardness. The down side is that they are unstable at higher temperatures, and are subsequently difficult to weld or even manufacture. Martin Marietta, though, developed an aluminum-lithium alloy 2195 that was reported to have exceptional properties and good weldability. Thus, it was chosen as the alloy for the space shuttles super light external tank. Unfortunately, welding 2195 has turned out to be much more of a challenge than anticipated. Thus, research has been undergone in order to understand the mechanisms that are causing the welding problems. Gas reactions have been observed to be detrimental to weld strength. Water vapor has often been identified as having a significant role in these reactions. Nitrogen, however, has also been shown to have a direct correlation to porosity. These reactions were suspected as being complex and responsible for the two main problems of welding 2195. One, the initial welds of 2195 are much weaker than the parent metal. Second, each subsequent welding pass increases the size and number of cracks and porosity, yielding significant reductions in strength. Consequently, the objective of this research was to characterize the high-temperature reactions of 2195 in order to understand the mechanisms for crack growth and the formation of porosity in welds. In order to accomplish that goal, an optical hot-stage microscope, HSM, was used to observe those reactions as they occurred. Surface reactions of 2195 were observed in a variety of environments, such as air, vacuum, nitrogen and helium. For comparison, some samples of Al-2219 were also observed. Some of the reacted surfaces were then analyzed on a scanning electron microscope, SEM. Additionally, a gas chromatograph was used to analyze the gaseous products of the high temperature reactions.
Author
Aluminum-Lithium Alloys; Weld Strength; Weldability; Porosity; High Temperature Tests; Microscopy; Crack Propagation; Welded Structures

19980206203 Alabama Univ., Mechanical Engineering Dept., Huntsville, AL USA

Solidification Interface Shape and Location During Processing in High Gradient Furnace with Quench

Woodbury, Keith A., Alabama Univ., USA; Oct. 1996; 6p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

High Gradient Furnace with Quench (HGFQ) is being developed to facilitate metals processing experiments aboard the International Space Station. The sample is centered in an annular furnace and is held fixed during processing. The furnace itself is made to translate over the sample. Once in process, heat will flow through the sample from the Heater Zone to the Chill Zone. If operating conditions are correct, the solidification interface will stand in the gradient zone. Objectives of the HGFQ process are to provide a high gradient for the solidification with the solidification interface properly positioned in the gradient zone. At the recent RDR for HGFQ, one of the panelists raised the question about the suitability of HGFQ for potential future PIs. Specifically, it was stated by the design team at RDR that the present HGFQ design would provide a radius of curvature of the solidification interface of at least one sample diameter. The RDR panel argued that this was too small, and that most investigators would need a radius of curvature larger than this. The requirements established by the current PIs are shown. These requirements do not contain any specification about the interface shape. However, these requirements do define the envelope of operational parameters for HGFQ. The objectives of the present investigation are to 1) determine a suitable means of quantifying the interface shape, and 2) investigate the interface shape and how it is affected by processing parameters. The processing parameters to be considered are 1) sample material, 2) sample diameter, and 3) gradient zone length.

Author

Electric Furnaces; Curvature; Temperature Gradients; Space Processing; Solidification; Metals; Interfaces; Radii; Metal Working

19980206255 Defence and Civil Inst. of Environmental Medicine, Air Vehicle Research Detachment, Downsview, Ontario Canada

Phase Diagram Modelling: Nickel - Aluminum - Chromium System

Jaansalu, Kevin M., Defence and Civil Inst. of Environmental Medicine, Canada; Apr. 1998; 43p; In English

Report No.(s): AD-A345689; DCIEM-98-TM-37; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Ni-Al-Cr system is of importance to the gas turbine industry as it forms the basis for protective coating design and application for hot section components. These thermodynamic models establish a foundation upon which the metallurgical chemistry of aluminum coating processes for nickel base superalloys can be addressed. The thermodynamic model of the ternary system is based on the binary phase diagrams for each pair of components. Given the technological importance of this system, the robustness of the models developed for each of the binary systems will have a direct impact on the success of future engineering work. It is primarily for this reason that these binary systems are examined in detail. This technical memo reviews the thermodynamic concepts upon which phase diagram models are based and presents an effective model for each of the binary systems: Al-Cr, Al-Ni, and Ni-Cr.

DTIC

Chromium Alloys; Phase Diagrams; Nickel Alloys; Gas Turbines; Thermodynamics; Aluminum Alloys; Aluminum; Aluminum Coatings; Chromium; Nickel

19980206273 Naval Postgraduate School, Monterey, CA USA

Acoustical Emission Source Location in Thin Rods Through Wavelet Detail Crosscorrelation

Jerauld, Joseph G., Naval Postgraduate School, USA; Mar. 1998; 150p; In English

Report No.(s): AD-A345954; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Flaws in structural elements release strain energy in the form of stress waves that can be detected through acoustical emission techniques. The transient nature of a stress wave is analytically inconsistent to Fourier Transforms, and the wave characteristics under the effects of dispersion and attenuation deviate from the formal basis of the Windowed Fourier Transform. The transient solid body elastic waves contain multiple wave types and frequency components which lend themselves to the time and frequency characteristics of Wavelet Analysis. Software implementation now enables the exploration of the Wavelet Transform to identify the time of arrival of stress wave signals for source location in homogeneous and composite materials. This investigation quantifies the accuracy and resolution of two existing source location methods and develops a third technique using the Discrete Wavelet Transform on a windowed portion of the stress wave signal. A refined method for the spatial location of material damage induced stress waves can be used to directly monitor the safe life of structures and provide a quantitative measure for the risk assessment of critical and aging structures.

DTIC

Structural Strain; Wavelet Analysis; Stress Waves; Composite Materials; Failure Analysis; Defects; Rods

19980206319 Sandia National Labs., Albuquerque, NM USA

Evaluation of the metal/adhesive interfaces in the MC2370 fire set

Zavadil, K. R., 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-97-2460C; CONF-970982; DE98-000382; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Several analysis methods have been applied to evaluate the structure and composition of the electrode/adhesive interfaces i previously fielded M2370 Fire Sets. A method of interfacial fracture at cryogenic temperatures as been employed to expose regions of these interfaces at multiple levels in a SFE stack. Electron microscopy shows that bond failure induced by the fracture is predominantly adhesive with an equal probability of failure of the Au and Cu interfaces. Some evidence for cohesive, indicative of a possible microstructure related to electrical breakdown. Pinhole-free larger regions of adhesive also exist which may explain the observed high resistance in impedance measurements.

DOE

Adhesives; Cohesion; Microstructure; Joints (Junctions); Cryogenic Temperature

19980206342 Brown Univ., Div. of Engineering, Providence, RI USA

Hydriding of Titanium ***Annual Report No. 2, 1997***

Briant, Clyde L., Brown Univ., USA; Kumar, K. S., Brown Univ., USA; Wang, Zheng-Fu, Brown Univ., USA; Mar. 1998; 63p; In English

Contract(s)/Grant(s): N00014-96-1-0272

Report No.(s): AD-A344947; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The reason for undertaking this work is that the US Navy would like to use titanium in a number of critical applications, where it would come in contact with sea water at elevated temperatures. Although the general reputation of titanium is that it is corrosion resistant in these environments, there is the possibility that it could pick up sufficient hydrogen from this environment to form a hydride and thus lose its mechanical integrity. Therefore, we must evaluate all conditions that could lead to hydriding and determine the effects of hydrides on mechanical properties. During the second year of work, the goals have been the following: to determine the effect of solution activity and temperature, material composition and heat treatment on the electrochemical properties of titanium; to determine the effect of these same variables on the corrosion potential of titanium galvanically coupled with other metals; to determine the critical potential of hydride formation as a function of solution activity and temperature, applied strain, and surface conditions; to measure the rate of hydrogen diffusion in titanium; to propose a model to describe crack propagation in titanium in these environments. All of the above work has been completed and the results are contained in this document. The results that we have obtained show that grade 2 titanium is generally resistant to hydrogen embrittlement. However, grade 3, with its higher interstitial content and lower hydrogen solubility is quite susceptible to hydrogen embrittlement. The mechanism by which this embrittlement occurs is one in which microcracks, which are centered on hydrides, form ahead of the main crack tip. With increased deformation these microcracks link up to the main crack and cause propagation.

DTIC

Mechanical Properties; Hydrides; Titanium; Hydrogen Embrittlement; Corrosion Resistance; Zinc Coatings

19980206420 Plasma Processes, Huntsville, AL USA

Development Study of Cartridge/Crucible Tube Materials ***Final Report***

McKechnie, Timothy N., Plasma Processes, USA; ODell, Scott J., Plasma Processes, USA; Apr. 30, 1998; 13p; In English

Contract(s)/Grant(s): NAS8-97213

Report No.(s): NASA/CR-1998-208163; NAS 1.26:208163; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The limitations of traditional alloys and the desire for improved performance for components is driving the increased utilization of refractory metals in tile space industry. From advanced propulsion systems to high temperature furnace components for microgravity processing, refractory metals are being used for their high melting temperatures and inherent chemical stability. Techniques have been developed to produce near net shape refractory metal components utilizing vacuum plasma spraying. Material utilization is very high, and laborious machining can be avoided. As-spray formed components have been tested and found to perform adequately. However, increased mechanical and thermal properties are needed. to improve these properties, post processing thermal treatments such as hydrogen sintering and vacuum annealing have been performed. Components formed from

alloys of tungsten, rhenium, tantalum, niobium, and molybdenum are discussed and a metallurgical analyses detailing the results are presented. A qualitative comparison of mechanical properties is also included.
Author
Cartridges; Crucibles; High Temperature Environments; Plasma Spraying; Refractory Metal Alloys; Heat Treatment; Forming Techniques

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.

19980203227 Infinite Materials and Products, Inc., Tucson, AZ USA
Thermally Insulated Flexible Composite Cores for Aerospace Applications ***Final Report, 21 Apr. 1997 - 21 Apr 1998***
Johnson, William L., Infinite Materials and Products, Inc., USA; Schick, Milton J., Infinite Materials and Products, Inc., USA; May 11, 1998; 35p; In English
Contract(s)/Grant(s): DASG60-97-M-0155
Report No.(s): AD-A343742; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Infinite Materials and Products, Inc. (IMP) has developed a very unusual and unique flexible ceramic insulation. The original research was oriented toward the incorporation of an insulation material into the open cells of a honeycomb core inside a Continuous Fiber Reinforced Plastic (CFRP) composite sandwich. IMP also perfected a method to spray this insulation onto whatever surface was required. The insulation can be easily applied to many types of surfaces regardless of geometrical configuration. IMP's insulation can be made to meet all of the necessary requirements for aerospace applications, as well as being able to compete directly against standard fiberglass building insulation, dollar for dollar, while offering superior insulation performance. IMP's insulation has excellent potential commercial growth for a wide variety of applications. Several investment groups are currently evaluating IMP's business plan with the intent of providing investment for manufacturing and marketing start-up to facilitate the commercialization of IMP's insulation.
DTIC
Aerospace Systems; Composite Structures; Insulation; Aerospace Engineering; Carbon Fiber Reinforced Plastics; Ceramics; Thermodynamic Properties

19980203241 Michigan State Univ., Composite Materials and Structures Center, East Lansing, MI USA
Characterization of Hybrid Material Interphases ***Final Report***
Drzal, Lawrence T., Michigan State Univ., USA; Ho, Henjen, Michigan State Univ., USA; Alt, Matthias, Michigan State Univ., USA; Mar. 30, 1998; 156p; In English
Contract(s)/Grant(s): DAAH04-95-1-0496
Report No.(s): AD-A344423; ARO-34890.1-MS; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

A comprehensive non-linear finite element analysis study has been performed of the single fiber fragmentation test and the microindentation test to evaluate the mechanics of these techniques for measuring fiber-matrix adhesion in fiber reinforced polymeric composite materials. The determination of the fiber-matrix interphase modulus and its spatial variation has been shown to be important to relating microtesting methods to composites properties. As a result, a novel micro testing technique has been proposed for adherend-adhesive or fiber-matrix interphase properties characterization. A modified shear lag relationship was combined with the fiber strain energy equation to obtain an equation for mean/average interfacial shear stress and pseudo mean interfacial shear modulus. Good agreement was found. An experimental study using dynamic mechanical analysis was performed using these methods. The influence of test parameters has been evaluated and have been found to give a clear, reproducible reading of the loss and storage modulus as well as the exact glass transition temperature. The sensitivity of the DMA has proven to be exceptionally high. The viscoelastic response of an interphase with a thickness of only 3% by volume of the fiber can be detected and the interphase influence on the storage modulus of the composite can be quantified.
DTIC
Adhesion; Characterization; Fiber Composites; Fiber-Matrix Interfaces; Hybrid Composites

19980203275 State Univ. of New York, Stony Brook, NY USA

Characterization of Mechanical Properties of Interphase in Glass/Polyester Composite System ***Final Report, 1 Sep. 1995 - 31 Aug. 1997***

Chiang, Fu-Pen, State Univ. of New York, USA; Dec. 1997; 27p; In English

Contract(s)/Grant(s): DAAH04-95-1-0543

Report No.(s): AD-A344296; ARO-34927.1-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A bimaterial pair consisting of homopolymers PMMA (polymethylmethacrylate) and PS (polystyrene) was selected for this study. A graft copolymer was used to bind the two homopolymers together. Instead of the conventional asymmetric double cantilever beam test we selected the asymmetric four-point-bend test scheme to evaluate the bimaterial system, because the latter can be employed to evaluate the effect of mode mixity. The mechanical properties of PMMA and PS are quite similar; thus the resulting Dunder's parameters are very small. Yet the material pair exhibits strong characteristics of a typical bimaterial. As it turned out the two materials have distinctly different fracture mechanisms. PMMA fails by generating a large amount of microcrack whereas PS fails by crazing which consumes much more energy. Depending upon the mode mixity an interfacial crack can be driven either into PMMA or into PS. and the resulting fracture toughnesses are quite different. Detailed strain distributions at the crack tips were mapped by the micromechanics technique called SIEM (Speckle Interferometry with Electron Microscopy) which provides the foundation for the fracture mechanism.

DTIC

Mechanical Properties; Composite Materials; Glass; Polystyrene; Polyester Resins; Phase Stability (Materials)

19980203290 State Univ. of New York, Stony Brook, NY USA

Structures and Dynamics of Self-Assembled Organized Functional Polymers in Solution ***Final Report, 1 Jan. 1994 - 31 Dec. 1997***

Chu, Benjamin, State Univ. of New York, USA; Apr. 30, 1998; 5p; In English

Contract(s)/Grant(s): DAAH04-94-G-0053

Report No.(s): AD-A344334; ARO-32508.13-CH; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Fruitful results were achieved by investigating the structure and dynamics of self-assembled diblock and triblock copolymers by means of a combination of physical techniques, including static and dynamic light scattering, small angle x-ray scattering, small angle neutron scattering and atomic force microscopy. The polymer colloids are able to form core-shell micelles in a closed association process, as well as flower-like and more open-structured aggregates, depending on the molecular architecture, composition and solvent selectivity of the block. A detailed study on even a few selected samples of Pluronic polyols consisting of EPE type triblock copolymers in aqueous solution has resulted in the development of a new separation medium for DNA capillary electrophoresis where E and P are, respectively, oxyethylene and oxypropylene. by taking advantage of our knowledge on colloid physics, narrow size distribution polymeric microspheres with superparamagnetic magnetite cores are being developed. The polymeric shells contain active sites which can be modified chemically, making the microspheres possible candidates as drug delivery or magnetic resonance imaging agents. Finally, we have developed a centrifuge ball viscometer capable of measuring the viscosity of polymer melts, including that of poly(tetrafluoroethylene) (also known as Teflon).

DTIC

Block Copolymers; Polymer Physics; Experimentation; Light Scattering; X Ray Scattering; Dynamic Structural Analysis

19980203328 Duke Univ., Durham, NC USA

Instrumentation for Processing and Characterization of Nano-Modulated Ceramics ***Final Report, 1 Aug. 1995 - 31 Dec. 1997***

Litvinenko, Vladimir N., Duke Univ., USA; Mar. 12, 1998; 11p; In English

Contract(s)/Grant(s): F49620-95-1-0476

Report No.(s): AD-A341035; FELL-DURIP95-313-6015-98; AFRL-SR-BL-TR-98-0295; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This grant was sponsored by the FY95 Defense University Research Instrumentation Program (DURIP). The objective was to acquire instrumentation compatible with the Duke University Free Electron Laser (FEL) Laboratory light sources in the infrared (IR), ultra-violet (Uv), extreme ultra-violet (XUV), X-Ray and gamma-ray wavelength regions, that would support the research and characterization of advanced materials, including nano-modulated coatings and ceramics. This report summarizes progress made with the existing FEL Laboratory light sources and describes three major pieces of equipment fabricated with funds from

this program for application to nano-modulated coatings and ceramics research. Capabilities of the resulting equipment and experiments planned in the near-term are also described.
DTIC
Extreme Ultraviolet Radiation; Laser Outputs

19980203345 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France
Thermal Barrier Coatings ***les Revetements anti-mur de chaleur***
Apr. 1998; 177p; In English; In French; 85th; AGARD Structures and Materials Panel, 15-16 Oct. 1997, Aalborg, Denmark; Sponsored by Advisory Group for Aerospace Research and Development, France
Report No.(s): AD-A344715; AGARD-R-823; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
No Abstract
Author
Thermal Control Coatings; Aircraft Engines; Ceramic Coatings; Thermal Conductivity; Inlet Temperature; Barriers; Turbines; Yttria-Stabilized Zirconia; Jet Engines

19980203466 Case Western Reserve Univ., Dept. of Macromolecular Science, Cleveland, OH USA
Twenty-First Asilomar Conference on Polymeric Materials ***Final Report, 1 Jul. 1997 - 30 Jun. 1998***
Baer, Eric, Case Western Reserve Univ., USA; Mar. 10, 1998; 31p; In English; 21st, 22-25 Feb. 1998, Pacific Grove, CA, USA
Contract(s)/Grant(s): DAAG55-97-1-0337
Report No.(s): AD-A344623; ARO-37530.1-MS-CF; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The 1998 Asilomar Conference on Polymeric Materials was devoted to interface/interphase design, control and property relationships. In particular, the conference focused on the development of new materials systems that are controlled by structure in interfacial regions at the nanoscale. Both synthetic polymeric materials and biological systems were considered. Special emphasis was on such issues as durability, property enhancement, compatibility, and integration with inorganic and biological compounds. As in previous years, this conference addressed the problems and opportunities that are arising with the emergence of a hierarchical approach in the design of new materials systems. This year, in particular, the conference focused on the newly emerging nano materials systems and the hierarchical approach interrelating our understanding of structure at various scales to solid state properties and materials processing. Such an approach may prove invaluable in the design of new polymers, their blends and composites, novel processing, and advanced materials systems in general.
DTIC
Conferences; Composite Materials; Macromolecules; Design Analysis; Control Data (Computers); Inorganic Compounds

19980203693 Jordan Univ., Amman, Jordan
Diffusion in glass
Mubarak, A. S., Jordan Univ., Jordan; 1990; 102p; In English
Report No.(s): INIS-JO--003; DE97-637164; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche
Rutherford backscattering spectrometry technique (RBS) was used to characterize and investigate the depth distribution profiles of Ca-impurities of Ca-doped soda-time glass. The purposely added Ca-impurities were introduced into the glass matrix by a normal ion exchange diffusion process. The measurements and analysis were performed using 2 MeV (sup 2) He(sup +) ions supplied from the University of Jordan Van de Graff accelerator (JOVAG). The theoretical treatment was carried out by setting up and solving the diffusion equation under the conditions of the experiment. The resulting profiles are characterized by a complementary error function. The theoretical treatment was extended to include the various methods of enchancing the diffusion process, e.g. using an electric field. The diffusion coefficient, assumed constant, of the Ca-impurities exchanged in the soda-lime glass was determined to be 1.23 x 10(exp 13) cm(exp 2)/sec. A comparison between theoretically and experimentally determined profiles is made and commented at, where several conclusions are drawn and suggestions for work are mentioned.
DOE
Backscattering; Ion Exchanging; Glass; Diffusion Coefficient; Calcium Oxides

19980203725 Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX USA
Development of Improved HE Adhesives Systems ***Quarterly Report, Jan. - Mar. 1964***
Christiansen, H. P., Mason and Hanger-Silas Mason Co., Inc., USA; [1997]; 15p; In English
Contract(s)/Grant(s): DE-AC04-91AL-65030

Report No.(s): MHSMP-64-3B; DE97-008776; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Optimum mix of allyl glycidyl ether, needed as a thinner for Aerobond H-7, appears to be about 10 pph AGE which reduces viscosity to 165 cps. This reduces torsional shear strength to 930 in-lbs/sq in versus 1616 in-lbs/sq in in tests this quarter and values as low as 520 in-lbs/sq in reported previously. Water permeability was measured again for Adiprene, Perm-A-Lon and Estane; Aerobond H-7 was also measured using a filter paper backing material. The value for Estane was lower than in previous tests, 0.27 mg/sq cm/hour versus 1.08 and 1.15 mg/sq cm hour reported earlier. The disc extrudability test was set up and preliminary data were gathered for three lots of LX-0201 and several tile materials. The experiment to detect deficiencies in Adiprene L-100 as an adhesive for H.E. caused by aging is in its third year. Tensile strength results indicated no deterioration; but shear strength results were questionable. In both cases, breakage occurred in the H.E.

DOE

Adhesives; Ethers; Mechanical Properties

19980203825 Los Alamos National Lab., NM USA

Industrial processing of complex fluids: Formulation and modeling

Scovel, J. C., Los Alamos National Lab., USA; Bleasdale, S., Los Alamos National Lab., USA; Forest, G. M., Ohio State Univ., USA; Bechtel, S., Ohio State Univ., USA; [1997]; 6p; In English

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

Report No.(s): LA-UR-97-2168; DE97-008591; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The production of many important commercial materials involves the evolution of a complex fluid through a cooling phase into a hardened product. Textile fibers, high-strength fibers(KEVLAR, VECTRAN), plastics, chopped-fiber compounds, and fiber optical cable are such materials. Industry desires to replace experiments with on-line, real time models of these processes. Solutions to the problems are not just a matter of technology transfer, but require a fundamental description and simulation of the processes. Goals of the project are to develop models that can be used to optimize macroscopic properties of the solid product, to identify sources of undesirable defects, and to seek boundary-temperature and flow-and-material controls to optimize desired properties.

DOE

Real Time Operation; Industries; Cooling Systems; Boundary Layer Flow; Fluid Flow

19980203840 Centre National de la Recherche Scientifique, Chatenay-Malabry, France

Current Challenges on Large Supramolecular Assemblies

Tsoucaris, Georges, Centre National de la Recherche Scientifique, France; Jan. 1997; 121p; In English; Advanced Research Workshop, 31 Oct. 5 Nov. 1997, Athens, Greece; Sponsored by North Atlantic Treaty Organization, Belgium

Contract(s)/Grant(s): N00014-97-1-0554

Report No.(s): AD-A343687; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Over the last few years several breakthroughs in the Supermolecular (SM) domain have being accomplished or foreseen in the near future: (1) bigger molecules are being synthesis; (2) crystals with larger unit cells are being obtained; and (3) more and more molecular components are used to build SM compounds with increasing versatility in applications. This Conference will bring together experts in synthesis and chemical reactivity, in preparation of crystalline compounds, and in methodologies for analysing large SM Assemblies. The stability and properties of such Assemblies heavily depend upon their three-dimensional (3D) structure involving specific patterns of non covalent bonds and interactions. The difficulty in making complex SM compounds and obtaining structural information has increased to such a level, that a single technique is not sufficient. Various methods are now made available for obtaining, characterizing and analysing SM compounds including crystallography, 2D layers, NMR, AFM/STM, FAB/MS, time-resolved phenomena, computational approaches and others. The efficiency of these methods will be examine in the light of recent or foreseen developments in synthesis and formation of large Assemblies. Further improvements can be expected by combining methods that provide complementary information.

DTIC

Chemical Reactions; Complex Compounds; Crystallography; Nuclear Magnetic Resonance

19980203873 Los Alamos National Lab., NM USA

Influence of temperature and strain rate on the mechanical behavior of Adiprene L-100

Gray, G. T., III, Los Alamos National Lab., USA; Blumenthal, W. R., Los Alamos National Lab., USA; Trujillo, C. P., Los Alamos National Lab., USA; Carpenter, R. W., II, Los Alamos National Lab., USA; [1997]; 8p; In English; Mechanical and Physical

Behavior of Materials Under Dynamic Loading, 22-26 Sep. 1997, Toledo, Spain
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-905; CONF-970944-6; DE97-005033; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The effect of sample thickness, strain rate, and temperature on the mechanical response of Adiprene-L100 is presented. The compressive stress-train response of Adiprene-L100 was found to depend on both the applies train rate; 0.001 (le) (dot (var epsilon)) (le) 7,000 s(sup -1), and the test temperature at high-rate; 77 (le) T (le) 298 K. Due to the slow, dispersive wave propagation in Adiprene-L100, thinner sample thicknesses are needed to assure uniform, uniaxial stress conditions within Hopkinson Bar samples; the optimal sample thickness being dependent on test temperature. Decreasing temperature from 298 to 77 K at 3,000 s(sup -1) was found to increase the maximum flow stress in Adiprene-L100 from 10 to approximately 210 MPa.
DOE
Mechanical Properties; Temperature Effects; Temperature Dependence; Adiprene (Trademark)

19980203898 Stevens Inst. of Tech., Dept. of Materials Science and Engineering, Hoboken, NJ USA
Transmission Electron Holography of Polymer Microstructure ***Final Report, 1 Jun. 1993 - 31 Dec. 1997***
Libera, Matthew R., Stevens Inst. of Tech., USA; Apr. 24, 1998; 17p; In English
Contract(s)/Grant(s): DAAH04-93-G-0239
Report No.(s): AD-A344467; 5-27362; ARO-31117.15-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final report describing a four year effort to develop and apply phase contrast imaging based on transmission electron holography as a means to measure unstained multiphase polymer microstructure. The experiments involve a 200keV transmission electron microscope with a high-coherence field emission electron source. A Mollenstadt biprism was constructed and installed to perform holographic interference experiments, and a slow-scan CCD camera was installed to provide for linear and fully digital hologram recording. A technique was developed to measure the average electron-optical refractive index characteristic of amorphous polymers. This method exploited the model spherical geometry of tilde 50nm diameter polymer latexes. This geometry enabled specimen thickness to be decoupled from the refractive effects of the material as measured by characteristic phase shifts imparted on an incident electron wave. The key quantity involved in the average refraction is known as the mean inner potential (MIP). The MIP for polystyrene was determined experimentally and agrees with predictions of simple models based on electrostatic properties of the polymer. Similar measurements were made on amorphous and crystalline silicon nanospheres yielding a MIP in excellent agreement with LDA calculations of Spence et al. at ASU. Simulations of holographic phase imaging of two-phase polymer microstructure were performed which indicate that the technique is sufficiently sensitive to distinguish between subtly different polymeric materials where no amplitude contrast can be observed.
DTIC
Block Copolymers; Holography; Electron Sources; Electron Microscopes; Transmission Electron Microscopy; Polymers; Microstructure; Electrostatics; Imaging Techniques

19980203910 Acurex Environmental Corp., Mountain View, CA USA
Control Technology for Depainting Operations: Estimation of Life-Cycle Costs of Controlling Methylene Chloride in Aircraft-Depainting Operations Versus Alternative Processes ***Final Report***
Venkatesh, Shyam, Acurex Environmental Corp., USA; Wolbach, C. D., Acurex Environmental Corp., USA; Waterland, Larry R., Acurex Environmental Corp., USA; Nov. 24, 1997; 155p; In English
Contract(s)/Grant(s): F08637-95-D6003/DO5303
Report No.(s): AD-A344806; FR-97-104; AL/EQ-TR-1997-0046; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Stripping the paint and other coatings from aircraft frames using chemical stripper formulations based on methylene chloride (MC) has been a standard practice at Air Logistics Centers (ALCs) for more than 50 years. The US Environmental Protection Agency (EPA) has recently listed MC as a hazardous air pollutant and has subsequently issued National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for major source categories. EPA specifically promulgated MC NESHAPs for Aerospace Manufacturing and Rework Facilities in September 1995. These standards will require paint stripping facilities that continue to use MC to implement MC emission controls that are at least 95% efficient by 1 September 1998. This report discusses the technical feasibility and costs of replacing current MC-stripping operations at ALCs with alternative stripping processes, discusses various MC-control technologies and control strategies that could be applied to current MC-stripping operations at ALCs, and estimates the life-cycle costs of selected alternative processes and MC-control strategies. These estimated life-cycle costs, and the proce-

dures used to derive them, can be used by depainting facility managers to support informed decisions in their selection of NESHAP compliance approaches.
DTIC
Chlorides; Airframes; Methylene; Chemical Compounds; Paints; Life Cycle Costs; Air Pollution; Paint Removal

19980203924 University of Central Florida, Center for Research in Electro-Optics and Lasers, Orlando, FL USA
Equipment for Processing and Characterizing Polymers ***Final Report, 1 Apr. 1997 - 1 Apr 1998***
Stegeman, G., University of Central Florida, USA; Apr. 01, 1998; 6p; In English
Contract(s)/Grant(s): F49620-97-1-0119; AF Proj. 3484
Report No.(s): AD-A343842; AFRL-SR-BL-TR-98-0434; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Equipment for processing and characterizing polymers was purchased with this DURIP equipment grant. Three items were purchased. The Reactive Ion Etching Unit (RIE) was purchased as an add-on to an existing instrument and the installation was completed in March 98. It will be used for making ridge waveguides in polymers. The high temperature poling station that was purchased is now being used by three separate researchers to pole a variety of polymers for parametric mixing devices. The single crystal growing apparatus was installed almost immediately and has been very successful in making state-of-the-art single crystal polydiacetylene PTS crystals. It has been demonstrated that these crystals have damage thresholds of greater than 400 GW/sq cm for 100 femtosecond pulses in the communications band at 1550 nm. In these crystals, the strongest reported multi-photon absorption ever, three and four photon, has been observed. Single crystal films for waveguiding have been grown and slab and channel waveguides in PTS have been demonstrated.
DTIC
Crystal Growth; High Temperature; Multiphoton Absorption; Single Crystals

19980203925 Dayton Univ. Research Inst., OH USA
Biodegradation of Polymeric Coatings and Composites ***Final Report, 1 Mar. 1995 - 28 Feb. 1998***
Thorp, Katie E., Dayton Univ. Research Inst., USA; Feb. 28, 1998; 13p; In English
Contract(s)/Grant(s): F49620-95-1-0168; AF Proj. 2303
Report No.(s): AD-A343843; AFRL-SR-BL-TR-98-0428; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Air Force structures are susceptible to corrosion under normal service conditions. Many of these metallic and polymeric structures can be protected against corrosion by organic coatings. However, routine maintenance, special mission requirements, and the ever-increasing life-cycle requirements of these aircraft structures necessitate periodic stripping of these coatings. The application, stripping, and disposal of these coatings cause a substantial environmental pollution problem for the Air Force. Current metal primers utilized by the U.S. Air Force contain chromates to inhibit corrosion of the underlying metal. These chromates are both highly toxic and carcinogenic and pose a severe health risk to personnel involved in their application, stripping, and disposal. The health risks are of particular concern during the stripping and disposal processes prior to refinishing the metal surfaces. Environmentally-friendly nonchromate replacement primers have historically performed poorly with respect to corrosion inhibition. Microorganisms have been shown to both initiate and accelerate corrosion in many environments. The aim of this study was to investigate the interaction of chromates with microorganisms in an environment not traditionally associated with biologically-enhanced corrosion and to determine it the corrosion inhibiting action of the chromate pigment might be due, in part, to its action as a biocide. The results of this investigation provide some guidance in the search for environmentally-benign chromate replacements.
DTIC
Corrosion Prevention; Environment Pollution; Plastic Coatings; Organic Materials

19980204013 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Applications of Temperature and Pressure Sensitive Paints
Liu, Tian-Shu, Purdue Univ., USA; Sullivan, John P., Purdue Univ., USA; May 1998; 10p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Luminescent molecular probes imbedded in a polymer binder form a temperature or pressure paint. On excitation by light of the proper wavelength, the luminescence, which is quenched either thermally or by oxygen, is detected by a camera or photodetector. From the detected luminescent intensity, temperature and pressure can be determined. The basic photophysics, calibration, accuracy and time response of a luminescent paint is described followed by applications in low speed, transonic, supersonic and cryogenic wind tunnels and in rotating machinery.
Author
Paints; Sensitivity; Pressure Measurement; Luminous Intensity; Luminescence

19980204725 Central Lab. of the Research Councils, Daresbury Lab., Warrington, UK

Fibre Diffraction Review: The CCP13 Newsletter Software, Issue 6, Development for Fibre Diffraction

Squire, J., Central Lab. of the Research Councils, UK; Dec. 1997; 60p; In English; Original contains color illustrations

Report No.(s): PB98-145279; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Contents include the following: Contents, Cover Caption and Production; The CCP13 Committee Members; Chairman's Message; Report on the ICNS, 1997, Toronto, .T. Forsyth; Report on the 4th Synchrotron Radiation School; Report on the 6th CCP13/NCD Workshop, 1997; Report on the 3rd Fibre Diffraction Workshop, 1997; Report on the Proceedings the Royal Society 1997; Report on 50 years of Synchrotron Radiation; Report on the Alpbach Workship 1997; Summary of Available CCP13/NCD Software; Contributed Articles; Optimal Difference Fourier Synthesis in Fibre Diffraction; Couette Cell Commissioned; Data Analysis of 2D-SAXS Pattern with Fiber Symmetry from some Elastomers; Chain Mobility in Polymer Systems; Lamellar Doubling during Annealing of Polyethylene; S. Rastogi, A.B. Spoelstra, J.G.P. Goosens and P.J. Lemstra; X-PLOR for Polycrystalline Fibre Diffraction; 5th Annual Workshop Prize - Winning Abstracts; 1996 CCP13/NCD Annual Meeting Abstracts; CCP13 Travelling Fellowships; CCP13 Visiting Scientist Fellowship Program; and Forthcoming Meetings.

NTIS

Synchrotron Radiation; Chemical Analysis; Conferences; Diffraction

19980204727 Sandia National Labs., Albuquerque, NM USA

Advances in ferroelectric polymers for shock compression sensors

Bauer, F., Institut Franco-Allemand de Recherches, France; Moulard, H., Institut Franco-Allemand de Recherches, France; Samara, G., Sandia National Labs., USA; 1997; 5p; In English; Shock Compression of Condensed Matter of the American Physical Society, 27 Jul. - 1 Aug. 1997, Amherst, MA, USA

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

Report No.(s): SAND-97-2282C; CONF-970707-13; DE98-000041; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Our studies of the shock compression response of PVDF polymer are continuing in order to understand the physical properties under shock loading and to develop high fidelity, reproducible, time-resolved dynamic stress gauges. New PVDF technology, new electrode configurations and piezoelectric analysis have resulted in enhanced precision gauges. Our new standard gauges have a precision of better than 1% in electric charge release under shock up to 15 GPa. The piezoelectric response of shock compressed PVDF gauges 1 sq mm in active area has been studied and yielded well-behaved reproducible data up to 20 GPa. Analysis of the response of these gauges in the "thin mode regime" using a Lagrangian hydrocode will be presented. P(VDF-TrFE) copolymers exhibit unique piezoelectric properties over a wide range of temperatures depending on the composition. Their properties and phase transitions are being investigated. Emphasis of the presentation will be on key results and implications.

DOE

Ferroelectricity; Copolymers; Piezoelectricity; Measuring Instruments; Shock Loads

19980206023 Allison Engine Co., Rolls-Royce Aerospace Group, Indianapolis, IN USA

Effective Spectral Emissivity Measurements of Superalloys and YSZ Thermal Barrier Coating at High Temperature Using a 1.6 Micron Single Wavelength Pyrometer

Alaruri, Sami, Allison Engine Co., USA; Bianchini, Lisa, Allison Engine Co., USA; Brewington, Andrew, Allison Engine Co., USA; May 1998; 12p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A method employing an integrating sphere and a single wavelength (1.6 micron) pyrometer for measuring the spectral effective emissivities of superalloys in the temperature range (approx. 650-1050 C) is described. The spectral effective emissivities for five superalloys, namely, MARM-247, MARM-509, CMSX-4, Inconel-7 18, N- 155, and two Rene-N6 samples coated with YSZ thermal barrier coating were measured. Correcting the pyrometer measurements for the variations in the object emissivity would reduce the uncertainty in the temperature measurements to less than +/- 1%.

Author

Temperature Measurement; Thermal Control Coatings; Yttria-Stabilized Zirconia; Heat Resistant Alloys; Pyrometers; Spectral Emission

19980206175 Mississippi State Univ., Dept. of Chemical Engineering, Mississippi State, MS USA

Testing Protocol Proposal to Identify and Evaluate Candidate Materials to Substitute for Silverized Teflon in Thermal Control Applications

Losure, Nancy S., Mississippi State Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright;

Avail: CASI; A02, Hardcopy; A04, Microfiche

Electrostatic discharge (ESD) has been shown to be the primary cause of several glitches in spacecraft operations. It appears that charged particles encountered in the natural environment in certain orbits can collect on the outer surfaces of a spacecraft, building up a charge of several thousand volts. If the potential exceeds the breakdown voltage of the charged material, then an ESD will occur. ESD events involving relatively low voltages, on the order of 100 V, have been shown to damage electronic components. When ESD occurs, electronic and electrical components can be damaged, computer instructions can be garbled, and ablation of material from the spacecraft may occur; degrading both the performance of the thermal control blankets, and the cleanliness of any surfaces on which the detritus becomes deposited. There appear to be six ways to prevent or mitigate the effects of ESD: (1) Choose an orbit where charging is not a problem; (2) Carry extra electromagnetic shielding; (3) Provide redundancy in components and programming; (4) Provide for active dissipation of the charge, by generating a plasma with which to bathe susceptible surfaces; (5) Provide for passive dissipation from a plasma contactors on the susceptible surfaces; and (6) Provide thermal control blankets that do not hold a charge, i.e., that are conductive enough to bleed a charge off harmlessly. These six options are discussed in detail in Losure (1996). of these six options, number 1 is not always practical, given other requirements of the mission; 2, 3, 4 and 5 will require that extra mass in the form of shielding, etc., be carried by the spacecraft. The most attractive option from a mass and energy point of view seems to be that of finding a material which matches the other performance characteristics of the current thermal control blankets without their tendency to build up an electrostatic charge. The goal of this paper is to describe and justify a testing program which will lead to the approval of materials of this kind.

Derived from text

Protocol (Computers); Proposals; Electrostatic Charge; Charged Particles; Electric Discharges; Temperature Control

19980206184 University of Western Kentucky, Dept. of Chemistry, Bowling Green, KY USA

The Effect of Gravity Axis Orientation on the Growth of Phthalocyanine Thin Films

Pearson, Earl F., University of Western Kentucky, USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Experimentally, many of the functions of electrical circuits have been demonstrated using optical circuits and, in theory, all of these functions may be accomplished using optical devices made of nonlinear optical materials. Actual construction of nonlinear optical devices is one of the most active areas in all optical research being done at this time. Physical vapor transport (PVT) is a promising technique for production of thin films of a variety of organic and inorganic materials. Film optical quality, orientation of microcrystals, and thickness depends critically on type of material, pressure of buffer gas and temperature of deposition. An important but understudied influence on film characteristics is the effect of gravity-driven buoyancy. Frazier, Hung, Paley, Penn and Long have recently reported mathematical modelling of the vapor deposition process and tested the predictions of the model on the thickness of films grown by PVT of 6-(2-methyl-4-nitroanilino)-2,4-hexadiyn-l-ol (DAMNA). In an historic experiment, Debe, et. al. offered definitive proof that copper phthalocyanine films grown in a low gravity environment are denser and more ordered than those grown at 1 g. This work seeks to determine the influence on film quality of gravity driven buoyancy in the low pressure PVT film growth of metal-free phthalocyanine.

Author

Thin Films; Vapor Deposition; Gravitational Effects; Phthalocyanin

19980206279 Los Alamos National Lab., NM USA

Auger parameter determination of bonding states on thinly oxidized silicon nitride

Taylor, T. N., Los Alamos National Lab., USA; Butt, D. P., Los Alamos National Lab., USA; Pantano, C. G., Pennsylvania State Univ., USA; [1997]; 31p; In English; Annual Symposium of the New Mexico American Vacuum Society, 20 - 22 May 1997, Albuquerque, NM, USA

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

Report No.(s): LA-UR-97-1867; CONF-9705143-2; DE97-008162; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Silicon nitride powders have been thermally oxidized between 700 and 1,200 C in a high purity N2--20% O2 gas environment. The powders were subsequently analyzed by x-ray photoelectron and Auger electron spectroscopy for evidence of oxynitride surface states. Measurements were made on the Si 2p, O 1s, N 1s, C 1s, F 1s, and Si KLL transitions, the latter being obtained using bremsstrahlung radiation from the Mg x-ray source. As a function of increasing temperature the data show a clear progression of spectral binding energies and peak shapes that are indicative of more advanced surface oxidation. However, definitive analysis of these data rests on the combined use of both Auger and photoelectron data to define the oxidized surface states for a system that involves two electrically insulating end states, silicon nitride and silicon dioxide. Curve fitting the Si 2p and Si KLL transitions as a function of oxidation, coupled with use of Auger parameters for the starting silicon nitride and final silicon dioxide, reveals

no measurable evidence for an interphase oxynitride in the thin oxide scales of this study, where the silicon nitride substrate is detectable. Possible incorrect assignment of oxynitride bonding, from shifted Si 2p states in the carbon referenced spectra, is attributable to band bending as the transition is made from incipient to fully formed silicon dioxide.
DOE
Silicon Nitrides; Spectroscopic Analysis; Oxidation; Bonding; Oxynitrides; Chemical Composition

19980206312 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Ultra-thin overcoats for the head/disk interface tribology
Bhatia, C. S., International Business Machines Corp., USA; Anders, S., California Univ., Lawrence Berkeley Lab., USA; Brown, I. G., California Univ., Lawrence Berkeley Lab., USA; May 1997; 28p; In English; Micromechatronics for Information and Precision Equipment, 20 - 23 Jul. 1997, Tokyo, Japan
Contract(s)/Grant(s): DE-AC03-76SF-00098; MDA972-93-1-0009
Report No.(s): LBNL-40416; LSBL-385; CONF-970798-; DE97-008864; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Areal density in magnetic storage is increasing at a blistering pace of 60% annually. Recently IBM announced its mobile product with the industry highest areal density of 2.64 Gb/sq In. The areal density demonstrations have shown up to 5 Gb/sq In possible. Reaching higher areal density targets dictate that magnetic spacing between heads and disks be reduced. For the example of a 10 Gb/sq In areal density goal, the magnetic spacing should be approximately 25 nm. In budgeting this magnetic spacing, it is required that disk and slider air bearing surface overcoats thickness be reduced to 5 nm range. Present choice of carbon overcoat in the magnetic storage hard disk drive industry is sputter deposited, hydrogenated carbon (CH(sub x)) with thickness in the range of 12-15 nm on heads and disks. Novel overcoats such as nitrogenated carbon (CN(sub x)) and cathodic arc carbon films are being developed for future applications. Cathodic arc deposition forms ultra-thin amorphous hard carbon films of high sp(sup 3) content, high hardness, and low coefficient of friction. These properties make it of great interest for head/disk interface application, in particular for contact recording. In many cases, the tribological properties of the head disk interface could be improved by factors up to ten applying cathodic arc overcoats to the slider or disk surface. This paper reviews the results of cathodic arc ultra-thin (2-10 nm) carbon overcoats for head/disk interface tribological applications.
DOE
Coatings; Tribology; Thin Films; Amorphous Materials; Carbon; Magnetic Storage; Deposition; Friction

19980206328 Los Alamos National Lab., NM USA
Exciton and biexciton signatures in femotosecond transient absorption of (pi)-conjugated oligomers
Klimov, V., Los Alamos National Lab., USA; McBranch, D., Los Alamos National Lab., USA; Barashkov, N., Texas Univ., USA; Ferraris, J., Texas Univ., 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-97-3519; CONF-970706; DE98-000245; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors report femotosecond transient-absorption studies of a five-ring oligomer of polyphenylenevinylene (PPV) prepared in two different forms: as solid-state films and dilute solutions. Both types of samples exhibit a photoinduced absorption (PA) band with dynamics which closely match those of the stimulated emission (SE), demonstrating unambiguously that these features originate from the same species, namely from intrachain singlet excitons. Photo-chemical degradation of the solid-state samples is demonstrated to dramatically shorten the SE dynamics above a moderate incident pump fluence, whereupon the dynamics of the SE and the long-wavelength PA no longer coincide. In contrast to solutions, solid-state films exhibit an additional short-wavelength PA band with pump-independent dynamics, indicating the efficient formation of non-emissive inter-chain excitons. Correlations in the subpicosecond dynamics of the two PA features, as well as the pump intensity-dependence provide strong evidence that the formation of inter-chain excitons is mediated by intrachain two-exciton states. At high pump levels, the authors see a clear indication of interaction between excited states also in dilute solutions. This is manifested as a superlinear pump-dependence and shortening of the decay dynamics of the SE. They attribute this behavior to the formation of biexcitons resulting from coherent interaction between two excitons on a single chain.
DOE
Oligomers; Chemical Properties; Excitons; Signatures; Conjugation; Chemical Attack; Absorption Spectra

19980206331 Sandia National Labs., Albuquerque, NM USA

Structure-property relationships of antiferroelectric Pb(Zr, Ti)O3) based materials: Hydrostatic depoling characteristics

Tuttle, B., Sandia National Labs., USA; Voigt, J., Sandia National Labs., USA; Moore, R., Sandia National Labs., USA; 1997; 7p; In English; 8th; Dielectric and Piezoelectric, 15 - 18 Oct. 1997, Plymouth, MA, USA

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

Report No.(s): SAND-97-2225C; CONF-971080; DE97-009387; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A novel technique has been developed for the synthesis of homogeneous, weakly agglomerated highly filterable Pb(Zr, Ti)O3) (PZT) powders. PZT 95/5 based ceramics were fabricated from these powders to determine interrelationships among microstructure, dielectric properties and pressure induced ferroelectric (FE) to antiferroelectric (AFE) phase transitions. Initial measurements indicate that microstructure has a substantial effect on hydrostatic depoling characteristics. While smaller grain size materials and higher switching pressures, subtleties in microstructure, which may include entrapped porosity, resulted in a more diffuse depoling characteristic. In addition, greater than 90% dense materials were obtained at process temperatures as low at 900(degrees)C. were only 30% of the values of PZT 95/5 fired at 1300(degrees)C, the dielectric constants of the 900(degrees)C materials were almost a factor of two higher. Backscattered electron Kikuchi pattern analysis determined that adjacent, nonlinear, irregularly shaped domain structures observed by electron channel imaging were 109(degrees) domains.

DOE

Dielectric Properties; Lead Zirconate Titanates; Phase Transformations; Microstructure; Ceramics

19980206372 Brookhaven National Lab., Upton, NY USA

Underpotential deposition of Ag adlayers on Pt(111): Structures and determination of O2 adsorption on Pt(111)

Marinkovic, N. S., Brookhaven National Lab., USA; Wang, J. X., Brookhaven National Lab., USA; Adzic, R. R., Brookhaven National Lab., USA; [1997]; 13p; In English; 191st, 4 - 9 May 1997, Montreal, Canada; Sponsored by Electrochemical Society, Inc., USA

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

Report No.(s): BNL-64662; CONF-970517; DE97-008948; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The structure of Ag adlayers deposited at underpotentials in sulfuric acid on Pt(111), and the inhibition of O2 reduction they cause, have been studied using grazing incident angle x-ray diffraction measurements, as well as linear sweep voltammetry and in situ FTIR spectroscopy. Ag forms a hexagonal incommensurate bilayer, with two mutually commensurate monolayers. It is aligned with the Pt(111) substrate, although slightly expanded. The first monolayer has a commensurate (1 x 1) structure. A second layer causes a restructuring of the first monolayer. Deposition of each monolayer is associated with one voltammetry Peak. A complete inhibition of O2 reduction on Pt(111) has been observed upon deposition of both, Ag monolayer and bilayer. Analysis of the inhibition of O2 reduction as a function of the Ag coverage shows that during reduction O2 adsorbs in a bridge configuration on Pt(111).

DOE

Electrodeposition; Silver; Platinum; Morphology; Substrates; Microstructure; Adsorption

28
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.

19980203538 Swedish Transport and Communications Research Board, Stockholm, Sweden

The Use of Methanol as a Fuel for Transportation

Egebaeck, K. E., Lulea Univ., Sweden; Walsh, M. P., Walsh (M. P.), USA; Westerholm, R., Stockholm Univ., Sweden; Jun. 1997; ISSN 1401-1271; 99p; In English

Report No.(s): KFB-MED-97-15; DE97-769035; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The aim of the project was to collect and report international experiences concerning the use of methanol as an automotive fuel. The method has been to study the literature which covers the subject and most of the information has been collected that way. The project started with a participation in a conference and a visit to people who have been involved in activities concerning the use of automotive alcohols. Car manufacturers, environmental authorities and users of alcohol fuels i.e. representatives of bus

companies, were interviewed. The different applications for the use of methanol as an automotive fuel has been described in the report as well as the production of methanol. Some results, mostly in form of emission data and other experiences derived from the use of alcohol fuels, have also been presented. The use of ethanol and methanol has been compared and based on information from engine manufacturers and users of alcohol fueled vehicles there seems to be a preference for the use of ethanol. However, the question 'methanol or ethanol' has not been answered as the decision which of the two is to be used seems to depend more on economic factors, such as cost of the production of the fuel etc., than on other factors.
DOE
Automobile Fuels; Methyl Alcohol; Emission; Environment Effects; Fuel Production; Transportation

19980203773 Princeton Univ., Dept. of Mechanical and Aerospace Engineering, NJ USA
Fuels Combustion Research ***Final Report, 1 Oct. 1994 - 30 Sep. 1997***
Glassman, Irvin, Princeton Univ., USA; Goddard, Robert H., Princeton Univ., USA; Feb. 1998; 17p; In English
Contract(s)/Grant(s): F49620-95-1-0016; AF Proj. 2308
Report No.(s): AD-A343308; AFRL-SR-BL-TR-98-0362; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A high pressure plug flow reactor designed for supercritical hydrocarbon reaction studies was applied to the analysis and fuel fouling aspects of the endothermic fuel methylcyclohexane (MCH). At a reduced pressure of 1.3 (4.5 MPa), a residence-time of 0.9 minutes, and temperatures from 750-344 K, conditions typical of the most extreme aircraft conditions envisioned for the future, gaseous and liquid MCH products were analyzed. At the lower temperatures examined conversion of MCH to Polynuclear Aromatic Hydrocarbons (PAH) was essentially zero. At higher temperatures, above 820 K, significant PAH formation was observed, as was particulate formation, a very important practical result and a trend established for soot formation in gaseous diffusion flames. Operation in the supercritical region revealed varying temperature to be significantly more important than pressure with regard to PAH and particulate formation. Chromatograms of MCH reactor products established that there were hundreds of gaseous and liquid intermediates under both the sub- and supercritical conditions of operation. In gas phase experiments at 1 atm and temperatures around 1100 K in the Princeton Turbulent Flow Reactor, explicit equations for the rate of decay of MCH and another endothermic fuel decalin were determined. Significantly, product compositions of both fuels were found to be very different from those observed by others for the catalytic decomposition of these fuels.
DTIC
Fuel Combustion; Flow Equations; Turbulent Flow; Chromatography; Diffusion Flames

19980203942 Argonne National Lab., IL USA
Assessment of PNGV fuels infrastructure, Phase 1, Additional capital needs and fuel-cycle energy and emissions impacts
Wang, M., Argonne National Lab., USA; Stork, K., Argonne National Lab., USA; Vyas, A., Argonne National Lab., USA; Mintz, M., Argonne National Lab., USA; Singh, M., Argonne National Lab., USA; Johnson, L., Argonne National Lab., USA; Jan. 1997; 69p; In English
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/ESD/TM-140; DE97-009052; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report presents the methodologies and results of Argonne's assessment of additional capital needs and the fuel-cycle energy and emissions impacts of using six different fuels in the vehicles with tripled fuel economy (3X vehicles) that the Partnership for a New Generation of Vehicles is currently investigating. The six fuels included in this study are reformulated gasoline, low-sulfur diesel, methanol, ethanol, dimethyl ether, and hydrogen. Reformulated gasoline, methanol, and ethanol are assumed to be burned in spark-ignition, direct-injection engines. Diesel and dimethyl ether are assumed to be burned in compression-ignition, direct-injection engines. Hydrogen and methanol are assumed to be used in fuel-cell vehicles. The authors have analyzed fuels infrastructure impacts under a 3X vehicle low market share scenario and a high market share scenario. The assessment shows that if 3X vehicles are mass-introduced, a considerable amount of capital investment will be needed to build new fuel production plants and to establish distribution infrastructure for methanol, ethanol, dimethyl ether, and hydrogen. Capital needs for production facilities will far exceed those for distribution infrastructure. Among the four fuels, hydrogen will bear the largest capital needs. The fuel efficiency gain by 3X vehicles translates directly into reductions in total energy demand, fossil energy demand, and CO2 emissions. The combination of fuel substitution and fuel efficiency results in substantial petroleum displacement and large reductions in emissions of nitrogen oxide, carbon monoxide, volatile organic compounds, sulfur oxide, and particulate matter of size smaller than 10 microns.
DOE
Diesel Fuels; Automobile Fuels; Environment Effects; Fuel Consumption; Diesel Engines

19980203973 Los Alamos National Lab., NM USA

The importance of safety in achieving the widespread use of hydrogen as a fuel

Edeskuty, F. J., Los Alamos National Lab., USA; [1997]; 12p; In English; Hypothesis 2: Symposium on Hydrogen Power Theoretical and Engineering Solutions, 18 - 22 Aug. 1997, Grimstad, Norway

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

Report No.(s): LA-UR-97-2098; CONF-970860-2; DE97-008754; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The advantages of hydrogen fuel have been adequately demonstrated on numerous occasions. However, two major disadvantages have prevented any significant amount of corresponding development. These disadvantages have been in the economics of producing sufficient quantities of hydrogen and in the safety (both real and perceived) of its use. to date work has mostly been properly centered on solving the economic problems. However, a greater effort on the safety of new hydrogen systems now being proposed also deserves consideration. to achieve the greatest safety in the expansion of the use of hydrogen into its wide-spread use as a fuel, attention must be given to four considerations. These are, obtaining knowledge of all the physical principles involved in the new uses, having in place the regulations that allow the safe interfacing of the new systems, designing and constructing the new systems with safety in mind, and the training of the large number of people that will become the handlers of the hydrogen. Existing organizations that produce, transport, or use hydrogen on a large scale have an excellent safety record. This safety record comes as a consequence of dedicated attention to the above-mentioned principles. However, where these principles were not closely followed, accidents have resulted. Some examples can be cited. As the use of hydrogen becomes more widespread, there must be a mechanism for assuring the universal application of these principles. Larger and more numerous fleet operations with hydrogen fuel may be the best way to begin the indoctrination of the general public to the more general use of hydrogen fuel. Demonstrated safe operation with hydrogen is vital to its final acceptance as the fuel of choice.

DOE

Hydrogen Fuels; Safety; Hydrogen Production; Hydrogen-Based Energy

19980205776 Air Force Research Lab., Edwards AFB, CA USA

Chemical, Physical and Hazards Properties of Quadricyclane

Wucherer, E. J., Air Force Research Lab., USA; Wilson, Angelica, Air Force Research Lab., USA; Mar. 1998; 78p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A345589; PL-TR-97-3053; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Theoretical predictions have identified quadricyclane, a liquid hydrocarbon, as a possible replacement for, or additive to, the current kerosene-based rocket propellant RP-1. Density, viscosity, thermal conductivity, heat capacity, flash point, purity, 90-day aging, high temperature decomposition, impact sensitivity, friction sensitivity and detonation sensitivity (card gap) have been studied. In-depth studies on the thermal decomposition and rapid compression heating were performed by NASA White Sands and are included in this report. Taken as a whole, the results indicate that quadricyclane can be easily handled as a liquid propellant fuel and should have performance advantages over RP-1. However, since the performance and physical properties of quadricyclane differ from RP-1, implementation of quadricyclane may require some modification of current propulsion hardware.

DTIC

Toxicity; Fuels; Hydrocarbons; Thermal Conductivity; Hazardous Materials; Rocket Propellants; Numerical Analysis; Chemical Properties

19980206035 Societe Nationale des Poudres et Explosifs, Direction des Operations Scientifiques et Technologiques, Saint-Medard-en-Jalles, France

Solid Rocket Propellant Behavior During Static Firing Test Using Real Time X-Ray Radioscopy

Tauzia, J. M., Societe Nationale des Poudres et Explosifs, France; Lamarque, P., Societe Nationale des Poudres et Explosifs, France; May 1998; 6p; In French; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Unlike ordinary motors, solid propellants rockets operate only once and for a very short period of time. So, a method able to investigate the behavior of the grain during static firing test is of high interest for the people in charge of the development program especially regarding the following phases: ignition, burning surface Propagation, and defects behavior and motors failure modes. The connection of high speed video camera with real time x ray equipment allows valuable data acquisition during the

firing and fulfill the need of direct investigation of the related phenomenon. In this paper some examples are presented, analyzed, and compared with computed simulation.
Author
Solid Rocket Propellants; Solid Propellant Rocket Engines; Static Firing; X Ray Analysis; Propellant Combustion; Real Time Operation; Propellant Properties

19980206165 Memphis Univ., Dept. of Mechanical Engineering, Memphis, TN USA
Computational Modeling of Magnetically Actuated Propellant Orientation
Hochstein, John I., Memphis Univ., USA; Oct. 1996; 6p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Unlike terrestrial applications where gravity positions liquid at the ”bottom” of the tank, the location of liquid propellant in spacecraft tanks is uncertain unless specific actions are taken or special features are built into the tank. Some mission events require knowledge of liquid position prior to a particular action: liquid must be positioned over the tank outlet prior to starting the main engines and must be moved away from the tank vent before vapor can be released overboard to reduce pressure. It may also be desirable to positively position liquid to improve propulsion system performance: moving liquid away from the tank walls will dramatically decrease the rate of heat transfer to the propellant, suppressing the boil-off rate, thereby reducing overall mission propellant requirements. The process of moving propellant to a desired position is referred to as propellant orientation or reorientation. Propulsive reorientation relies on small auxiliary thrusters to accelerate the tank. The inertia of the liquid causes it to collect in the aft-end of the tank if the acceleration is forward. Liquid Acquisition Devices (LAD’s) rely on surface tension to hold the liquid within special geometries, (i.e. vanes, wire-mesh channels, start-baskets), to positively position propellants. Both of these technologies add significant weight and complexity to the spacecraft and can be limiting systems for long duration missions. The subject of the present research is an alternate technique for positively positioning liquid within spacecraft propellant tanks: magnetic fields. LOX is paramagnetic (attracted toward a magnet) and LH2 is diamagnetic (repelled from a magnet). Order-of-magnitude analyses, performed in the 1960’s to determine required magnet size, concluded that the magnets would be prohibitively massive and this option has remained dormant during the intervening years. Recent advances in high-temperature superconducting materials hold the promise of electromagnets with sufficient performance to support cryogenic propellant management tasks. In late 1992, NASA MSFC began a new investigation in this technology commencing with the design of the Magnetically-Actuated Propellant Orientation (MAPO) experiment. A mixture of ferrofluid and water is used to simulate the paramagnetic properties of LOX and the experiment is being flown on the KC-135 aircraft to provide a reduced gravity environment. The influence of a 0.4 Tesla ring magnet on flow into and out of a subscale Plexiglas tank is being recorded on video tape. The most efficient approach to evaluating the feasibility of MAPO is to compliment the experimental program with development of a computational tool to model the process of interest. The goal of the present research is to develop such a tool. Once confidence in its fidelity is established by comparison to data from the MAPO experiment, it can be used to assist in the design of future experiments and to study the parameter space of the process. Ultimately, it is hoped that the computational model can serve as a design tool for full-scale spacecraft applications.
Author
High Temperature Superconductors; Liquid Rocket Propellants; Propellant Tanks; Superconducting Magnets; Mathematical Models; Magnetic Control

19980206310 Los Alamos National Lab., Center for Materials Science, NM USA
Storage of hydrogen in powders with nanosized crystalline domains
Schwarz, R. B., Los Alamos National Lab., USA; [1997]; 6p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1937; DE97-008873; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The term nanostructured materials is being used in the literature to denote different materials prepared by different techniques: (a) by the gas condensation of vapors in a partial vacuum and (b) by mechanical alloying, a high energy ball milling technique. The authors discuss the origin of this confusion and propose a differentiating nomenclature. They then discuss the use of particles with nanosized structures for the storage of hydrogen.
DOE
Crystal Structure; Powder Metallurgy; Alloying; Hydrogen; Energy Storage

19980206314 National Renewable Energy Lab., Golden, CO USA
Determination of alternative fuels combustion products, Phase 1
Whitney, K. A., Southwest Research Inst., USA; Sep. 1997; 159p; In English
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/TP-425-7528; DE98-000606; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report describes the laboratory effort to identify and quantify organic exhaust species generated from alternative-fueled light-duty vehicles operating over the Federal Test Procedure on compressed natural gas, liquefied petroleum gas, methanol, ethanol, and reformulated gasoline. The exhaust species from these vehicles were identified and quantified for fuel/air equivalence ratios of 0.8, 1.0, and 1.2, nominally, and were analyzed with and without a vehicle catalyst in place to determine the influence of a catalytic converter on species formation.
DOE
Combustion Products; Exhaust Gases; Fuels; Natural Gas; Methyl Alcohol; Ethyl Alcohol; Gasoline

19980206340 Alabama Univ., Dept. of Chemistry, Birmingham, AL USA
Insensitive High Explosives: A Computational Study ***Final Report, 30 Sep. 1994 - 29 Dec. 1997***
Lammertsma, Loop, Alabama Univ., USA; Dec. 1997; 14p; In English
Contract(s)/Grant(s): F49620-94-1-0451
Report No.(s): AD-A345380; AFRL-SR-BL-TR-98-0467; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this final report we summarize our computational efforts addressing the thermal decomposition of 3-nitro-1,2,4-triazol-5-one (NTO) and hexahydro-1,2,3-trinitro- 1,3,5 triazine (RDX), These efforts expand our earlier work on the common explosive 2,4,6-trinitrotoluene (TNT), which has been described in Report AL-TR-9O-OO4 (32 pages). We also report on the dimethylnitramide (rMNA) decomposition, bonding properties of bridged hydrogens, and a superacid solvation model. Tautomcrism is the common thread in the studies on NTO and RDX, which are summarized in sections 1 and 2, respectively. In section 6 we expand the earlier reported imine - enamine, keto - enol, and nitro - sci-nitro, tautomerisms with the nitroso - oxime tautomerism using GZ theory with specific inclusion of the effects of solvent molecules. Isotope effects are often used as indicator of the decomposition mechanism for the expulsio% of nitro groups. Hence, we report the douterium kinetic isotope effects for decomposition of dimethylnitramine using denstry functional theory. This is summarized in section 3. Superncid initiated electrophilic nitrstions reactions are intriguing processes, which are, however, not modeled conveniently because of soivation (pro-tonation)effects. Therefore, we developed a computational model that determines
DTIC
Chemical Composition; Explosives; Decomposition; Computation; Sensitivity

29
MATERIALS PROCESSING

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

19980206170 Alabama A & M Univ., Dept. of Food Science and Animal Industries, Huntsville, AL USA
Adaptation of Motility Analysis Apparatus for Space Science and Microgravity Ground-Based Experiments
Johnson, Jacqueline U., Alabama A & M Univ., USA; Oct. 1996; 6p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Previous space flight studies have described unfavorable effects of microgravity on testicular morphology and spermatogenesis (Cosmos 1887 Biosputnik flight, 9/29/87 - 10/12/87). The flight animals demonstrated small reductions in testicular and epididymal size, the phenomenon explained as resulting water loss. Yet, light microscopic histological preparations revealed few spermatozoa in the rete testis of the flight males compared to control animals. The cause for this finding was subjectively assessed to be due to ”the anatomical dislocation of the organs... and a disturbance in testicular blood supply”. Unfortunately, the reported effects of microgravity on the reproductive processes (particularly within males) are few and divergent. If habitation in space is a futuristic goal, more objective testing (of male and female gametes) in a microgravity environment will provide insight to the developmental potential of these reproductive cells. As part of the Marshall Space Flight Centers’ Summer Faculty Fellowship Program within the Biophysics Branch, a key component of the research investigation was to develop a test to evaluate individual cell motility and orientation in varying gravitational environments, using computerized assessment of sperm cell concentration, morphology and motility to provide objective, quantitative experimental control. In previous work performed jointly by the author

and a NASA colleague, it has been shown that macroscopic motile aggregates of spermatozoa were not altered by the absence of microgravity. Variations in the number of normal versus abnormal sperm due to microgravity influences have yet to be established. It is therefore of interest to monitor the cytoskeletal matrix (microtubulin) of these organisms as a possible indicator of cell viability and/or function.
Derived from text
Spermatogenesis; Gravitational Effects; Biophysics; Microgravity; Abnormalities; Locomotion

31
ENGINEERING (GENERAL)

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

19980203431 Sandia National Labs., Albuquerque, NM USA
BFIT: A program to analyze and fit the BCJ model parameters to experimental data. Tutorial and user's guide
Lathrop, J. F., Sandia National Labs., USA; Dec. 1996; 28p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-8218; DE97-053285; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

While the BCJ plasticity model is powerful in representing material behavior, finding values for the 20 parameters representing a particular material can be a daunting task. BFIT was designed to make this task at least feasible if not easy. The program has been developed over several years and incorporates the suggestions and requests of several users.
DOE
Computer Programs; Manufacturing; User Manuals (Computer Programs); Plastic Properties

19980203537 Cryogenic Society of Japan, Tokyo, Japan
56th Meeting on Cryogenics and Superconductivity, *FY 1997 Dai 56 kai 1997 Nendo Shunki Teion Kogaku Chodendo Gakkai Koen Gaiyoshu*
May 14, 1997; 321p; In Japanese; 56th; Cryogenics and Superconductivity, Japan
Report No.(s): DE97-770261; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In the meeting, 266 papers were made public which deal with the following fields: GM refrigerators, pulse tube refrigerators, cold storage equipment, Bi-2212 system, coil application, superconducting generators, LHD/ITER/accelerators, cable-in conduit conductors, electromagnetic phenomena/proximity effect, oxide cable, Nb3Sn, Nb3Al, metal materials, WE-NET, friction/organic materials, composite materials, Nb3Sn, Nb3Al wires, strand wire structure analysis, hybrid superconducting wire, Y system, Bi system, low temperature device, measurement, high magnetic field NMR magnet, oxide NMR application, Bi-2223 system wire, pinning, NbTi ac wire, pinning/ac loss, various characteristics, superconducting application, refrigerating system, heat transfer, cryostat, Hg/Ti/Y system wire, ac loss/application, superconducting electric power storage system and the development of element technology therefor, current limiter/magnetic flotation, stability and drift of strand conductors, stability, ITER, LHD/accelerator/SLIM, oxide application, conductor stability test and others, and quench of ac cable.
DOE
Cryogenics; Superconductivity; Conferences; Cryogenic Equipment; Superconducting Devices

19980203724 Department of Energy, Office of Energy Research, Washington, DC USA
Summaries of FY 1996 Engineering Research
Jun. 1997; 64p; In English
Report No.(s): DOE/ER-0704; DE97-008794; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report documents the Basic Energy Sciences (BES) Engineering Research Program for fiscal year 1996; it provides a summary for each of the program projects in addition to a brief program overview. The report is intended to provide staff of Congressional committees, other executive departments, and other DOE offices with substantive program information so as to facilitate governmental overview and coordination of Federal research programs. of equal importance, its availability facilitates communication of program information to interested research engineers and scientists. Each BES Division administers basic, mission oriented research programs in the area indicated by its title. The BES Engineering Research Program is one such program; it is administered by the Engineering and Geosciences Division of BES. In preparing this report the principal investigators were asked to submit summaries for their projects that were specifically applicable to fiscal year 1996. The summaries received have

been edited if necessary, but the press for timely publication made it impractical to have the investigators review and approve the revised summaries prior to publication. For more information about a given project, it is suggested that the investigators be contacted directly.
DOE
Research and Development; Energy Technology; Project Management

19980203852 Los Alamos National Lab., NM USA
Integrated approach to advanced machining
LeSar, R. A., Los Alamos National Lab., USA; Bourke, M. A. M., Los Alamos National Lab., USA; Rangaswamy, P., Los Alamos National Lab., USA; Day, R. D., Los Alamos National Lab., USA; Hatch, D. J., Los Alamos National Lab., USA; [1997]; 21p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2177; DE97-008573; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The residual stress state induced by machining in a Ti alloy as function of cutting tool sharpness and depth of cut was predicted and measured. Residual stresses were greater for the dull tool than for the sharp tool. XRD was used to measure the residual stress state of the material; these measurements revealed that the hoop stress increased with depth of cut; however the radial stress decreased with depth of cut. An elastic-plastic model provided a possible explanation for this behavior in that, for small depths of cut, the tool makes multiple passes through the damage subsurface layer. This causes both residual stress components to increase, but the radial stress increases by a much greater amount than the hoop stress.
DOE
Residual Stress; Titanium Alloys; Cutters; Machining

19980204479 National Inst. of Standards and Technology, Fire Science Div., Gaithersburg, MD USA
Next-Generation Fire Suppression Technology Program (NGP)
Gann, R. G., National Inst. of Standards and Technology, USA; May 1998; 18p; In English
Report No.(s): PB98-149032; NISTIR-6163; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NGP, now in its second year, has as its goal the development by 2004 of alternative fire fighting technologies to halon 1301 that can be economically implemented in aircraft, ships, land combat vehicles, and critical mission support facilities. This paper describes the first projects and their early results.
NTIS
Alternatives; Research Projects; Fire Fighting; Fires

19980204710 Swedish Environmental Protection Agency, Stockholm, Sweden
Recycling of Paint and Water Curtains with Ultrafiltration ***Aetervinning av Faerg och Ridaevatten med Ultrafiltrering***
Fortkamp, U., Swedish Environmental Protection Agency, Sweden; Allard, A. S., Swedish Environmental Protection Agency, Sweden; Ekengren, O., Swedish Environmental Protection Agency, Sweden; Dec. 1997; 30p; In Swedish
Report No.(s): PB98-147531; IVL-B-1254; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Painting in spray booths causes overspray that is collected by a water curtain. The mixture of water and paint is commonly treated by means of precipitation. by means of this method, water can be used again but a paint sludge is created. Within this project, it was investigated how the paint as well as the water can be recycled. Separation by membrane filtration was tested for different paints in laboratory scale (0.2 liter volume). It was possible to separate all tested paints from the water and to concentrate it. At large scale (15 to 75 liters volume), an emulsion paint and a dispersion paint were tested. Under the tested conditions, it was slightly easier to concentrate the emulsion paint than the dispersion paint. It was possible to concentrate the paints to the original dry substance percentage. An important aspect of membrane filtration is cleaning of the membrane when the performance decreases. It was possible to clean all the tested membranes, but in many cases it was difficult. A ceramic membrane and a membrane of polyaramide showed the best results with regard to flux and cleaning of the membrane under the tested conditions. During the performance of the project two new applications of membrane filtration of paint were found. The method can be used for waste minimization by only separating the paint in an easy way at low costs. A third application is treated of cleaning water from paint manufacturing.
NTIS
Waste Water; Waste Management; Procedures; Technologies; Paints; Sprayed Coatings; Filtration; Separators

19980204718 Corrpro Companies, Inc., Medina, OH USA

Field Evaluation of a New Aluminum Alloy as a Sacrificial Anode for Steel Embedded in Concrete ***Final Report, Apr. 1995 - Oct. 1997***

Funahashi, M., Corrpro Companies, Inc., USA; Young, W. T., Corrpro Companies, Inc., USA; Apr. 1998; 72p; In English

Report No.(s): PB98-147135; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This is the final report for a study to evaluate the use of sacrificial cathodic protection for reinforced and prestressed concrete bridge members. Cathodic Protection (CP) using impressed current is an accepted and common method used to provide corrosion protection to steel in concrete. Sacrificial cathodic protection, however, is relatively easy to apply, does not require that the anode be electrically isolated from the steel, and does not require an external power supply.

NTIS

Evaluation; Performance Tests; Aluminum Alloys; Bridges (Structures); Cathodic Coatings; Reinforced Plates

19980204874 Naval Postgraduate School, Monterey, CA USA

Development and Calibration of a Torsional Engine Model for a Three-Cylinder, Two-Stroke Diesel Engine

Hudson, James W., Naval Postgraduate School, USA; Dec. 1997; 74p; In English

Report No.(s): AD-A343145; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An experimental and analytical investigation was conducted to develop a calibrated torsional model of a three-cylinder, two-stroke diesel engine. A Detroit Diesel 3-53 engine was instrumented for time resolved measurement of cylinder firing pressures and high resolution near instantaneous shaft speed using a 720 and a 3,600 count per revolution optical encoder. Data were taken for three speeds and three torques for a total of nine conditions. A six degree-of-freedom torsional vibration model of the crankshaft, connecting rods, and pistons was developed. The nonlinear inertias, due to the reciprocating pistons, were included along with linear stiffness and damping. The equations of motion were numerically integrated over a cycle to obtain predicted response. The predicted response was compared to the measured response at the free end of the crankshaft.

DTIC

Diesel Engines; Calibrating; Torsional Vibration; Torsion; Cylindrical Bodies

19980204877 Alabama Univ., Dept. of Aerospace Engineering and Mechanics, Tuscaloosa, AL USA

Analytical Modeling of High Rate Processes ***Final Report, 1 Sep. 1994 - 31 Aug. 1997***

Jones, S. E., Alabama Univ., USA; Apr. 13, 1998; 4p; In English

Contract(s)/Grant(s): F49620-94-1-0418

Report No.(s): AD-A343323; AFRL-SR-BL-TR-98-0380; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Research was undertaken to deduce the mechanical properties of materials that are not usually candidates for Taylor test analysis. The Taylor test is a very promising method for acquiring data in the 10000 - 1000000 /sec. Strain rate regime. It may be the only for deducing the state of stress for these strain rates, if high strains are required. The Taylor test is usually performed for ductile metals for which there is a recovered specimen and elastic unloading is insignificant. However, many of the materials that presently interest the Air Force are not of this nature. Polymers are not of this nature. They have large elastic strains and the recovered specimen is usually of no value in determining the states of stress that the specimen has experienced during the deformation process. This is also true of some energetic materials. The mechanical behavior of energetics is of paramount importance to the Air Force's Hard Target Penetrator designers. In order to accomplish their objective, the computational mechanics group requires the mechanical behavior of energetic materials in a regime of strain rates that are consistent with impact and penetration events. This leads us to the direction that the work supported by AFOSR has taken.

DTIC

Mechanical Properties; Mathematical Models; Metals; Stress-Strain Relationships

19980205602 Sandia National Labs., Albuquerque, NM USA

Characterization of plasma sprayed and explosively consolidated simulated lunar soil

Powell, S. J., New Mexico Tech, USA; Inal, O. T., New Mexico Tech, USA; Smith, M. F., Sandia National Labs., USA; 1997; 13p; In English; Materials Week Conference, 7 - 11 Oct. 1997, Cincinnati, OH, USA

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

Report No.(s): SAND-97-1362C; CONF-971051-1; DE97-006413; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Two methods for the use of lunar materials for the construction of shelters on the Moon are being proposed: explosive consolidation of the soil into structural components and plasma spraying of the soil to join components. The plasma-sprayed coating would also provide protection from the intense radiation. In this work, a mare simulant was plasma-sprayed onto a stainless steel

substrate. Deposition of a 0.020 inch coating using power inputs of 23, 25, 27 and 29 kW were compared. Hardness of the coatings increased with each increase of power to the system, while porosity at the interface decreased. All coatings exhibited good adhesion. Simultaneously, an explosively consolidated sample was similarly characterized to afford a comparison of structural features associated with each mode of proposed use.
DOE
Plasma Spraying; Sprayed Coatings; Lunar SOIl; Adhesion; Coating; Arc Spraying; Moon; Construction

19980205665 National Inst. of Standards and Technology, Building Environment Div., Gaithersburg, MD USA
Modeling Study of Ventilation, IAQ and Energy Impacts of Residential Mechanical Ventilation
Persily, A. K., National Inst. of Standards and Technology, USA; May 1998; 94p; In English
Report No.(s): PB98-148737; NISTIR-6162; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This paper reports on a simulation study of indoor air quality, ventilation and energy impacts of several mechanical ventilation approaches in a single-family residential building. The study focused on a fictious two-story house in Spokane, Washington and employed the multizone airflow and contaminant dispersal model CONTAM. The model of the house included a number of factors related to airflow including exhaust fan and forced-air system operation, duct leakage and weather effects, as well as factors related to contaminant dispersal including adsorption/desorption of water vapor and volatile organic compounds, surface losses of particles and nitrogen dixoide, outdoor contaminant concentrations, and occupant activities. The contaminants studied include carbon monoxide, carbon dioxide, nitrogen dioxide, water vapor, fine and coarse particles, and volatile organic compounds. One-year simulations were performed for four different ventilation approaches: a base case of envelope infiltration only, passive inlet vents in combination with exhaust fan operation, an outdoor intake duct connected to the forced-air system return balanced by exhaust fan operation, and a continuously-operated exhaust fan. Results discussed include whole building air change rates, air distribution within the house, heating and cooling loads, contaminants concentrations, and occupant exposure to contaminants.
NTIS
Buildings; Indoor Air Pollution; Ventilation; Residential Areas; Heating; Cooling; Examination

19980205802 Los Alamos National Lab., NM USA
Rapid fabrication and characterization of sine wave targets
Day, R. D., Los Alamos National Lab., USA; Armijo, E., Los Alamos National Lab., USA; Gobby, P., Los Alamos National Lab., USA; Hatch, D., Los Alamos National Lab., USA; Rivera, G., Los Alamos National Lab., USA; Salzer, L., Los Alamos National Lab., USA; Townsend, J.; [1997]; 7p; 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-97-2332; CONF-970706-6; DE97-009113; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The effect of surface perturbations on Inertial Confinement Fusion target performance is currently being researched at Los Alamos National Laboratory (LANL). These perturbations can cause hydrodynamic instabilities which in turn reduce the targets' yield. to systematically measure the growth of these instabilities requires targets to be produced which have perturbations of a known amplitude and spatial frequency. The authors have recently assembled hardware onto one of their diamond turning lathes which enables them to machine and measure these sine waves in about 15 minutes. This is a significant reduction in time from the two and one half hours required by the previous method. This paper discusses the hardware, how it works, and how well the system is working for them to produce these targets.
DOE
Fabrication; Perturbation; Sine Waves; Research Management

19980206002 Advisory Group for Aerospace Research and Development, Propulsion and Energetics Panel, Neuilly-Sur-Seine, France
Advanced Non-Intrusive Instrumentation for Propulsion Engines *L'Instrumentation Non-Invasive Avancee pour les Propulseurs*
Advanced Non-Intrusive Instrumentation for Propulsion Engines; May 1998; 550p; In English; In French; 90th, 20-24 Oct. 1997, Brussels, Belgium; Also announced as 19980206003 through 19980206050; Original contains color illustrations
Report No.(s): AGARD-CP-598; ISBN 92-836-0055-X; Copyright Waived; Avail: CASI; A23, Hardcopy; A04, Microfiche

Changes in engine technology such as higher temperatures, higher tip speeds, new metal/composite/ceramic materials together with radical changes in design philosophy will require amongst other prerequisites the ability to measure and to monitor key internal gas and structural characteristics. The symposium papers presented non-intrusive measurement and analysis technol-

ogies in the following categories: Laser Point Measurements (11); Absorption and Infrared Techniques (4); Paints - Surface Sensors (6); Laser Induced Fluorescence (6); Mechanical (7); Films (5); Laser Planar Measurement (9); and a Keynote Address
Author
Nonintrusive Measurement; Propulsion; Engine Parts; Gas Turbine Engines; Optical Measurement; Laser Applications; Combustion

19980206158 Alabama Univ., Dept. of Mechanical Engineering, Tuscaloosa, AL USA
A Flexible Alignment Fixture for the Fabrication of Replication Mandrels
Cuttino, James F., Alabama Univ., USA; Todd, Michael W., Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

NASA uses precision diamond turning technology to fabricate replication mandrels for its X-ray Calibration Facility (XRCF) optics. The XRCF optics are tubular, and the internal surface contains a parabolic profile over the first section and a hyperbolic profile over the last. The optic is fabricated by depositing layers of gold and nickel on to the replication mandrel and then separating it from the mandrel. Since the mandrel serves as a replication form, it must contain the inverse image of the surface. The difficulty in aligning the mandrel comes from the fabrication steps which it undergoes. The mandrel is rough machined and heat treated prior to diamond turning. After diamond turning, silicon rubber separators which are undercut in radius by 3 mm (0.12 in.) are inserted between the two end caps of the mandrel to allow the plating to wrap around the ends (to prevent flaking). The mandrel is then plated with a nickel-phosphor alloy using an electroless nickel process. At this point, the separators are removed and the mandrel is reassembled for the final cut on the DTM. The mandrel is measured for profile and finish, and polished to achieve an acceptable surface finish. Wrapping the plating around the edges helps to prevent flaking, but it also destroys the alignment surfaces between the parts of the mandrel that insure that the axes of the parts are coincident. Several mandrels have been realigned by trial-and-error methods, consuming significant amounts of setup time. When the mandrel studied in this paper was reassembled, multiple efforts resulted in a minimum radial error motion of 100 microns. Since 50 microns of nickel plating was to be removed, and a minimum plating thickness of 25 microns was to remain on the part, the radial error motion had to be reduced to less than 25 microns. The mandrel was therefore not usable in its current state.
Derived from text
Fixtures; Fabrication; Mandrels; Alignment; Machining; Mechanical Devices

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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.

19980203231 Naval Postgraduate School, Monterey, CA USA
Re-Engineering of a Mission Critical Satellite Communications Component TD-1271B/U
Hirschfelder, Joe T., Naval Postgraduate School, USA; Nixon, Laurence M., Naval Postgraduate School, USA; Mar. 1998; 175p; In English
Report No.(s): AD-A343611; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Legacy software in general, and in the DoD environment in particular, presents an ever growing maintenance challenge to program managers. The software is cumbersome, written in arcane languages and hosted on aging technology hardware. One of the options that is available to the program manager to alleviate this problem is to reengineer the existing software product and update it to a newer language software hosted on modern equipment. We review existing research, select a reengineering methodology, develop an implementation strategy and then perform a case study examination of this methodology and strategy. For the case study, we take a legacy system, the Navy satellite communications multiplexer, the TD1271B/U Multiplexer, examine its existing documentation, develop a code analysis tool, perform the reengineering on one of its subsystems, and analyze the results. We provide observations, recommendations and conclusions on changes, enhancements and pitfalls to the methodology that will be of assistance in future reengineering efforts of legacy systems.
DTIC
Software Engineering; Time Division Multiplexing; Satellite Communication

19980203264 Army War Coll., Carlisle Barracks, PA USA

The Evolution of Signal Doctrine

Dausen, Peter G., Army War Coll., USA; Mar. 10, 1998; 50p; In English

Report No.(s): AD-A344352; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this paper is to track the evolution of signal doctrine from World War II to the present day. While signal doctrine has evolved through conflict and technology, there have been enduring signal principles that have shaped present signal doctrine and are the key to the signal doctrine of the future.

DTIC

Warfare; Evolution (Development); Radio Signals; Military Operations; Strategy

19980203329 Operational Technologies Corp., San Antonio, TX USA

The Direct Problem in Ultra-Short Pulse Electromagnetic Wave Propagation and Scattering ***Final Report, Nov. 1994 - Mar. 1995***

Petropoulos, Peter G., Operational Technologies Corp., USA; Aug. 1997; 103p; In English

Contract(s)/Grant(s): F41624-92-D-4001; AF Proj. 6770

Report No.(s): AD-A341076; AL/OE-TR-1997-0109; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This effort addressed the direct problem in electromagnetic wave propagation and scattering in dispersive dielectrics objects. Particularly, the research concentrated on the development of numerical approaches that can solve the problem in a timely fashion as accurately as possible given a reasonable amount of computational resources. In addition, analytical methods were developed for the purpose of extracting features of the problem which are special to dispersive objects. First, four existing Finite Difference Time Domain extensions for the modeling of pulse propagation in Debye or Lorentz dispersive media were analyzed through studying the stability and phase error properties of the coupled difference equations corresponding to Maxwell's equations and to the equations for the dispersion. In order to understand more fully the discretization requirements and the general behavior of existing numerical methods for dispersive media we considered the propagation of arbitrary electromagnetic pulses in anomalously dispersive dielectrics characterized by M relaxation processes. Armed with the knowledge that finite difference schemes, which are more accurate in space than in time, are better suited for modeling pulse propagation in dispersive dielectrics we next determined some important properties of such high order schemes in comparison to standard schemes. Finally, we examined further aspects of electromagnetic pulse propagation in anomalously dispersive media, using the Debye model as an example.

DTIC

Wave Propagation; Electromagnetic Scattering; Electromagnetic Pulses; Electromagnets; Numerical Analysis

19980203351 Polytechnic Univ., Brooklyn, NY USA

AASERT on Ultra-Wideband Electromagnetics ***Final Report, 15 Jun. 1994 - 14 Sep. 1997***

Pillai, Unnikrishna, Polytechnic Univ., USA; Carin, Lawrence, Polytechnic Univ., USA; Aug. 28, 1997; 4p; In English

Contract(s)/Grant(s): F49620-94-1-0363

Report No.(s): AD-A339219; AFRL-SR-BL-TR-98-0249; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In the course of our research we have demonstrated that the ultra wideband transient fields which scatter from a general target can be represented as a sum of wavefronts, resonances, and chirps. The latter is of particular importance for scattering from engine inlets, often the principal source of scattering from military aircraft. to date inverse algorithms have been developed based on wavefronts and resonances separately, and very little work has been directed toward including the effects of chirps. Over the last year we have implemented a wave based matching pursuits algorithm which incorporates all three wave objects, with application to data scattered from military aircraft. In addition to developing the algorithm per se, we have performed a detailed analysis of its performance for noisy data.

DTIC

Electromagnetism; Wave Fronts

19980203499 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia

Prediction of Radar Pulse Envelope Distortion due to Tropospheric Propagation

Ozerova, Marina, Defence Science and Technology Organisation, Australia; Dec. 1997; 45p; In English

Report No.(s): AD-A343205; DSTO-TN-0125; DODA-AR-010-403; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project is a part of research into the detection of radar signals at ranges well beyond the horizon by exploiting the effect of tropospheric scattering. A result of this work is a program written in C language which enables the distortion of the envelope of a given radar pulse, which occurs as a result of propagating over any path by tropospheric scattering, to be predicted.
DTIC
Pulses; Horizon; Radar Range; Radar Echoes

19980203683 Los Alamos National Lab., NM USA
Advances in 3D electromagnetic finite element modeling
Nelson, E. M., Los Alamos National Lab., USA; [1997]; 5p; In English; 17th; Particle Accelerator, 12-16 May 1997, Vancouver, Canada
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1775; CONF-970503-251; DE97-008202; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Numerous advances in electromagnetic Finite Element Analysis (FEA) have been made in recent years. The maturity of frequency domain and eigenmode calculations, and the growth of time domain applications is briefly reviewed. A high accuracy 3D electromagnetic finite element field solver employing quadratic hexahedral elements and quadratic mixed-order one-form basis functions will also be described. The solver is based on an object-oriented C++ class library. Test cases demonstrate that frequency errors less than 10 ppm can be achieved using modest workstations, and that the solutions have no contamination from spurious modes. The role of differential geometry and geometrical physics in finite element analysis is also discussed.
DOE
Electromagnetic Fields; Three Dimensional Models; Mathematical Models; Electromagnetic Absorption; Finite Element Method

19980203841 Naval Postgraduate School, Monterey, CA USA
Radar Cross Section Reduction: Geometric control of Discontinunities Using Serrated Edges
Yong, Matthew K., Naval Postgraduate School, USA; Mar. 1998; 60p; In English
Report No.(s): AD-A343828; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of this thesis is to investigate and evaluate the effectiveness of radar cross section (RCS) reduction by means of the geometric control of discontinuities using serrated edges. Although the use of serrated edges for RCS reduction can be clearly seen on stealth aircraft such as the Northrop B-2, and was mentioned in several papers and references, not much data on the reduction magnitude, the associated geometry, or the design methodology are available in the open literature. Parameters of interest include the number of basic serration cells (triangles) required per wavelength, and the aspect ratio of the triangles that form the zig zags. An infinitely thin metallic plate is considered for the analysis. The RCS of such a plate with serrated edges is computed and compared against the RCS of a plate of the same sized without serrated edges. The infinitely thin assumption is valid if the wing of the aircraft, which is represented by the plate, is thin compared to the wavelength. The results obtained show significant reduction in RCS.
DTIC
Radar Cross Sections; Aspect Ratio; Triangles; Thin Plates; Wings

19980203911 International Business Machines Corp., Thomas J. Watson Research Center, Yorktown Heights, NY USA
Robust Models and Features for Speech Recognition ***Final Report, 24 Sep. 1993 - 31 Dec. 1997***
Nahamoo, David, International Business Machines Corp., USA; Mar. 13, 1998; 9p; In English
Report No.(s): AD-A344834; IBM-DABT63-94-C00042; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of this project were: (1) to develop algorithms for achieving significant improvements in accuracy over current state-of-the-art speech recognition systems, (2) to implement these algorithms and assemble them into a prototype for a hands-on demonstration and (3) to test these algorithms for the transcription of 'real-world' speech like radio/TV broadcast shows.
DTIC
Speech Recognition; Television Systems

19980204711 Research Inst. of National Defence, Avdelningen foer Sensorteknik, Linkoeping, Sweden
Optimization of the Focussing Algorithm in ISAR ***Optimering av Fokuseringsalgoritmen i ISAR***
Schoenborg, N., Research Inst. of National Defence, Sweden; Dec. 1997; 58p; In Swedish
Report No.(s): PB98-147507; FOA-R-97-00654-615-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A new algorithm that optimizes the focusing in ISAR has been developed. The new algorithm is now implemented in the ISAR 2.1 package. Measurement data has been used to evaluate the new algorithm. The results were very good. The new algorithm gives, for arbitrary bandwidths and angles, a better resolution compared with the previous one. This paper is written for those who use and develop ISAR methods.
NTIS
Radar Cross Sections; Synthetic Aperture Radar; Focusing; Optimization; Algorithms

19980205012 Appalachian State Univ., Dept. of Psychology, Boone, NC USA
The Effects of Movement and Intravehicular Versus Intervehicular Communication on C2V Crew Performance: Limited User Test Phase 3
Beck, Hall P., Appalachian State Univ., USA; Pierce, Linda G., Appalachian State Univ., USA; Jan. 1998; 45p; In English
Contract(s)/Grant(s): DAAL03-91-C-0034
Report No.(s): AD-A344603; ARL-TR-1428; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The procedure and results of the group performance component of the command and control vehicle (C2V) Limited User Test (LUT) Phase 3 are described in this report. The test was conducted to examine: (a) the effects of movement on the ability of crews to work effectively as a team, (b) terrain impacts on team performance tasks, and (c) the effect of distributed team operations. Sixteen National Guardsmen, divided into four-person teams, served as participants. The evaluation design was similar to a 2 (Movement: Stationary, Moving) x 2 (Terrain: Paved, Course A) x 2 (Communication: Intravehicle, Intervehicle) with the baseline occupying the position of the nonfitting control arrangement. The effects of movement on team performance were evaluated by conducting some trials while the C2V was stationary and other trials while it was moving. The influence of terrain on team performance was studied by conducting some trials on Course A of the Perryman test course and the remaining trials on a paved 3-mile course. In the intravehicular communication condition, the four members of a team were housed in the same C2V and worked together on the same task. Teammates had visual contact and communicated verbally via intercom. Two teammates were in each C2V for the intervehicular manipulation. It was concluded that the C2V environment impaired all group performance tasks, especially those that appeared to demand a great degree of coordination and integration. Team performance was below the baseline when crews were housed in the C2V, regardless of whether the vehicle was stationary or moving, although movement increased the deleterious impact of the C2V on group performance. The impact of terrain on performance was inconclusive, possibly because of the small sample size and the limited number of situational conditions examined.
DTIC
Evaluation; Performance Tests; User Requirements; Command and Control; Control Systems Design; Automobiles

19980205076 National Inst. of Standards and Technology, Electromagnetic Fields Div., Boulder, CO USA
Time-Domain Calibrations of D-Dot Sensors
Johnk, R. T., National Inst. of Standards and Technology, USA; Ondrejka, A. R., National Inst. of Standards and Technology, USA; Feb. 1998; 46p; In English
Report No.(s): PB98-149099; NIST/TN-1392; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This technical note covers in detail the procedures that are necessary to measure the receiving transfer function of broadband electric-field sensors using direct-pulse, time-domain methods. The calibration techniques presented here are applied to a cone and ground plane system in the 50 MHz to 14 GHz frequency range, as well as to a TEM cell in the 10 MHz to 100 MHz range. Measurement results using both types of facilities are presented for selected D-Dot sensors. In addition to a comparison of results from the two measurement facilities in the overlapping frequency range, a thorough combined uncertainty analysis is presented.
NTIS
Aircraft Equipment; Electromagnetic Radiation; Antennas; Calibrating; Transfer Functions; Broadband; Sensors

19980205673 National Telecommunications and Information Administration, Washington, DC USA
Software Implementation of a Wideband HF Channel Transfer Function
Sutherland, D. A., National Telecommunications and Information Administration, USA; Apr. 1998; 124p; In English
Report No.(s): PB98-145733; NTIA-98-348; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This report presents an analytic model implemented as the computer programs of the transfer function of a wideband HF Channel model for use in a hardware simulator. The transfer function is the basis input to the hardware simulator. The Parameters that characterize the skywave paths of a particular HF ionospheric condition are inputs to the program.
NTIS
Transfer Functions; Broadband; Sky Waves; Mathematical Models

19980205674 National Telecommunications and Information Administration, Washington, DC USA

Technological Rationale to Use Higher Wireless Frequencies

Vanderau, J. M., National Telecommunications and Information Administration, USA; Matheson, R. J., National Telecommunications and Information Administration, USA; Haakinson, E. J., National Telecommunications and Information Administration, USA; Apr. 1998; 40p; In English

Report No.(s): PB98-145717; NTIA-98-349; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper examines the relationships between propagation loss and antenna gain a higher frequencies, shows how dense intelligent infrastructure affects cell size and system capacity, and describes the improving high frequency capabilities of RF electronics technology.

NTIS

High Frequencies; Radio Frequencies; Microwaves; Mobile Communication Systems

19980205777 Army War Coll., Carlisle Barracks, PA USA

The Strategic Communication Plan: Effective Communication for Strategic Leaders

Reeder, Melanie, Army War Coll., USA; May 08, 1998; 43p; In English

Report No.(s): AD-A345593; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper looks at the importance of the strategic communication plan to strategic leaders and the organizations they lead. It addresses the purpose, developmental process, content, and implementation of a strategic communication plan offering specific recommendations for the creation and effective use of a successful plan. This subject is particularly important to those in government service because communication is the link between what an organization intends to do and the understanding and support needed from particular groups and the general public to ensure the ultimate achievement of its program goals. Therefore, a well developed communication plan can be essential to the success or failure of key programs. Throughout the document, two examples of excellent strategic communications plans, from the Office of the Secretary of Defense and the Office of National Drug Control Policy, will be used to illustrate key points.

DTIC

Strategy; Planning; Communication Networks

19980206162 Purdue Univ., Dept. of Electrical Engineering Technology, West Lafayette, IN USA

BPSK Demodulation Using Digital Signal Processing

Garcia, Thomas R., Purdue Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A digital communications signal is a sinusoidal waveform that is modified by a binary (digital) information signal. The sinusoidal waveform is called the carrier. The carrier may be modified in amplitude, frequency, phase, or a combination of these. In this project a binary phase shift keyed (BPSK) signal is the communication signal. In a BPSK signal the phase of the carrier is set to one of two states, 180 degrees apart, by a binary (i.e., 1 or 0) information signal. A digital signal is a sampled version of a ”real world” time continuous signal. The digital signal is generated by sampling the continuous signal at discrete points in time. The rate at which the signal is sampled is called the sampling rate (f(s)). The device that performs this operation is called an analog-to-digital (A/D) converter or a digitizer. The digital signal is composed of the sequence of individual values of the sampled BPSK signal. Digital signal processing (DSP) is the modification of the digital signal by mathematical operations. A device that performs this processing is called a digital signal processor. After processing, the digital signal may then be converted back to an analog signal using a digital-to-analog (D/A) converter. The goal of this project is to develop a system that will recover the digital information from a BPSK signal using DSP techniques. The project is broken down into the following steps: (1) Development of the algorithms required to demodulate the BPSK signal; (2) Simulation of the system; and (3) Implementation a BPSK receiver using digital signal processing hardware.

Derived from text

Binary Phase Shift Keying; Pulse Communication; Signal Processing; Real Time Operation; Receivers; Modulation; Digital Systems; Algorithms

19980206163 Auburn Univ., Dept. of Aerospace Engineering, AL USA

Development of a Technique for Separating Raman Scattering Signals from Background Emission with Single-Shot Measurement Potential

Hartfield, Roy, Auburn Univ., USA; Oct. 1996; 6p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Raman scattering is a powerful technique for quantitatively probing high temperature and high speed flows. However, this technique has typically been limited to clean hydrogen flames because of the broadband fluorescence interference which occurs in hydrocarbon flames. Fluorescence can also interfere with the Raman signal in clean hydrogen flames when broadband UV lasers are used as the scattering source. A solution to this problem has been demonstrated. The solution to the fluorescence interference lies in the fact that the vibrational Q-branch Raman signal is highly polarized for 90 deg. signal collection and the fluorescence background is essentially unpolarized. Two basic schemes are available for separating the Raman from the background. One scheme involves using a polarized laser and collecting a signal with both horizontal and vertical laser polarizations separately. The signal with the vertical polarization will contain both the Raman and the fluorescence while the signal with the horizontal polarization will contain only the fluorescence. The second scheme involves polarization discrimination on the collection side of the optical setup. For vertical laser polarization, the scattered Q-branch Raman signal will be vertically polarized; hence the two polarizations can be collected separately and the difference between the two is the Raman signal. This approach has been used for the work found herein and has the advantage of allowing the data to be collected from the same laser shot(s). This makes it possible to collect quantitative Raman data with single shot resolution in conditions where interference cannot otherwise be eliminated.

Derived from text

Raman Spectra; Emission; Flames; Flow Measurement; Fluorescence; Polarization Characteristics; Signal Processing; Electromagnetic Interference; Signal Measurement

19980206194 Florida Univ., Dept. of Telecommunication, Gainesville, FL USA

An Analysis of MSFC Public Affairs Television and Target Audiences with Suggestions for Future Growth and Directions

Smeyak, Gerald P., Florida Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Because of profound changes in government and the space program, this may be an ideal time to evaluate MSFC's Public Affairs television efforts. The changes are continued downsizing of government programs; reduction in research and development; changes in the space program from periodic manned launches to a full-time presence in space with Space Station; and greater emphasis on science and communicating science information. At the same time that NASA is undergoing change, the media and society are also undergoing substantial upheaval. Twenty-five years ago, the three main over-the-air television networks (ABC, CBS and NBC) had a 93 share of the television audience. We now have four popular over-the-air networks (ABC, CBS, NBC and Fox) who maintain a 52 percent share of the television audience. Technological development, competition, and changing consumer tastes have created specialized media and audiences. This media fragmentation is part of a normal maturation cycle of use or adoption. While phases in the cycle vary in length due to many factors, the cycle has been consistent and reflects patterns of adoption. The cycle is: (1) Elite Media usage, (2) Popular or Mass Media usage, and (3) Specialized Media usage. Another factor that affects the media development and adoption cycle is the creation of new and competing mass and personal mediums. While television remains the dominant and most popular mass medium, it is declining and we see (via cable television) specialized networks catering to small audience segments. Because of changing technology and consumer behavior, we may not see a dominant mass media like television again.

Author

NASA Programs; Information Flow; Public Relations; Promotion; Television Transmission

19980206264 Colorado Univ., Dept. of Electrical and Computer Engineering, Boulder, CO USA

Distributed Multisensor Fusion Algorithms for Tracking Applications ***Annual Report, 1 Jun. 1997 - 31 May 1998***

Pao, Lucy Y., Colorado Univ., USA; May 26, 1998; 4p; In English

Contract(s)/Grant(s): N00014-97-1-0642

Report No.(s): AD-A345499; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of the research under this ONR award is to develop distributed multisensor data fusion algorithms for tracking applications, as well as non-simulation and analytical methods of performance evaluation. Since the beginning of this project in June 1997, we have achieved results in several different areas: (1) We have developed a method of distributed fusion that is amenable to general distributed architectures; (2) We have developed two non-simulation techniques for comparing multisensor probabilistic data association filters that are significantly more computationally efficient than performing Monte Carlo simulation evaluations; (3) We have investigated and compared the computational complexity and tracking performance of sequential and parallel implementations of the multisensor probabilistic data association algorithm; and (4) We have developed several schemes for controlling sensor information and have evaluated the effects of delays. Our results will provide insight as to the relative performance of various multisensor fusion methods, and the results will also provide a basis for assessing the tradeoffs between perfor-

mance and computational and communication requirements when planning new sensor network architectures or communication link protocols.
DTIC
Multisensor Fusion; Monte Carlo Method; Communication Networks; Algorithms

19980206265 Communications Research Centre, Ottawa, Ontario Canada
ACCORD Broadband ATM Satellite Experiment (BASE): Protocols characterization ***Final Report***
Labbe, Isabelle, Communications Research Centre, Canada; Gravel, Louis, Communications Research Centre, Canada; Pike, Corey, Communications Research Centre, Canada; Butterworth, John, Communications Research Centre, Canada; Lanigan, Sean, Rome Lab., USA; Dec. 1997; 26p; In English
Report No.(s): AD-A345492; CRC-RP-97-008; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A Broadband ATM satellite Experiment (BASE) was carried out between the Communicadons Research Centre, Canada and Rome Laboratory, USA during the period of May 95 to March 96. The objectives of the experiment was to perform a series of tests to characterize ATM over broadband satellite bearers. This document reports on the second phase of the experiment that was conducted from December 95 to March 96 over the NASA Advanced Communication Technology Satellite (ACTS) satellite(Ka-band). Tests consisted in throughput measurements of TCP over a broadband ATM satellite link as a function of Bit Error Rate (BER). The throughput performance of TCP/IP was very poor due mostly to the (bandwidth * delay) product being limited by the TCP window size implementation. The results are presented along with the influence of others factors such as the Maximum Transmission Unit (MTU) size and packet size. Finally, a performance comparison with a special implementation of TCPfor network with large delays and high bandwidth (TCPfor Long Fat Networks - TCP-LFN) is presented.
DTIC
ACTS; Communication Networks; Protocol (Computers); Bandwidth

19980206266 Communications Research Centre, Ottawa, Ontario Canada
ACCORD Broadband ATM Satellite Experiment (BASE): DS3 Ka-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; Butterworth, John, Communications Research Centre, Canada; Dec. 1997; 23p; In English
Report No.(s): AD-A345489; CRC-TN-97-008; 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 objectives of the experiment was to perform a series of tests to characterize ATM over broadband satellite bearers. This document reports on the second portion of the first phase of the experiment that was conducted from July 95 to September 95 over the NASA ACTS satellite(Ka-band). Tests consisted in measurements ofATM 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, the results are presented for two different modulations (QPSK and 8-PSK) and compared against theoretical curves. Results show that Ku- and Ka- band satellite channels have similar ATM behaviour Results suggest that applications using ATM over burst error channel will experience greater difficulties for a given bit error rate than they would on a random error media. The characterization of the break- ing point remains, however application dependent. Moreover the broadband channel and its embedded sub-channels have been found to be coherent. As suggested in the first portion of the experiment, this result confirms that the characteristics of the sub-chan- nels can be inferred from the broadband channel and vice-versa.
DTIC
ACTS; Phase Shift Keying; Broadband; Extremely High Frequencies; Satellite Communication

19980206271 Naval Postgraduate School, Monterey, CA USA
Comparison of Evaporation Duct Height Measurement Methods and Their Impact on Radar Propagation Estimates
Whalen, John David, Naval Postgraduate School, USA; Mar. 1998; 75p; In English
Report No.(s): AD-A345694; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A study was performed to compare shipboard measurements of atmospheric parameters that impact the evaporation duct and its effect on the propagation of electromagnetic energy from the AEGIS AN/SPY-1 radars. Two ships, USS ANZIO and USS CAPE ST GEORGE, participated in the annual NATO exercise, BALTOPS, during the summer of 1997. They were equipped with an automated METOC sensor system, developed by John Hopkins University Applied Physics Laboratory, called SEAWASP. SEAWASP provided continuous measurement of parameters determining near surface refractivity and the evaporative duct throughout the cruise. SEAWASP data were compared with manual bridge observations in order to illustrate the difference in propagation conditions assessed by the two methods. Additionally, ERS-1 Scatterometer wind data were used in conjunction with

SEAWASP data to determine the feasibility of incorporating satellite wind data in determining evaporative duct heights. The automated SEAWASP data was able to depict, with greater accuracy, the constantly changing duct height conditions whereas the bridge observations, made at hourly intervals, lacked temporal resolution, thereby missing much of the variation in duct height. The discrepancies in duct heights between the two measurement systems led to differing propagation ranges resulting in shorter reaction times to counter threats to the ship.
DTIC
Atmospheric Refraction; Evaporation; Ducts; Height; Estimates; Ships; Wind Measurement

19980206323 Los Alamos National Lab., NM USA
Computers and small satellites: How FORTE is utilizing the WWW as a 'paperless' information resource and the development of a unique resource management planning tool
Roussel-Dupre, D., Los Alamos National Lab., USA; Carter, M., Los Alamos National Lab., USA; Franz, R., Los Alamos National Lab., USA; 1997; 6p; In English; 11th; Conference on Small Satellites, 15 - 18 Sep. 1997, Logan, UT, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3431; CONF-970991; DE98-000275; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Fast-On-orbit Recording of Transient Events (FORTE) satellite is the second satellite to be developed and flown by Los Alamos National Laboratory and is scheduled to be launched August, 1997 by a Pegasus XL rocket. FORTE follows in the footsteps of the ALEXIS satellite in utilizing a very small operations crew for mission operations. Partially based upon the ALEXIS automation and World Wide Web (WWW) usage for data dissemination, FORTE began at an early stage of ground processing to use the web as a repository of information about all aspects of the satellite. Detailed descriptions of the various satellite and experiment components, cable diagrams, integration photographs as well as extensive test data have all been compiled into a single site as a means of archiving the data at a single location. In this manner, it is readily available during times of ground testing, ground station operation training as well as anomaly resolution. Small satellites usually require extensive effort to optimize operation under minimal resources. For the FORTE satellite, a unique planning tool has been developed over the past 2 years which balances the various resources of the satellite (power, memory, downlink, on board command buffer, etc.) to provide the maximum data acquisition. This paper will concentrate on a description of both the extensive web interface and the planning tool.
DOE
World Wide Web; Ground Stations; Computers; Satellites; Data Acquisition; Resources Management; Downlinking

19980206341 Space and Naval Warfare Systems Command, San Diego, CA USA
An Evaluation of the RF LOS/BLOS Communications Enhancements Deployed with USS BOXER Amphibious Ready Group
Hafner, A. N., Space and Naval Warfare Systems Command, USA; Mar. 1998; 36p; In English
Report No.(s): AD-A344948; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents the results of one of three operational deployments of products produced by the Expeditionary Warfare Communications Enhancement Project (ExWAR). ExWAR supports the re-structuring of joint command and control by introducing existing commercial and government products into line-of-sight (LOS) and beyond line-of-sight (BLOS), high-frequency (HF) and ultra- high-frequency (UHF) voice radio circuits. The program provides TCP/IP-based data communication linking units of the Amphibious Ready Group (ARG), including the smallest shore-based components of the Marine Expeditionary Unit (MEU). This report discusses the empirical research conducted by the USS BOXER ARG.
DTIC
Evaluation; Radio Communication; Command and Control; Augmentation; Communication; Radio Relay Systems

19980206419 Norwegian Defence Research Establishment, Kjeller, Norway
A Wave Propagation Method for Three-Dimensional Hyperbolic Conservation Laws
Olav, Langseth Jan, Norwegian Defence Research Establishment, Norway; LeVeque, Randall J., Norwegian Defence Research Establishment, Norway; May 12, 1997; 69p; In English
Report No.(s): FFI/RAPPORT-97/02327; FFIVM/670-E/170; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A class of wave propagation algorithms for three-dimensional conservation laws is developed. These unsplit finite volume methods are based on solving one-dimensional Riemann problems at the cell interfaces and applying flux-limiter functions to suppress oscillations arising from second derivative terms. Waves emanating from the Riemann problem are further split by solving

Riemann problems in the transverse direction to model cross-derivative terms. Due to proper upwinding, the method is stable for Courant numbers up to one. Several examples using the Euler equations are included.
Author
Wave Propagation; Three Dimensional Models; Hyperbolic Functions; Algorithms; Finite Volume Method; Computational Fluid Dynamics

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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.

19980203232 Purdue Univ., School of Electrical Engineering, West Lafayette, IN USA
Femtosecond Laser System for Research on High-Speed Optical Transmultiplexing and Coding ***Final Report, 15 Sep. 1996 - 14 Sep 1997***
Weiner, Andrew M., Purdue Univ., USA; Sep. 1997; 5p; In English
Contract(s)/Grant(s): F49620-96-1-0414
Report No.(s): AD-A343619; AFRL-SR-BL-TR-98-0338; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
A key goal of our research is to demonstrate all-optical methods for generation, processing, and transmultiplexing (data format conversion) of ultrafast lightwave signals. Recently our effort has focused on incorporating pixellated optoelectronic modulator arrays into femtosecond pulse shaping systems. This work could lead to pulse shaping systems generating (or processing) data signals and packets which can be reprogrammed at rates in the nanosecond regime. This would fill an important need in both TDM packet networks and bit-parallel WDM linds. The research also aims at experimental tests of an ultrashort pulse code-division, multiple-access (CDMA) optical communications system and of the devices needed to implement such a system.
DTIC
Lasers; High Speed; Multiple Access; Optical Activity; Procedures

19980203245 California Univ., Dept. of Applied Science, Davis, CA USA
Theoretical and Experimental Investigation of Electron Beam Acceleration and Sub-Millimeter Wave Generation ***Final Report, 15 May 1995 - 14 Nov. 1997***
Luhmann, N. C., Jr., California Univ., USA; McDermott, D. B., California Univ., USA; Hartemann, F. V., California Univ., USA; Feb. 05, 1998; 11p; In English
Contract(s)/Grant(s): DAAH-95-1-0336
Report No.(s): AD-A344453; ARO-34594.1-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Four separate processes for electron beam acceleration and sub-millimeter wave generation have been studied: (1) We have extended our concept that harmonic gyro-TWT amplifiers can stably generate substantially higher power than at the fundamental cyclotron frequency by designing a third harmonic amplifier that is predicted to generate 2 MW with good stability and gain characteristics. (2) A three-cavity TE(0n) gyroklystron circuit, which is predicted to efficiently generate a peak power of 250 kW with high amplifier performance, has been received from the machinist. (3) The first high energy photoelectrons have been produced in the X-band rf gun. (4) In addition, the previous sixth-harmonic gyrofrequency multiplier that produced 3 kW with 5% efficiency has been upgraded so that it will emit its design value of 150 kW with 30% efficiency.
DTIC
Cyclotron Resonance Devices; Electron Accelerators; Traveling Waves; Wave Generation; Electron Beams; Submillimeter Waves; Traveling Wave Tubes; Electron Guns

19980203249 Naval Postgraduate School, Monterey, CA USA
Design, Construction and Analysis of a 14-Bit Direct Digital Antenna Utilizing Optical Sampling and Optimum SNS Encoding
Ringer, William P., Naval Postgraduate School, USA; Sep. 1997; 134p; In English
Report No.(s): AD-A341473; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
Direct digital Direction Finding (DF) antennas will allow an incoming signal to be digitally encoded at the antenna with high dynamic range (14 bits approx. equal 86 dB) without the use of down conversion that is typically necessary. As a shipboard DF device, it also allows for the encoding of wide band, high power signals (e.g., +/- 43 volts) that can often appear on shipboard antennas due to the presence of in band transmitters that are located close by. This design utilizes three pulsed laser driven Mach-

Zehnder optical interferometers to sample the RF signal. Each channel requires only 6 bit accuracy (64 comparators) to produce an Optimum Symmetrical Number System (OSNS) residue representation of the input signal. These residues are then sent to a locally programmed Field Programmable Gate Array (FPGA) for decoding into a 14 bit digital representation of the input RF voltage. Modern day FPGA devices are rapidly becoming the state of the art in programmable logic. The inclusion of on chip flip flops allows for a fast and efficient pipelined approach to OSNS decoding. This thesis documents the first 14 bit digital antenna which utilizes an FPGA algorithm as a method of OSNS decoding. This design uses FPGA processors for both OSNS decoding and Parity processing.
DTIC
Signal Processing; Analog to Digital Converters; Design Analysis; Construction; Antenna Arrays

19980203274 Advanced Device Technologies, Inc., Charlottesville, VA USA
Heterodimensional Technology for High Power, High Temperature Electronics ***Final Report, 1 Aug. 1997 - 31 Jan. 1998***
Peatman, William C., Advanced Device Technologies, Inc., USA; Jan. 30, 1998; 14p; In English
Contract(s)/Grant(s): DAAG55-97-C-0046
Report No.(s): AD-A344265; A1-13098; ARO-37558.1-EL; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There is an accelerating need for electronic devices and integrated circuits which operate at extremely high temperatures. Increasingly, electronics are finding applications in measurement and control systems in automotive and jet engine environments, for example, where temperatures can easily exceed 150 C. Wide band gap materials have shown promise for high temperature applications, however, cost and reliability issues presently limit their widespread use. GaAs MESFETs have shown some promise at temperatures as high as 400 C, however, high gate leakage currents and degraded breakdown characteristics lead to poor reliability and large variations in device characteristics. Recently, a greater than tenfold reduction in the threshold voltage temperature coefficient was demonstrated in the heterodimensional MESFET compared with GaAs MESFET. Heterodimensional devices have also demonstrated excellent operation to high breakdown voltage. The goal of this project is to explore the feasibility of developing heterodimensional technology for high power and/or high temperature applications.
DTIC
Gallium Arsenides; Field Effect Transistors; High Temperature Environments; Semiconductor Devices

19980203291 Tennessee Univ., Knoxville, TN USA
Design for Packageability: Early Consideration of Packaging from a Microelectronic System Designer's Viewpoint ***Final Report***
Bouldin, Donald W., Tennessee Univ., USA; Mar. 1998; 134p; In English
Contract(s)/Grant(s): DAAH04-94-G-0004
Report No.(s): AD-A344340; ARO-32575.1-EL; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The goal of this project was to assist in globally optimizing the design of higher performing microelectronic systems by incorporating critical packaging factors into the IC design flow. More specifically, our work was intended to empower system designers, especially designers of multi-million transistor ICs, to obtain optimized MCM-based systems.
DTIC
Packaging; Design Analysis; Microelectronics

19980203324 Naval Postgraduate School, Monterey, CA USA
Evaluating Color Fused Image Performance Estimators
Ogawa, James S., Naval Postgraduate School, USA; Sep. 1997; 261p; In English
Report No.(s): AD-A340997; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This thesis evaluated the effectiveness of sensor fusion--combining infrared and low-light-level image to improve the F/A-18 target standoff range requirement. Several human performance studies have shown inconsistent results regarding the benefits of color-fusion imagery. One method to test the validity of sensor fusion is to use mathematical models that simulate and predict the detection abilities of the human visual system. The mathematical models are derived quantitatively from the image statistics, while the behavior data are a qualitative measure of a human observer. This thesis developed a statistical analysis to compare and contrast these techniques to assess sensor fusion. The four models evaluated were: a Global matched filters, a Local matched filter, a Template matching filter, and a contrast-base image quality metric. of the four models, the Global matched filter produced the highest degree of correlation with the human data. The Global matched filter moderately predicted which of the single-band sensors and which of the fined sensors provided the higher sensitivities despite the characteristically different scenes. Although there are many

refinements that need to be explored, the Global matched filter concept may be used to evaluate and compare the many different fusion algorithms being proposed.
DTIC
Mathematical Models; Detection; Images; Evaluation; Effectiveness; Estimating; Color

19980203340 Stevens Inst. of Tech., Hoboken, NJ USA
Quantum Mechanical Balance Equation Approach to Semiconductor Device Simulation ***Final Report, Oct. 1994 - Sep. 1997***
Cui, Long Liang, Stevens Inst. of Tech., USA; Dec. 28, 1997; 66p; In English
Contract(s)/Grant(s): DAAH04-94-G-0413
Report No.(s): AD-A344464; ARO-33854.8-EL; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This research project was focused on the development of a quantum mechanical balance equation based device simulator that can model advanced, compound, submicron devices, under all transport conditions (AC, DC, and transient response). This report documents the complete project, its planning, execution, and completion. The device models are described, along with representative simulation results for various devices, such as Si-MESFET, Si-MOSFET and GaAs-MESFET.
DTIC
Semiconductor Devices; Quantum Theory; Simulation

19980203450 Arizona Univ., Optical Sciences Center, Tucson, AZ USA
Novel Quantum Dot-Waveguide Devices by the Sol-Gel Method ***Final Report, 1 Jun. 1994 - 30 Nov. 1997***
Peyghambarian, N., Arizona Univ., USA; Wright, E., Arizona Univ., USA; Honkanen, S., Arizona Univ., USA; Guerreiro, P., Arizona Univ., USA; Apr. 24, 1998; 8p; In English
Contract(s)/Grant(s): F49620-94-1-0343; AF Proj. 1651/01
Report No.(s): AD-A343690; AFRL-SR-BL-TR-98-0435; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Passive CW mode-locking of a Cr:forsterite laser using PbS quantum-dot glass samples as intracavity saturable absorbers was demonstrated. This is believed to be the first application of a quantum-dot system in a practical device. Average output powers of 74 MW, 4.6 ps laser pulses at 110 MHz repetition rate, and a wide tunability range of 1207 to 1307 nm were obtained. The mode-locking was made possible by the absorption saturation in the PbS quantum-dot samples, observed at room temperature. For the first time, significant optical gain was measured in quantum-dots pumped with nanosecond-pulse excitation. The samples studied were sol-gel derived CdS quantum-dots. The gain persists up to room temperature, it has a broad spectral width, and has its maximum value slightly below the absorption band edge. The measured rather surprising gain features were confirmed by theoretical calculations. Ultrashort pulse propagation in quantum dot waveguides was investigated. The measured characteristics of femtosecond pulse propagation, near two-photon resonance, in a CdS quantum-dot waveguide were theoretically explained. The new theoretical models developed open the doorway to propagation of space-time solitons in quantum-dot waveguides.
DTIC
Waveguides; Quantum Dots; Saturation (Chemistry); Sol-Gel Processes

19980203513 Rochester Univ., NY USA
Quantum Computing with Superconducting Electronics ***Final Report, 1 Jul. 1996 - 30 Jun. 1997***
Feldman, Marc J., Rochester Univ., USA; Bocko, Mark F., Rochester Univ., USA; Feb. 02, 1998; 8p; In English
Contract(s)/Grant(s): DAAG04-96-1-0298
Report No.(s): AD-A344625; ARO-35789.1-PH-QC; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
An implementation of a quantum computer using superconducting electronics has been proposed and studied. A single Josephson junction superconducting quantum interference device (SQUID) may serve as a suitable two-state quantum system to be used as the qubits of a possible quantum computer. The quantum states of the superconducting qubits may be manipulated by single flux quantum pulses created and controlled by other ”on-chip” superconducting circuitry. Gates to allow logical interactions of qubits have also been conceptualized. The parameters of the qubit SQUIDs and other associated circuitry were found to be within current technological constraints and a first experiment to demonstrate quantum coherence in a superconducting qubit was designed.
DTIC
Computers; Quantum Electronics; Superconductivity; Electronic Equipment; Computation; Technology Transfer

19980203550 Texas A&M Univ., College Station, TX USA
A Knife-edge Array Field Emission Cathode
Lee, B., Texas A&M Univ., USA; Aug. 1994; 203p; In English
Contract(s)/Grant(s): DE-FG02-91ER40613
Report No.(s): DOE/ER/40613--T1; DE97-008030; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Many cathode applications require a new type cathode that is able to produce short pulsed electron beams at high emission current. Gated field emitter arrays of micrometer size are recognized as candidates to meet this need and have become the research focus of vacuum microelectronic. Existing fabrication methods produce emitters that are limited either in frequency response or in current emission. One reason is that the structure of these emitters are not sufficiently optimized. In this study, the author investigated the factors that affect the performance of field emitters. An optimum emitter structure, the knife-edge field emitter array, was developed from the analysis. Large field enhancement factor, large effective emission area, and small emitter capacitance are the advantages of the structure. The author next explored various options of fabricating the knife-edge emitter structure. He proposed a unique thin film process procedure and developed the fabrication techniques to build the emitters on (110) silicon wafers. Data from the initial cathode tests showed very low onset voltages and Fowler-Nordheim type emission. Emission simulation based on the knife-edge emitter arrays have the potential to produce high performance in modulation frequency and current emission. Several fabrication issues that await further development are discussed and possible solutions are suggested.
DOE
Microelectronics; Cathodes; Electron Beams; Emitters; Field Emission

19980203601 Kyushu Univ., Dept. of Electrical and Electronic Systems Engineering, Fukuoka, Japan
Two Dimensional Drive Motor With Circular Core
Fujii, Nobuo, Kyushu Univ., Japan; Kihara, T., Kyushu Univ., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 35-47; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A surface induction motor is described that has smooth force for any directional drive including rotation, compared with other surface motors. This motor has a toroidal core with an armature winding as a primary member, and a secondary reaction plate composed of a conducting plate and a back iron plate. The thrust and normal force characteristics are studied by using a test facility and two-dimensional electromagnetic analysis. This surface motor has a relatively high utilization factor for the thrust in spite of the circular shape. Compared with a single-sided linear induction motor, the performance of the magnetic circuit is the same or better, and the thrust is larger than that of two linear motors in a relatively small number of slots of the primary core. The large attractive normal force is suitable for magnetic suspension making use of the circular shape.
Author
Induction Motors; Equipment Specifications; Magnetic Circuits; Systems Engineering; Design Analysis

19980203602 Science Univ. of Tokyo, Chiba Lab., Chiba, Japan
A Design and Characteristics of Switched Reluctance Type Bearingless Motors
Takemoto, Masatsuga, Science Univ. of Tokyo, Japan; Shimada, Ken, Science Univ. of Tokyo, Japan; Chiba, Akira, Science Univ. of Tokyo, Japan; Fukao, Tadashi, Tokyo Inst. of Tech., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 49-63; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Switched reluctance type bearingless motors have been proposed. The principle of radial force generation is explained on a stator with differential winding configurations. The radial force is a function of the radial force winding current and the motor current, as well as the rotor rotational position. If salient poles are unaligned, the radial force is the minimum. In this condition, fringing fluxes play an important role. In this paper, the theoretical equations of radial forces are derived with a close examination of the flux distribution. Based on results of FEM analysis, a simple mathematical equation is proposed to express fringing fluxes neglecting magnetic saturation. The radial force and current relationships are derived with the fringing effects. The derived equations are found to be effective especially at unaligned positions.
Author
Electric Motors; Switching Circuits; Force Distribution; Finite Element Method; Equipment Specifications; Design Analysis

19980203603 International Superconductivity Technology Center, Superconductivity Research Lab., Tokyo, Japan
Electromagnetic Interaction Between Permanent Magnets and Bulk Y-Ba-Cu-O Superconductors
Nagashima, Ken, International Superconductivity Technology Center, Japan; Murayama, Tomohiko, International Superconduc-

tivity Technology Center, Japan; Otani, Tsuyoshi, International Superconductivity Technology Center, Japan; Murakami, Masato, International Superconductivity Technology Center, Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 67-80; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We have measured the electromagnetic force (EMF) between Nd-Fe-B magnets and bulk Y-Ba-Cu-O superconductors, by varying magnet configurations such as the number of poles, the thickness of magnets and back iron yokes, the number of subsectioned magnets and the shape of bulk superconductors and studied the effects of these variables on the EMF. The EMF is strongly dependent on the magnet configuration, and therefore for the design of magnetic bearings in a superconducting flywheel system, it is very important to optimize the arrangement of permanent magnets for achieving a large EMF.
Author

Electromagnetic Interactions; Permanent Magnets; YBCO Superconductors; Electromagnetic Fields; Electromagnetic Measurement

19980203605 Florida State Univ., National High Magnetic Field Lab., Tallahassee, FL USA

Progress in High Temperature Superconductivity for Magnet Applications

Schwartz, Justin, Florida State Univ., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 97; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche; Abstract Only; Abstract Only

High temperature superconductors (HTS) have progressed greatly in the 10 years since their discoveries. Bi-SR-Ca-Cu-O conductors are fabricated on long length-scales with transport critical current density (J(c)) sufficient for technical applications. Recent breakthroughs with Y-Ba-Cu-0 have led to incredibly large transport J(c) in short lengths, which, if scaleable, would lead to a plethora of new applications. Hg-Ba-Ca-Cu-O materials have significantly larger critical temperature (T(c)) than other HTS materials (up to 135K), and have the potential to be a significant second-generation conductor. In this paper, the status of HTS conductor development is reviewed with a focus on applicability to practical magnet systems. Issues such as scale-up, mechanical properties, thermal properties (i.e., stability and quench behavior), and intrinsic superconducting properties, are discussed. Progress on system applications of Bi-SR-Ca-Cu-O conductors (e.g., motors and high field solenoids) and on the latest developments with Y-Ba-Cu-0 coated conductors are reviewed. Recent breakthroughs in the processing of Hg-Ba-Ca-Cu-O materials with metallic substrates or sheaths are also presented and the practicality of using a high-toxicity material in commercial systems is analyzed.
Author

BSCCO Superconductors; YBCO Superconductors; High Field Magnets; Fabrication

19980203608 Science Univ. of Tokyo, Dept. of Electrical Engineering, Chiba, Japan

A Measurement of VA Requirements in an Induction Type Bearingless Motor

Ito, Eichi, Science Univ. of Tokyo, Japan; Chiba, Akira, Science Univ. of Tokyo, Japan; Fukao, Tadashi, Tokyo Inst. of Tech., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 125-137; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Bearingless motors are electrical motors combined with magnetic bearing functions. In order to produce radial force, radial force windings are wound in a stator of a 4-pole induction motor. In this paper, voltage and current are measured at the radial force winding terminals of a test machine. It is found that the volt-ampere requirement is only 0.0059 times of that of the motor terminals.
Author

Magnetic Bearings; Induction Motors; Bearingless Rotors; Force Distribution; Electric Motors

19980203613 National High Magnetic Field Lab., Tallahassee, FL USA

Resistive and Superconducting Magnet Configurations for Levitation of Weakly Diamagnetic Materials

Eyssa, Y. M., National High Magnetic Field Lab., USA; Schneider-Muntau, Hans J., National High Magnetic Field Lab., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 187-195; In English; Also announced as 19980203598

Contract(s)/Grant(s): NSF DMR-90-16241; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The magnetic fields that can be generated today by superconducting and resistive magnets are so strong that even weakly diamagnetic materials can be levitated. Materials with magnetic susceptibilities in the order of 10(exp -5) require a product of field times field gradient of about 1000 sq T/m. Such values are easily obtained in standard 12-20 T, small bore (30-50 mm) resistive and superconducting solenoid magnets, available in many locations. to levitate larger objects, magnets with wider bores and different field configurations than solenoids are necessary, as for instance a split coil magnet with opposite field direction in the two

halves. In this study, we characterize the levitation capability of some of the resistive magnets available at the NHMFL. We also examine different configurations, optimized for maximum levitation, such as strong gradient magnets and magnets in racetrack form, with the goal to determine the relationship between the limitation imposed by today's available conductor materials and the size of the body that can be levitated.
Author
Solenoids; Levitation; Superconducting Magnets; Electrical Resistivity; Magnetic Fields

19980203615 Kyushu Inst. of Tech., Dept. of Control Engineering, Kitakyushu, Japan
Mathematical Treatment of Superconducting Linear Synchronous Motor
Sakamoto, Tetsuzo, Kyushu Inst. of Tech., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 211-220; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The paper deals with the superconducting linear synchronous motor with application to the propulsion system of a high-speed transportation maglev vehicle. The system is composed of superconducting magnets (SCMs) on the vehicle and linear synchronous motor armature windings on the ground. The suitable coordinate system on the speed control may be dq-axis fixed on the SCMS. The system variables are formulated viewing from the dq0-axes and the block diagram is constructed accordingly. A speed control system is then designed with appropriate disturbance compensations included, and it is confirmed from computer simulations that it works well under disturbed conditions.
Author
Computerized Simulation; Mathematical Models; Synchronous Motors; Superconductivity; Superconducting Magnets

19980203620 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA
Eddy Current Influences on the Dynamic Behaviour of Magnetic Suspension Systems
Britcher, Colin P., Old Dominion Univ., USA; Bloodgood, Dale V., Old Dominion Univ., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 273-284; In English; Also announced as 19980203598
Contract(s)/Grant(s): NCC1-248; NAG1-1056; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This report will summarize some results from a multi-year research effort at NASA Langley Research Center aimed at the development of an improved capability for practical modelling of eddy current effects in magnetic suspension systems. Particular attention is paid to large-gap systems, although generic results applicable to both large-gap and small-gap systems are presented. It is shown that eddy currents can significantly affect the dynamic behavior of magnetic suspension systems, but that these effects can be amenable to modelling and measurement. Theoretical frameworks are presented, together with comparisons of computed and experimental data particularly related to the Large Angle Magnetic Suspension Test Fixture at NASA Langley Research Center, and the Annular Suspension and Pointing System at Old Dominion University. In both cases, practical computations are capable of providing reasonable estimates of important performance-related parameters. The most difficult case is seen to be that of eddy currents in highly permeable material, due to the low skin depths. Problems associated with specification of material properties and areas for future research are discussed.
Author
Eddy Currents; Magnetic Suspension; Magnetic Bearings; Magnetic Properties

19980203626 Keio Univ., Faculty of Science and Technology, Yokahama, Japan
Electromaglev System of a YBCO Bulk Superconductor
Sawa, K., Keio Univ., Japan; Horiuchi, H., Keio Univ., Japan; Nishi, K., Keio Univ., Japan; Iwasa, Y., Massachusetts Inst. of Tech., USA; Tsuda, M., Massachusetts Inst. of Tech., USA; Lee, H., Massachusetts Inst. of Tech., USA; Nagashima, K., International Superconductivity Technology Center, Japan; Miyamoto, T., International Superconductivity Technology Center, Japan; Murakami, M., International Superconductivity Technology Center, Japan; Fujimoto, H., Railway Technical Research Inst., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 353-365; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes an "Electromaglev" system, in which a HTS sample, that is, a YBCO disk or ring, is stably levitated in a DC magnetic field generated by electromagnets placed under the levitated object. The most versatile and useful features of this system are: (1) easily adjustable levitation height - it is made possible by varying the electromagnet coil current, (2) large levitation height - it is feasible by sufficiently large electromagnets. This levitation system is theoretically and experimentally discussed from the view of levitation stability. Consequently, for stable levitation, specifically pitch stability, magnetic flux is required to be trapped in the YBCO disk as the disk is initially cooled from the normal state to the superconducting state in the

presence of an external magnetic field. Further, the levitation height can be controlled by the coil current. The range of the maximum levitation height achieved by a 40 mm diameter (with a 30 mm diameter hole) YBCO ring was 100 mm.
Author
YBCO Superconductors; Superconductors (Materials); Superconductivity; Electric Fields; Levitation

19980203627 Nippon Steel Corp., Advanced Technology Research Labs., Kawasaki, Japan
Levitation Force Properties of Bulk Superconductors for Magnetic Bearings
Teshima, Hidekazu, Nippon Steel Corp., Japan; Morita, Mitsuru, Nippon Steel Corp., Japan; Kaneko, Takayuki, Nippon Steel Corp., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 367-381; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Because superconducting levitation using high-temperature superconducting bulk materials is essentially stable, the possibility that completely noncontact and passive bearings can be realized without any control exists. In this study, an investigation was experimentally made into the basic properties of superconducting levitation force using large-size, high-performance Y-Ba-Cu-0 bulk superconductors. It became apparent that an orientation of the c-axis of bulk superconductors and a reduction in the number of divided portions of samples by increasing the sample size are effective in improving the levitation force. It was also found that a sufficient sample thickness of bulk superconductors is about 10 mm. Furthermore, a near-net shape process was proposed for the processing of optimum-shaped materials for bulk superconductors.
Author
Superconductivity; Levitation; Superconductors (Materials); YBCO Superconductors; Magnetic Bearings

19980203631 National Aerospace Lab., Tokyo, Japan
Superconductive Solenoid for the NAL 60-cm MSBS
Sawada, Hideo, National Aerospace Lab., Japan; Kohno, Takashi, National Aerospace Lab., Japan; Kunimasu, Tetsuya, National Aerospace Lab., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 425-439; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The model position sensing system at the NAL 60-cm Magnetic Suspension and Balance System (MSBS) has been improved to provide a more accurate measurement of lateral positions by using an additional sensing camera mounted at the upper side of the test section. The MSBS is equipped with a model holding system in order to establish safe model release and capture. The holding system has a balance to monitor the load on the model while the system holds it. Suitable dimensions of the cylindrical model core for the MSBS are estimated. A larger MSBS for the 1.25 in high Reynolds number supersonic wind tunnel is designed by scaling up the dimensions of the 60-cm MSBS. A superconductive solenoid core is inevitable if suspending a model magnetically in the high Reynolds number supersonic wind tunnel. The proposed goal of the cylindrical core is 0.9 m long and 74 mm in diameter, with 80 kA/sq cm current density. In order to examine its feasibility, a superconductive solenoid model core of 300 mm long and 45 kA/sq cm current density has been designed and built.
Author
Magnetic Suspension; Position Sensing; Solenoids; Supersonic Wind Tunnels; Superconducting Devices; Magnetic Cores

19980203646 Syracuse Univ., Office of Sponsored Programs, NY USA
Propagation of a Gaussian-Beam in a Bacteriorhodopsin Fill ***Final Report, Apr. 1996 - Oct. 1997***
Song, Q. W., Syracuse Univ., USA; Mar. 1998; 33p; In English
Contract(s)/Grant(s): F30602-96-C-0066; AF Proj. 4600
Report No.(s): AD-A343526; AFRL-SN-RS-TR-1998-33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Presented is a computational study on the Gaussian-beam propagation in the bio-optical material bacteriorhodopsin with considerations of the material's intensity-dependent absorption and refractive index modulation. The beam focusing size, focusing position, intensity change in the material and their dependence on the incident beam parameters are simulated. Results of the simulation have application to the limits on memory storage in bacteriorhodopsin.
DTIC
Optical Materials; Bacteriophages; Refractivity; Bacteria; Electro-Optics

19980203658 Naval Postgraduate School, Dept. of Electrical and Computer Engineering, Monterey, CA USA
Symmetrical Number System Phase Sampled Interferometer Direction Finding Antennas
Jenn, D. C., Naval Postgraduate School, USA; Pace, P. E., Naval Postgraduate School, USA; Feb. 20, 1998; 28p; In English
Report No.(s): AD-A343391; NPS-EC-98-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A novel phase sampled interferometer Direction Finding (DF) antenna architecture is described. Based on the Optimum Symmetrical Number System (OSNS) the analog spatial filtering operation is broken down into a number of parallel sub operations (moduli) that are of smaller complexity. One two-element interferometer is used for each sub operation and only requires a precision in accordance with its modulus. A much higher spatial resolution is achieved after the different OSNS moduli are used and the filtering results of these low precision sub operations are recombined. The use of the symmetrically folding phase waveform provides for a straight forward implementation of a high resolution DF antenna. Simulated and experimental results are shown to numerically evaluate the feasibility of the design. Spatial encoding errors that may occur due to the angle-of-arrival being located about a code transition point are also quantified.
DTIC
Direction Finding; Antennas; Architecture; Interferometers; Symmetry; Spatial Resolution; Coding

19980203681 Instituto de Fisica Teorica, Sao Paulo, Brazil
Fermion helicity flip in higher-derivative electromagnetism
Accioly, A. J., Instituto de Fisica Teorica, Brazil; Mukai, H., Universidade Estadual de Maringa, Brazil; Oct. 1996; 16p; In English
Report No.(s): IFT-P-040/96; DE97-636876; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

It is shown that massive fermions have their helicity flipped on account of their interaction with an electromagnetic field described by Podolsky's generalized electrodynamics. Massless fermions, in turn, seem to be unaffected by the electromagnetic field as far as their helicity is concerned.
DOE
Electromagnetic Fields; Fermions; Electrodynamics

19980203731 Calspan Corp., UB Research Center, Buffalo, NY USA
Macromodeling Electromagnetic Effects in Circuits ***Final Report, Oct. 1994 - Jul. 1996***
Kennealky, Daniel J., Calspan Corp., USA; Oct. 1997; 286p; In English
Contract(s)/Grant(s): F30602-93-D-0075; AF Proj. 2338
Report No.(s): AD-A341551; RL-TR-97-185; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This report presents results of an investigation to develop CAD macromodels for simulating and assessing electromagnetic (EM) effects in linear and digital ICs. The effects of interest are any unintended IC responses due to inadvertently (or intentionally) coupled EM energy entering into any accessible ports on the victim circuit. Assessments of possible EM effects require robust methodology to encompass a variety of coupling waveforms and conditions. In this study, both Thevenin and Norton sources were used as equivalent circuits for coupling the intrusive EM fields. Both digital and linear ICs were used as victim circuits to determine and benchmark performance of the candidate macros. Three ICs of representative families, however, were specifically selected for bench marking because they are used in current and planned Air Force Systems. In addition, other contemporary linear ICs and OpAmps were used in various circuit configurations to demonstrate use of the (EM) assessment macromodels.
DTIC
Computer Aided Design; Integrated Circuits; Electromagnetic Fields; Magnetic Permeability

19980203834 Los Alamos National Lab., NM USA
Nonlinear simulation of a tetrode vacuum tube
Doss, J. D., Los Alamos National Lab., USA; [1997]; 19p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2472; DE97-008698; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We have developed a variety of circuit models that may be used to simulate vacuum triodes and tetrodes in the extremes of nonlinear operation - from cutoff to saturation. These models, which run on Spectrum Software's Microcap-IV(R) (MC4) electronic circuit analysis program, have been used to analyze radiofrequency (rf) amplifiers and high- voltage pulse modulators. In this preliminary report, we provide a single example of a high-power tetrode model and its use in a simple radio-frequency amplifier circuit. Within the next few months, we intend to produce a more exhaustive report that will provide a detailed explanation of the purpose of specific model elements, simulation of a variety of vacuum triodes and tetrodes, and additional circuit applications for these models.
DOE
Tetrodes; Computerized Simulation; Vacuum Tubes; Electric Networks; Network Analysis; Triodes; Circuits

19980203835 Synectics Corp., Rome, NY USA

Diminishing Manufacturing Sources (DMS) Studies for Joint Tactical Information Distribution Systems (JTIDS) ***Final Report, Aug. 1996 - Sep. 1997***

Martin, Kathy, Synectics Corp., USA; Volp, Jeff, Synectics Corp., USA; Apr. 1998; 53p; In English

Contract(s)/Grant(s): F30602-95-D-0028; AF Proj. 2982

Report No.(s): AD-A343494; AFRL-IF-RS-TR-1998-35; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this study was to provide a feasibility assessment and Rough Order of Magnitude (ROM) cost of using a 3rd party's approach for eliminating microcircuit part obsolescence on a printed wiring board, which was designed by a cognizant JTIDS contractor. The results of this study are to be used in supporting future acquisition strategies (e.g., organic vs contractor repair) for JTIDS life cycle sustainment. As a follow-up sequel to the initial studies, the overall benefits, risks and impacts associated with the we of Very High Speed Integrated Circuit Hardware Description Language (VHDL) as a Diminishing Manufacturing Sources (DMS) alternative for the chosen JTIDS board or other military applications was evaluated. Although a ROM cost was provided for one of the options developed it is not contained within this final report but was provided to the JTIDS Program Office for their use.

DTIC

Data Systems; Circuit Boards; Manufacturing; Feasibility Analysis; Costs; Printed Circuits; Life (Durability)

19980203874 Los Alamos National Lab., NM USA

Design and testing of high power, repetitively pulsed solid-state closing switches

Boenig, H. J., Los Alamos National Lab., USA; Schwartzenberg, J. W., Silicon Power Corp., USA; Willinger, L. J., Silicon Power Corp., USA; Piccone, D. E., Silicon Power Corp., USA; Lopez, D. A., New Mexico State Univ., USA; Smolleck, H. A., New Mexico State Univ., USA; [1997]; 8p; In English, Oct. 1997, New Orleans, LA, USA

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

Report No.(s): LA-UR-97-547; CONF-971033-1; DE97-004704; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Repetitively pulsed closing switches are often required in high-power physics experiments. Traditionally, ignitrons have been used for these applications. There are reasons why ignitrons have undesirable features, such as the high trigger current which causes electromagnetic interference, the arc instability and environmental concern with the mercury used in the switches. With the development of ever increasing power rating of solid-state switches, in particular thyristors, the designer has the tools to replace ignitrons with solid-state devices. Using as an example a recently designed and tested 10 kV, 80 kA high-power switch, the design philosophy for repetitively pulsed switches is developed. The parameters which impose the greatest challenge on the device, such as di/dt, temperature rise and reverse blocking voltage are investigated with respect to their capability when operating in the pulsed mode. Starting with the available device data sheet information and published results of the dependency of the number of life cycles as a function of the device temperature, it is shown how the overload capability of a device for short term pulsed applications can be exploited. The detailed design of a 2 Hz, 10(sup 8) cycle, 12.5 kV, 80 kA, 3 ms switch, with a short circuit capability of 250 kA, is presented. The paper concludes with a short summary about device limits in voltage, current amplitude and pulse length ratings for repetitively pulsed switches using available thyristors.

DOE

Design Analysis; Performance Tests; High Current; Solid State Devices; Switches

19980203878 Rochester Univ., Lab. for Laser Energetics, NY USA

Integrated circuit tester using interferometric imaging

Donaldson, W. R., Rochester Univ., USA; Michaels, E. M .R., Rochester Univ., USA; Akowuah, K., Rochester Univ., USA; 1997; 4p; In English

Contract(s)/Grant(s): DE-FC03-92SF-19460

Report No.(s): DOE/SF/19460-T2; DE97-001495; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An interferometric imaging technique can provide time-resolved diagnostics of semiconductor integrated circuits. The semiconductor device is placed in one arm of an interferometer and illuminated with a picosecond pulse from a sub-bandgap infrared laser. As the laser passes through the semiconductor, it samples local variations in the index of refraction. These variations are caused by a number of physical phenomena including dopants in the material such as those used to form device structures, heating due to the flow of electrical currents, and changes in carrier concentration due to injection. These variations have both static and dynamic components. The dynamic components are associated with the normal device operation and are the most interesting. To separate the components, the device is first imaged in a quiescent state, and then a second image is taken after the device enters

a known voltage state. Differences between the two images determine where the local index of refraction has changed and by how much. A third image taken with the reference arm of the interferometer blocked, allows device structures to be associated with particular changes in the index of refraction. Activation of the voltage state is synchronized with the pulsed illumination source, and the time delay between the application of the voltage and the laser probe pulse allows us to take a series of images that map the time evolution of the interferogram. This technique offers an exciting new diagnostic for semiconductor integrated circuits. The technique is noninvasive and compatible with high-speed operation of integrated circuits. The picosecond resolution enables us to either characterize specific logic states or watch an individual device turn on. This imaging technique is sensitive to all of the index of refraction changes that can be associated with IC's. These include heating due to current flowing through narrow wires and charge injection into the depletion region of a transistor.
DOE
Integrated Circuits; Diagnosis; Procedures; Electronic Equipment Tests; Interferometry; Imagery

19980203901 Air Force Research Lab., Rome, NY USA
Optically Controlled Phased Array Antenna
Garafalo, David A., Air Force Research Lab., USA; Apr. 1998; 26p; In English
Contract(s)/Grant(s): AF Proj. 4600
Report No.(s): AD-A344474; RL-TR-97-245; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An optically controlled phased array antenna developed by Hughes Aircraft under a DARPA/Rome Laboratory research program was tested at the Rome Laboratory Newport Test Site. The first round of tests were conducted in June/July 1993 and the second round of tests were in May/October 1996. The antenna is a 3-foot by 9 foot phased array capable of a scan angle of 120 degrees. The antenna was designed to be conformal to the cargo door of a large aircraft and is designed to operate in the frequency range of 830-1400 MHz with a 30% instantaneous bandwidth. The extensive bandwidth is made possible by the use of photonically based time delays. A typical phased array antenna based on electronic phase shifters would have on the order of a 3% bandwidth. When a bandwidth larger than 3% is attempted with a conventional electronically controlled phased array, beamsquint (or beamwander) will occur. This translates into inaccurate and unreliable radar data. A radar system with the advantage of a 30% bandwidth would make it possible to combine the functions of multiple antennas such as radar, communications and electronic warfare, which collectively operate over a large bandwidth into just one array.
DTIC
Optical Properties; Antenna Arrays; Phased Arrays

19980203903 Scientific Research Associates, Inc., Glastonbury, CT USA
Scientific and Engineering Semiconductor Device Simulation Tools as a Windows Application ***Final Report, 1 Apr. 1995 - 7 Jul. 1997***
Grubin, H. L., Scientific Research Associates, Inc., USA; Apr. 01, 1998; 6p; In English
Contract(s)/Grant(s): DAAH04-95-C-0040
Report No.(s): AD-A344482; SRA-9341-F; ARO-34102.1-EL-SB2; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A bottleneck associated with numerical simulations of quantum feature size semiconductor devices, has been the absence of a menu driven program that does not require user knowledge of the solution algorithm for the device equations. Under this SBIR study Scientific Research Associates, Inc. (SRA) transferred quantum transport algorithms, originally developed for supercomputer simulations to a PC environment. This resulted in (1) program execution via menu based Microsoft Windows-type interface, (2) user-defined parameters (dimension, doping, material property, voltage, etc.), (3) an intuitive user interface, and (4) acceptable execution and throughput times when compared to workstations and supercomputers. Under the Phase II study SRA configured three numerically robust software programs (plus operating manuals) for PC-Windows operation. These codes are ready for sale. The FORTRAN based simulation algorithms are: (1) SRA's algorithm for solving the quantum Liouville equation in the coordinate representation; (2) SRA's one dimensional quantum hydrodynamic algorithm; (3) SRA's two dimensional quantum hydrodynamic algorithm configured for HEMT simulations. The first two algorithms include time dependence. The algorithms can provide device parameters for coupling to standard commercially available circuit packages.
DTIC
Mathematical Models; Semiconductor Devices; Computerized Simulation

19980203941 Sandia National Labs., Albuquerque, NM USA
High reliability plastic packaging for microelectronics
Sweet, J. N., Sandia National Labs., USA; Peterson, D. W., Sandia National Labs., USA; Hsia, A. H., Sandia National Labs., USA;

Tuck, M., Sandia National Labs., USA; Jul. 1997; 39p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-1721; DE97-008786; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The goal was Assembly Test Chips (ATCs) which could be used for evaluating plastic encapsulation technologies. Circuits were demonstrated for measuring Au-Al wirebond and Al metal corrosion failure rates during accelerated temperature and humidity testing. The test circuits on the ATC02.5 chip were very sensitive to extrinsic or processing induced failure rates. Accelerated aging experiments were conducted with unpassivated triple track Al structures on the ATC02.6 chip; the unpassivated tracks were found to be very sensitive to particulate contamination. Some modifications to existing circuitry were suggested. The piezoresistive stress sensing circuitry designed for the ATC04 test chip was found suitable for determining the change in the state of mechanical stress at the die when both initial and final measurements were made near room temperature (RT). Attempt to measure thermal stress between RT and a typical polymer glass transition temperature failed because of excessive die resistor- substrate leakage currents at the high temperature end; suitable circuitry changes were developed to overcome this problem. One temperature and humidity experiment was conducted with Sandia developed static radom access memory parts to examine non-corrosion CMOS failures; this objective was not achieved, but corrosion failure at the metal to Si contacts on the die surface could be detected. This 2-year effort resulted in new designs for test circuits which could be used on an advanced ATC for reliability assessment in Defense Programs electronics development projects.
DOE
Electronic Equipment Tests; Encapsulated Microcircuits; Encapsulating; Microelectronics

19980204686 Sandia National Labs., Albuquerque, NM USA
Current transport in W and WSI(sub x) ohmic contacts to InGaN and InN
Vartuli, C. B., Florida Univ., USA; Pearton, S. J., Florida Univ., USA; Abernathy, C. R., Florida Univ., USA; 1997; 8p; In English, 31 Mar. - 4 Apr. 1997, San Francisco, CA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000; N00014-92-J-1895
Report No.(s): SAND-97-2350C; CONF-970302-24; DE98-000043; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The temperature dependence of the specific contact resistance of W and WSi(sub 0.44) contacts on n(sup +) In(sub 0.65)Ga(sub 0.35)N and InN was measured in the range -50 C to 125 C. The results were compared to theoretical values for different conduction mechanisms, to further elucidate the conduction mechanism in these contact schemes for all but as-deposited metal to InN where thermionic emission appears to be the dominant mechanism. The contacts were found to produce low specific resistance ohmic contacts to InGaN at room temperature, e(sup c) (approximately) 10(sup -7) (Omega) (center dot) cm(sup 2) for W and e(sub c) of 4x 10(sup -7) (Omega) (center dot) cm(sup 2) for WSi(sub x). InN metallized with W produced ohmic contacts with e(sub c) (approximately) 10(sup -7) (Omega) (center dot) cm(sup 2) and e(sub c) (approximately) 10(sup -6) (Omega) (center dot) cm(sup 2) for WSi(sub x) at room temperature.
DOE
Temperature Dependence; Contact Resistance; Field Emission; Electrical Resistivity

19980204713 Research Inst. of National Defence, Avdelningen foer Sensorteknik, Linkoeping, Sweden
Microwave Performance of Optically Steerable Silicon Wafers ***Mikrovaegsegenskaper hos Optiskt Styrda Kiselskivor***
Oennegren, J., Research Inst. of National Defence, Sweden; Jonsson, R., Research Inst. of National Defence, Sweden; Lindstroem, L., Research Inst. of National Defence, Sweden; Dec. 1997; 62p; In Swedish
Report No.(s): PB98-147457; FOA-R-97-00639-615-408-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In this report, the authors mainly focus on how to realize a randome to protect a radar antenna. If the radar is equipped with an optically steerable silicon surface in front of the antenna, the radar cross section can be reduced and the system can also withstand High Power Microwave (HPM) pulses. In this work the authors have studied theoretically and experimentally the microwave performance of optically steerable silicon wafers, where the silicon surface was continuously illuminated. The theory developed in chapters 2-5 has been implemented in a simulation program called Tectum. Tectum derives the excess carrier densities and the microwave performance for the case when the silicon surface is continuously illuminated. The surface recombination at both sides of the silicon wafer is taken into account in the simulations. to experimentally investigate different illumination inten-

sities, microwave measurements have been performed on various doped silicon wafers. Experiments have also been carried out by illumination of the wafers.
NTIS
Microwaves; Microwave Transmission; Silicon; Wafers; Optical Waveguides

19980204871 Rochester Univ., Dept. of Electrical Engineering, NY USA
Ultrafast Broadband Photodetectors for High-Tc Superconductive Optoelectronics ***Final Report, 1 Jul. 1993 - 30 Sep. 1996***
Sobolewski, Roman, Rochester Univ., USA; Fauchet, Philippe M., Rochester Univ., USA; Jan. 1997; 12p; In English
Contract(s)/Grant(s): DAAH04-93-G-0211
Report No.(s): AD-A344891; ARO-31188.7-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental research has been conducted to demonstrate the potential of the high-temperature superconductors (HTS) for optoelectronics. We performed systematic characterization of femtosecond optical response of superconducting YBa2Cu3O(x) (YBCO) thin films. We measured, for the first time, 1.5-ps-wide photoresponse signals from an epitaxial YBCO film irradiated with 150 fs optical pulses. Our results shed new light on the nonequilibrium carrier dynamics in HTS, as well as convincingly demonstrated that these materials are suitable for ultrahigh speed optoelectronic applications. We have developed a new, laser-based processing technique (so-called laser writing) for fabrication of HTS optoelectronic devices. The method exploited the contrasting optical and electrical properties of the oxygen-poor (semiconducting) and oxygen-rich (superconducting) YBCO phases and was used to fabricate superconducting structures with various oxygen doping profiles and YBCO photodetectors. Optical measurements were supplemented by extensive transport experiments of both partially oxygen-depleted and photodoped YBCO films. We observed both the persistent and erasable changes of the normal-state transport and superconducting properties of YBCO films, exposed to a prolonged white-light illumination at low temperatures. Our results indicated that both the charge transfer and oxygen ordering mechanisms were responsible for the photoinduced effects in YBCO.
DTIC
Broadband; Photometers; Superconducting Films; Superconductivity; Optoelectronic Devices; Electro-Optics; YBCO Superconductors

19980204873 Harvard Univ., Dept. of Physics, Cambridge, MA USA
Coulomb Blockade of Tunnel-Coupled Quantum Dots ***Final Report***
Golden, John M., Harvard Univ., USA; Apr. 1997; 170p; In English
Report No.(s): AD-A342891; AFRL-SR-BL-TR-98-0368; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Quantum dots are small conducting islands that can often be usefully modeled as tiny capacitors. Though classical charging models can explain the Coulomb blockade of an isolated dot, they must be modified to explain the Coulomb blockade of dots coupled through the quantum mechanical tunneling of electrons. This thesis presents quantum mechanical models for pairs of tunnel-coupled dots and uses these models to follow the coupled dot blockade as it evolves from that characteristic of two isolated dots to that characteristic of a single composite dot. The primary aim is to find the relation between two quantities: the fractional peak splitting f and the dimensionless inter-DOT channel conductance g, both of which go from 0 to 1 as the isolated dot blockade changes into the composite dot blockade. The thesis begins with Chapter 1, which introduces coupled quantum dots and the Coulomb blockade and highlights the contents of the succeeding chapters. Chapters 2 and 3 present a transfer Hamiltonian model for weakly coupled dots and a one-dimensional backscattering model for strongly coupled dots. The leading and subleading terms in the weak and strong coupling expressions for f as a function of g are derived. The weak coupling calculation is performed via Rayleigh-Schroedinger perturbation theory about the endpoint (g, f) = (0,0). The strong coupling calculation employs the bosonization approach about the endpoint (g, f) = (1, 1). The results show substantial dependence on the number of inter-DOT tunneling channels N sub ch. Chapter 4 goes beyond the work of Chapters 2 and 3, which rely upon the assumption that tunneling and backscattering amplitudes can be treated as energy-independent.
DTIC
Quantum Electronics; Quantum Dots; Tunneling

19980204879 University of Southern California, Signal and Image Processing Inst., Los Angeles, CA USA
Optics in Parallel Shared Memory Computing ***Final Report, 1 Jul. 1993 - 31 Oct. 1997***
Jenkins, B. K., University of Southern California, USA; Apr. 27, 1998; 14p; In English
Contract(s)/Grant(s): F49620-93-1-0437
Report No.(s): AD-A344024; AFRL-SR-BL-TR-98-0424; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A summary of accomplishments on the grant, "Optics in Parallel Shared Memory Computing", over the period 7/1/93-10/31/97, is given. Accomplishments include the design of a parallel shared memory optical/electronic computer, and a

centralized control algorithm for its processor-to-memory interconnection network. The grantee has also designed a volume-holographic shared memory system that can implement a set of parallel-access memory modules in a system comprising a single photorefractive crystal and 2 arrays of self-coherent but mutually incoherent sources. A proof-of-concept experimental demonstration has been successfully conducted. A closer-to-optimal multiplexing technique, which incorporates space, angle, and wavelength multiplexing, has also been developed. A technique for ”blind copying” of a multiplexed volume hologram has been analyzed and applied to various combinations of photorefractive and photopolymer media. The grantee has also developed and analyzed a multiple-access protocol based on wavelength, space, and time multiplexing, for use in distributed-memory parallel processors that use optical symmetric cellular hypercube interconnections. A hybrid optoelectronic CMOS-SEED chip, designed by the grantee and fabricated under the DARPA CO-OP program, provides conversion from electrical to parallel-optical formats with programmable number representation. This report also describes objectives of, personnel supported by, publications resulting from, and interactions/transitions of, the effort supported by this grant.
DTIC
Computation; Parallel Processing (Computers); Protocol (Computers); Memory (Computers); Optical Activity; Optical Data Storage Materials; Distributed Memory

19980205606 Sandia National Labs., Albuquerque, NM USA
Mechanisms for enhanced packaging and/or burn-in total dose sensitivity in microelectronics
Pease, R. L., Sandia National Labs., USA; Shaneyfelt, M., Sandia National Labs., USA; Winokur, P., Sandia National Labs., USA; 1997; 5p; In English; Radecs 97: Radiations and Their Effects on Devices and Systems Conference, 15 - 19 Sep. 1997, Cannes, France
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-0603C; CONF-970934-2; DE97-003730; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche
The ionizing radiation response of several semiconductor process technologies has been shown to be enhanced by plastic packaging and/or pre-conditioning (burn-in). Potential mechanisms for this effect are discussed and data on bipolar linear circuits are presented.
DOE
Microelectronics; Ionizing Radiation; Radiation Effects; Packaging; Burn-In; Semiconductor Devices; Linear Circuits

19980205607 Sandia National Labs., Albuquerque, NM USA
Effects of temperature on MOS radiation response
Shaneyfelt, M. R., Sandia National Labs., USA; Schwank, J. R., Sandia National Labs., USA; Winokur, P. S., Sandia National Labs., USA; Fleetwood, D. M., Sandia National Labs., USA; 1997; 4p; In English; Radecs 97: Radiations and Their Effects on Devices and Systems Conference, 15 - 19 Sep. 1997, Cannes, France
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-0602C; CONF-970934-1; DE97-003729; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche
Effects of irradiation and annealing temperature on radiation-induced charge densities are explored for MOS transistors. Both interface- and border-trap density increase with increasing radiation temperature, while the net oxide-trap charge density decreases.
DOE
Temperature Effects; Metal Oxide Semiconductors; Irradiation; Density (Number/Volume); Transistors

19980205666 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Metastable Behaviour in Arbiter Circuits
Kinniment, D. J., Newcastle-upon-Tyne Univ., UK; Yakovlev, A. V., Newcastle-upon-Tyne Univ., UK; Gao, B., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 26p; In English
Report No.(s): PB98-147978; TRS-604; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this paper, the authors derive a small signal model of a two input arbiter, and show it can be used to predict the response time of the circuit. This model is extended to circuits with n stable states, and the response of these circuits is demonstrated to be sufficiently simple to build practical circuits and calculate their response times. Finally the authors compare tree arbiter solu-

tions to the n-input arbitration problem with n-stable solutions, and show that a tree arbiter element based on a tristable Mutual Exclusion (MUTEX) gives a better performance than the more conventional bistable MUTEX.
NTIS
Response Time (Computers); Stability; Metastable State; Bistable Circuits

19980205689 Oak Ridge Inst. for Science and Education, TN USA
Determination of ionization fraction and plasma potential in a dc magnetron sputtering system using a quartz crystal microbalance and a gridded energy analyzer
Green, K. M., Oak Ridge Inst. for Science and Education, USA; Jan. 1997; 73p; In English
Contract(s)/Grant(s): DE-AC05-76OR-00033
Report No.(s): DOE/OR/00033-T700; DE97-053350; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A diagnostic which combines a quartz crystal microbalance and a gridded energy analyzer has been developed to measure the ion-to- neutral ratio and the plasma potential in a commercial dc magnetron sputtering device. Additional features of this sensor include an externally controlled shutter which protects the diagnostic when it is in the chamber, but it is not in use. The diagnostic is mounted on a linear motion feedthrough and embedded in a slot in the wafer chuck to allow for measuring uniformity in deposition and ionization throughout the plane of the wafer. RF power is introduced to ionize the Al particles. Using the quartz crystal microbalance and the gridded energy analyzer, the ion-to-neutral ratio and other parameters are determined. Comparing the total deposition rate with and without a bias that screens out the ions, but leaves the plasma undisturbed, allows for the determination of the ion-to-neutral ratio. by varying the voltage applied to the grids, the plasma potential is measured. For example, a magnetron configuration having a pressure of 35 mtorr, a dc power of 2 kW, and a net rf power of 310 +/- 5 W yielded 78 +/- 5% ionization and a plasma potential of 35 +/- 1 V.
DOE
Ionization; Plasma Potentials; Magnetrons; Technology Assessment; Ionization Potentials

19980205714 Kentucky Univ., Dept. of Electrical Engineering, Lexington, KY USA
Rigorous Analysis of Large Scale MMlC Circuit Devices ***Final Report, 14 Jul. 1994 - 31 Dec. 1998***
Gedney, Stephen, Kentucky Univ., USA; Apr. 30, 1998; 67p; In English
Contract(s)/Grant(s): DAAH04-94-G-0243
Report No.(s): AD-A344538; ARO-33149.8-EL-DPS; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The focus of this research has been on the development of scalable time-dependent solutions of Maxwell equations for the analysis of printed microwave circuits. The Planar Generalized Yee (PGY) algorithm has been developed which is an explicit scheme based on an unstructured grid with planar symmetry. Implicit finite element schemes have also been investigated. Radiation boundaries are enforced using the newly developed Uniaxial Perfectly MatchedLlayer (UPML). It is shown that the PML can be perfectly matched to a general lossy inhomogeneous media, as well as dispersive nonlinear and anisotropic media providing high levels of absorption. The means of efficiently modeling infinitely periodical geometries using orthogonal and nonorthogonal Finite Difference Time Domain (FDTD) methods is also introduce. Finally modeling linear and nonlinear devices within the FDTD and PGY methods using a state variable solution is presented. Examples of a linear amplifier, a nonlinear diode and nonlinear amplifier are presented.
DTIC
Integrated Circuits; Microwave Equipment; Large Scale Integration; Microwave Circuits; Microwave Sounding

19980205718 TRW, Inc., Redondo Beach, CA USA
Low Voltage, High Speed and High Contrast Electrooptical Thin Film Devices for Free Space Optical Interconnects ***Final Report, 1 Sep. 1993 - 31 Jan. 1998***
Sashital, Sanat, TRW, Inc., USA; Esener, Sadik, TRW, Inc., USA; Mar. 06, 1998; 18p; In English; Prepared in collaboration with UCSD, LaJolla, CA
Contract(s)/Grant(s): DAAH04-93-C-0029
Report No.(s): AD-A344550; ARO-32263.1-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Speed and 'crosstalk' limitations, encountered by conventional metal transmission lines in 'chip to chip' data/information communication are overcome by Free Space Optical Interconnects (FSOI) for future ultra fast computing/communications systems. Fabry-Perot thin film Electrooptic(EO) modulators (STFP) function as high speed, low voltage operable optical interconnects. Development and demonstration of such STFP's based on ferroelectric/EO F-P modulators is described. For self tuning, with respect to F-P cavity Ferroelectric(FE)/EO thin film) thickness variations and consequent nonuniformity of extinction/con-

trast across STFP arrays, a holographic mirror (photorefractive LiNbO3) for compensation of thickness was used. For ”proof-of-concept” demonstration, a PLZT bulk crystal plate was used for STFP arrays. A successful demo of 8 x 8 and 16 x 16 STFP interconnect arrays is described. The development of KTN (FE/EO) thin films on Sapphire substrates by RF-planar magnetron sputtering (for IC compatibility) and PLZT (low level of effort, backup material) are described. Successful FE properties observation in KTN and PLZT, materials characterization (structural and stoichiometric) and property evaluation are presented. The challenges presented in STFP applications are described. Deficiencies of K, primarily due to negative ion re-sputtering effects in KTN, Pb volatilization in PLZT and extraneous Pyrochlor phases are described.
DTIC
Low Voltage; High Speed; Electro-Optics; Modulators; Thin Films; Document Storage

19980205788 Sandia National Labs., Albuquerque, NM USA
Development of a hybrid microcircuit test vehicle for surface mount applications
Hernandez, C. L., Sandia National Labs., USA; Hosking, F. M., Sandia National Labs., USA; Vianco, P. T., Sandia National Labs., USA; 1997; 6p; In English; International Symposium on Microelectronics, 12 - 16 Oct. 1997, Philadelphia, PA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-0553C; CONF-971028-1; DE97-007794; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The technology drivers of the electronics industry continue to be systems miniaturization and reliability, in addition to addressing a variety of important environmental concerns. Surface Mount Technology (SMT) has evolved in response to these issues. Prototype hybrid test vehicles have been developed at Sandia National Laboratories to evaluate three lead-free solders for Au-Pt-Pd thick film soldering. The alloys are based on the Sn-Ag, Sn-Ag-Bi and Sn-Ag-Bi-Au systems. Populated test vehicles with surface mount devices were designed and fabricated to evaluate actual solder joints. Pastes were screen printed on the test substrates and reflowed with the components in place. The test components consist of a variety of dummy chip capacitors and Leadless Ceramic Chip carriers (LCC’s). The development of the reflow profiles will be discussed. Comprehensive defect analysis will also be presented.
DOE
Procedures; Microelectronics; Miniaturization; Electronic Equipment Tests; Test Vehicles

19980205818 National Inst. of Standards and Technology, Scalable Parallel Systems and Applications Group, Gaithersburg, MD USA
Dielectric Breakdown in a Simplified Parallel Model
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; Sullivan, F. E., Institute for Defense Analyses, USA; Jun. 1998; 42p; In English
Report No.(s): PB98-148778; NISTIR-6174; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The growth of streamer trees in insulating fluids (a submicrosecond process which triggers high-voltage breakdown) has been simulated with a combination of parallel-coding tools.
NTIS
Electrical Insulation; Actuators; Dielectric Permeability; Parallel Processing (Computers); Insulation

19980206137 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
A Novel Random Switching Technique for High Performance Inverter Control
Lai, Yen-Shin, Taipei Inst. of Technology, Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 131-138; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A novel random switching technique for high performance inverter control is presented in this paper. Since the switches of power devices are randomized, the acoustic noise generated by the voltage and current harmonics of inverter control can be significantly reduced. It will also be shown that the technique has been developed without changing the sampling and modulation schemes, asymmetric regular-sampling and double edge modulation schemes respectively, which have been widely used in practical inverter control systems. Therefore, the modifications necessary to upgrade the performance of inverters using the proposed random switching technique can be easily incorporated into existing digitalized inverter control systems, e.g. vector control systems. Furthermore, in comparison with the conventional randomized pulse position technique which may result in single edge modulation and thereby causes greater mean value of flux error for drive control, the proposed random switching technique provides less mean value of flux error due to double edge modulation. In comparison with conventional inverter control techniques

based purely upon the asymmetric regular-sampling technique, e.g. space vector modulation, which results in fixed voltage and current harmonic spectra and therefore generates annoying acoustic noise, the proposed random switching technique can reduce this kind of noise by randomizing the switches. Once the switches are randomized, the first dominant harmonic which dominates the generation of acoustic noise can be dramatically reduced. A novel Random Space Vector Modulation (RSVM) technique will be presented based upon the novel random switching technique. The RSVM technique is realized using a Digital Signal Processor (DSP) and the experimental results will be shown to confirm the theoretical analysis.
Author
Switching; Inverters; Directional Control; Signal Processing; Modulation; Random Sampling

19980206176 Auburn Univ., Dept. of Aerospace Engineering, AL USA
Application of Consider Covariance to the Extended Kalman Filter
Lundberg, John B., Auburn Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The extended Kalman filter (EKF) is the basis for many applications of filtering theory to real-time problems where estimates of the state of a dynamical system are to be computed based upon some set of observations. The form of the EKF may vary somewhat from one application to another, but the fundamental principles are typically unchanged among these various applications. As is the case in many filtering applications, models of the dynamical system (differential equations describing the state variables) and models of the relationship between the observations and the state variables are created. These models typically employ a set of constants whose values are established my means of theory or experimental procedure. Since the estimates of the state are formed assuming that the models are perfect, any modeling errors will affect the accuracy of the computed estimates. Note that the modeling errors may be errors of commission (errors in terms included in the model) or omission (errors in terms excluded from the model). Consequently, it becomes imperative when evaluating the performance of real-time filters to evaluate the effect of modeling errors on the estimates of the state.
Derived from text
Covariance; Kalman Filters; Differential Equations; Mathematical Models; Real Time Operation

19980206191 Florida International Univ., Physics Dept., Miami, FL USA
Electron Flow to a Satellite at High Positive Potential
Sheldon, John W., Florida International Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Tethered Satellite System (TSS) is designed to deploy a 1.6 m diameter spherical satellite a distance of 20 km above the space shuttle orbiter on an insulated conducting tether. Because of the passage of the conducting tether through the earth's magnetic field, an emf is generated producing a positive satellite potential of about 5000 V. Electron flow under the influence of this high positive potential is the focus of the present analysis. The ionospheric parameters at TSS orbit altitude are; thermal velocity of electrons, 1.9 x 10(exp 5) M/S, thermal velocity of the ions, 1.1 x 10(exp 3) m/s, velocity of the satellite 8 x 10(exp 3) m/s. The electrons, with a Debye length, lambda(D) = 0.49 cm, spiral about the earth's magnetic field lines (0.4 Gauss) with a radius of about 3 cm and the ions spiral with a radius of 5 m. Under these conditions, the electron thermal energy, kT is 0.17 eV. The TSS satellite radius, r(p) is 163 Debye lengths. There is an extensive literature on the interaction of satellites with the near-earth ionospheric plasma. The space charge limitation to the electron current collected by a sphere at positive electrical potential was calculated by Langmuir and Blodgett (1924). Parker and Murphy (1967) recognized the importance of the influence of the earth's magnetic field and used the guiding center approximation to calculate the electron current collected by a positive charged satellite. More recently Ma and Schunk (1989) have calculated the time dependent flow of electrons to a spherical satellite at positive potential utilizing numerical methods and Sheldon (1994) used similar methods to solve this problem for the steady state. In order to analyze some of the phenomena that occurred in the ionosphere during the TSS flights, it would be useful to have analytic expressions for these electron flows. The governing equations are very complex and an exact analytical solution is not likely. An approximate analytical solution is feasible however, and the results of one attempt are presented herein.
Derived from text
Tethered Satellites; Space Charge; Electromagnetic Fields; Tethering; Electron Energy; Space Plasmas; Geomagnetism; Particle Motion; Mathematical Models

19980206294 Brookhaven National Lab., Upton, NY USA
Corrosion of AB5 metal hydride electrodes
Adzic, G. D., Brookhaven National Lab., USA; Johnson, J. R., Brookhaven National Lab., USA; Mukerjee, S., Brookhaven National Lab., USA; McBreen, J., Brookhaven National Lab., USA; Reilly, J. J., Brookhaven National Lab., USA; [1997]; 15p;

In English; 191st, 4-9 May 1997, Montreal, Canada
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-64784; CONF-970517; DE98-001162; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Metal hydride electrodes are an attractive substitute for the cadmium electrode in Cd/Ni batteries because of their relatively benign environmental impact and higher energy density. However, even though MH(sub x)/Ni batteries are currently competitive in certain applications, their full potential as cheap, reliable, energy storage devices is not yet realized: a severe penalty has been incurred in storage capacity and materials costs in order to inhibit corrosion and attain acceptable electrode cycle life. Currently there are two types of alloys which are useful as metal hydride electrodes, the AB(sub 5) and the AB(sub 2) classes of intermetallic compounds. Commercial AB(sub 5) electrodes use mischmetal, a low cost combination of rare earth elements. The B(sub 5) component remains primarily Ni but is substituted in part with Co, Mn, Al etc. The partial substitution of Ni increases thermodynamic stability of the hydride phase and corrosion resistance. Such an alloy is commonly written as MmB(sub 5) where Mm represents the mischmetal component; the B(sub 5) composition in commercial batteries is variable but electrodes consisting of MmNi(sub 3.55)Co(sub .75)Mn(sub .4)Al(sub .3) have good storage capacity and cycle life and most AB(sub 5) battery electrodes have a similar composition. The authors have been concerned with the function that individual components play in such an alloy with respect to lattice expansion, hydride stability, and surface passivation. Thus they have focused on the properties of a similar alloy, A(NiCoMnAl)(sub 5) where A is La or La(sub 1(minus)x)Ce(sub x). Some of their results noted here have previously appeared in separate publications; the purpose of this paper is to combine them with new data to give a more coherent and complete whole. DOE

Thermodynamics; Service Life; Rare Earth Elements; Metal Hydrides; Life (Durability); Intermetallics; Environmental Surveys; Corrosion Resistance

19980206305 Argonne National Lab., IL USA

AC magnetic field losses in BSCCO-2223 superconducting tapes

Lelovic, M., Pittsburgh Univ., USA; Mench, S., Pittsburgh Univ., USA; Deis, T., Pittsburgh Univ., USA; Sep. 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): W-31109-ENG-38
Report No.(s): ANL/ET/CP-92619; CONF-970758; DE98-000360; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The AC magnetic losses at power frequencies (60 Hz) were investigated for mono- and multifilament Ag-sheathed (Bi, Pb)2SR2Ca2Cu3O(y) (BSCCO-2223) tapes with similar transport critical current (I(sub c)) values at 77 K. The multifilament sample exhibited higher losses than the monofilament under the same conditions. Loss peaks are discussed in terms of intergranular, intragranular and eddy current losses. Because of BSCCO's anisotropy, field orientation has a large effect on the magnitude of these peaks, even at relatively small angles. Losses for fields applied parallel to the c-axis of the textured BSCCO grains are larger by more than one order of magnitude than those applied perpendicular.
DOE

BSCCO Superconductors; Magnetic Fields; Alternating Current; Superconductivity

19980206318 Sandia National Labs., Albuquerque, NM USA

Evaluation of field enforced antiferroelectric to ferroelectric phase transition dielectrics and relaxor ferroelectrics for pulse discharge capacitors

Hoover, B. D., Sandia National Labs., USA; Tuttle, B. A., Sandia National Labs., USA; Olson, W. R., Sandia National Labs., USA; Goy, D. M., Sandia National Labs., USA; Brooks, R. A., Sandia National Labs., USA; King, C. F., Sandia National Labs., USA; Sep. 1997; 27p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2295; DE98-000396; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Discharge capacitors were designed based on materials with antiferroelectric (AFE) to ferroelectric (FE) field enforced transitions that had 10 times the capacitance of relaxor ferroelectric or state of the art BaTiO3 materials in the voltage range of interest. Nonlinear RLC circuit analysis was used to show that the AFE to FE materials have potentially more than 2 times the peak discharge current density capability of the BaTiO3 or lead magnesium niobate (PMN) based relaxor materials. Both lead lanthanum zirconium tin titanate (PLZST) AFE to FE field enforced phase transition materials and PMN based relaxor materials were fabricated and characterized for Sandia's pulse discharge capacitor applications. An outstanding feature of the PLZST materials is that

there are high field regimes where the dielectric constant increases substantially, by a factor of 20 or more, with applied field. Specifically, these materials have a low field dielectric constant of 1,000, but an effective dielectric constant of 23,000 in the electric field range corresponding to the FE to AFE transition during discharge. Lead magnesium niobate (PMN) based relaxor materials were also investigated in this project because of their high dielectric constants. While the PMN based ceramics had a low field dielectric constant of 25,000, at a field corresponding to half the charging voltage, approximately 13 kV/cm, the dielectric constant decreases to approximately 7,500.
DOE
Current Density; Barium Titanates; Zirconium Titanates; Ferroelectricity; Electric Potential; Electric Networks; Electric Fields

19980206320 National Renewable Energy Lab., Golden, CO USA
Progress update on the US photovoltaic manufacturing technology project
Mitchell, R. L., National Renewable Energy Lab., USA; Witt, C. E., National Renewable Energy Lab., USA; Thomas, H. P., National Renewable Energy Lab., USA; Oct. 1997; 6p; 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-AC36-83CH-10093
Report No.(s): NREL/CP-520-22962; CONF-970953; DE98-000380; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Photovoltaic Manufacturing Technology (PVMaT) project is helping the U.S. photovoltaic (PV) industry extend its world leadership role in manufacturing and stimulate the commercial development of PV modules and systems. Initiated in 1990, PVMaT is being carried out in several directed and staggered phases to support industry's continued progress. Thirteen subcontracts awarded in FY 1996 under Phase 4A emphasize improvement and cost reduction in the manufacture of full-system PV products. Areas of work in Phase 4A included, but were not limited to, issues such as improving module-manufacturing processes; system and system-component packaging, integration, manufacturing, and assembly; product manufacturing flexibility; and balance-of-system development with the goal of product manufacturing improvements. These Phase 4A, product-driven manufacturing research and development (R&D) activities are now completing their second phase. Progress under these Phase 4A and remaining Phase 2B subcontracts from the earlier PVMaT solicitation are summarized in this paper. Evaluations of the success of this project have been carried out in FY 1995 and late FY 1996. This paper examines the 1997 cost/capacity data that have been collected from active PVMaT manufacturers.
DOE
Research and Development; Manufacturing; Modules; Packaging; Cost Reduction; Systems Engineering; Systems Integration

19980206327 Los Alamos National Lab., NM USA
Silicon photodiode characterization from 1 eV to 10 keV
Idzorek, G. C., Los Alamos National Lab., USA; Bartlett, R. J., Los Alamos National Lab., USA; 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-36
Report No.(s): LA-UR-97-2284; CONF-970706; DE98-000248; 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 have assembled individually filtered photodiodes into an array designated the XUV-7. The XUV-7 provides seven photodiodes in a vacuum leak tight, electrically isolated, low noise, high bandwidth, x-ray filtered assembly in a compact package with a 3.7 cm outside diameter. In addition they have assembled the diodes in other custom configurations as detectors for spectrometers. Their 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. Silicon photodiodes have proven to be a versatile and useful complement to the standard photocathode detectors for soft x-ray measurement and are very competitive with diamond for a number of applications.
DOE
Photodiodes; Extreme Ultraviolet Radiation; X Rays; Radiation Detectors

19980206368 Los Alamos National Lab., NM USA

Development of a fast traveling-wave beam chopper for the National Spallation Neutron Source

Kurennoy, S. S., Los Alamos National Lab., USA; Jason, A. J., Los Alamos National Lab., USA; Krawczyk, F. L., Los Alamos National Lab., USA; Power, J., Los Alamos National Lab., USA; [1997]; 5p; In English; IEEE Particle Accelerator Conference, 12 - 16 May 1997, Vancouver, Canada

Contract(s)/Grant(s): W-7405-ENG-36; AC05-96OR22464

Report No.(s): LA-UR-97-1705; CONF-970503-229; DE97-008187; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

High current and severe restrictions on beam losses, below 1 nA/m, in the designed linac for the National Spallation Neutron Source (NSNS) require clean and fast--with the rise time from 2% to 98% less than 2.5 ns to accommodate a 402.5-MHz beam structure--beam chopping in its front end, at the beam energy 2.5 MeV. The R and D program includes both modification of the existing LANSCE coax-plate chopper to reduce parasitic coupling between adjacent plates, and development of new traveling-wave deflecting structures, in particular, based on a meander line. Using analytical methods and three-dimensional time-domain computer simulations the authors study transient effects in such structures to choose an optimal chopper design.

DOE

Linear Accelerators; Neutron Sources; Spallation; Beams (Radiation); Pulse Generators

19980206369 Los Alamos National Lab., NM USA

Continuous processing of YBCO/IBAD coated conductors on flexible substrates

Foltyn, S. R., Los Alamos National Lab., USA; Arendt, P. N., Los Alamos National Lab., USA; Dowden, P. C., Los Alamos National Lab., USA; 1997; 6p; In English; 3rd; Joint Istec-mrs International Workshop on Superconductivity, 15 - 18 Jun. 1997, Big Island, HI, USA; Sponsored by International Superconductivity Technology Center, Japan

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

Report No.(s): LA-UR-97-1377; CONF-9706119; DE98-000257; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A continuous coating system has been developed for depositing YBa2Cu3O7(minus)(delta)) (YBCO) on 1 cm wide flexible tapes up to 113 cm long. The authors best result to date is a 12 cm long tape with a critical current (I(sub c)) of 70 A at 75 K. Variations along the length of the tape limited the overall current, but indicated the potential for long length critical currents in excess of 100 A.

DOE

YBCO Superconductors; Deposition; Coatings

19980206401 New Mexico State Univ., Klipsch School of Electrical and Computer Engineering, Las Cruces, NM USA

Non-Gimbaled Antenna Pointing

Vigil, Jeannine S., New Mexico State Univ., USA; Aug. 1997; 60p; In English

Contract(s)/Grant(s): NAG5-1491

Report No.(s): NASA/CR-97-207548; NAS 1.26:207548; NMSU-ECE-97-019; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The small satellite community has been interested in accessing fixed ground stations for means of space-to-ground transmissions, although a problem arises from the limited global coverage. There is a growing interest for using the Space Network (SN) or Tracking and Data Relay Satellites (TDRS) as the primary support for communications because of the coverage it provides. This thesis will address the potential for satellite access of the Space Network with a non-gimbaled antenna configuration and low-power, coded transmission. The non-gimbaled antenna and the TDRS satellites, TDRS-East, TDRS-West, and TDRS-Zone of Exclusion, were configured in an orbital analysis software package called Satellite Tool Kit to emulate the three-dimensional position of the satellites. The access potential, which is the average number of contacts per day and the average time per contact, were obtained through simulations run over a 30-day period to gain all the possible orientations. The orbital altitude was varied from 600 km through 1200 km with the results being a function of orbital inclination angles varying from 20 deg through 100 deg and pointing half-angles of I0 deg through 40 deg. to compare the validity of the simulations, Jet Propulsion Laboratory granted the use of the TOPEX satellite. The TOPEX satellite was configured to emulate a spin-stabilized antenna with its communications antenna stowed in the zenith-pointing direction. This mimicked the antenna pointing spin-stabilized satellite in the simulations. to make valid comparisons, the TOPEX orbital parameters were entered into Satellite Tool Kit and simulated over five test times provided by Jet Propulsion Laboratory.

Derived from text

Antenna Design; Applications Programs (Computers); Communication Networks

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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.

19980203403 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
DTNS3D Computer Code Simulation of Tip-Vortex Formation: RANS Code Validation ***Final Report***
Telste, John G., Naval Surface Warfare Center, USA; Coleman, Roderick M., Naval Surface Warfare Center, USA; Gorski, Joseph J., Naval Surface Warfare Center, USA; Aug. 1997; 53p; In English
Report No.(s): AD-A343797; NSWCCD-TR-20-97/013; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes results of an effort to simulate the formation of a tip vortex on a wing attached to a half-body and the propagation of the vortex downstream from the wing using the Reynolds averaged Navier-Stokes (RANS) computer code DTNS3D. Computational results are presented for the Baldwin-Lomax turbulence model. Three components of the mean velocity in four planes behind the wing are compared with measurements obtained in experiments performed in the MIT water tunnel. The axial component of vorticity is also compared with experimental measurements in the four planes.
DTIC
Vortices; Simulation; Computer Programs; Baldwin-Lomax Turbulence Model; Hydrodynamic Equations; Program Verification (Computers)

19980203476 Army Research Lab., Aberdeen Proving Ground, MD USA
Early Results From the Porting of the Computational Fluid Dynamics Code, F3D, to the Silicon Graphics Power Challenge ***Final Report, Jan. 1995 - Dec. 1996***
Pressel, Daniel M., Army Research Lab., USA; Dec. 1997; 35p; In English
Report No.(s): AD-A344717; ARL-TR-1562; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report briefly discusses some of the issues involved in porting a computationally intensive code from a Cray vector supercomputer to the Silicon Graphics (SGI) Power Challenge (75-MHz Mips R8000-based shared memory Symmetric Multiprocessor). Additionally, some evidence is presented to indicate that similar results should be expected when taking this code to comparable boxes from other vendors (e.g., Digital Equipment, Convex, HP, or SUN). Performance results are also discussed. This discussion deals with both the highly successful nature of these results in terms of absolute levels of performance and the even more impressive results in terms of cost effective performance. This report concludes with some thoughts on the future of this project.
DTIC
Computational Fluid Dynamics; Silicon; Cray Computers; Computer Programs

19980203581 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Modelling of the Mixing Noise of a Free Hot Supersonic Jet: Application of the LIlley's Equation ***Modelisation du bruit de melange turbulent d'un jet libre supersonique chaud: Application de l'equation de Lilley***
Raguenet, Wilfrid, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 176p; In French; Original contains color illustrations
Report No.(s): NT-1998-4; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

The object of this thesis is to contribute to the modelling of mixing noise due to a hot supersonic jet. The acoustic field is computed using data from numerical simulations of the aerodynamic field, and applying an acoustic analogy. A CFD code using a k-epsilon turbulence closure has been applied for the computation of the aerodynamic field. The supersonic jet noise model is based on a shear flow analogy, governed by the Lilley's equation. The code is tested for high temperature and high speed circular free jets in the anechoic wind tunnel CEPRA 1 9 (CEPR, Soclay/ONERA) and in the MARTEL facility (CEAT, Poitiers). Finally, the computations show the importance of the radiation of Mach waves on the radiated acoustic field.
Author
Models; Sound Fields; Supersonic Jet Flow; Computation; Jet Aircraft Noise

19980203585 Advisory Group for Aerospace Research and Development, Propulsion and Energetics Panel, Neuilly-Sur-Seine, France
CFD Validation for Propulsion System Components ***La Validation CFD des Organes des Propulseurs***
May 1998; 96p; In English; Original contains color illustrations
Report No.(s): AGARD-AR-355; ISBN 92-836-1075-X; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche

Computer codes which solve the Reynolds-averaged Navier-Stokes equations are now used by manufacturers to design turbomachines, but there is no consensus about which grids and which turbulence models are good enough to provide a reliable basis for design decisions. The AGARD Propulsion and Energetics Panel set up Working Group 26 to help to clarify these issues, by analysing predictions (using as wide a range of codes as possible) of two representative but difficult single blade row test cases: NASA Rotor 37 and an annular turbine cascade tested by DLR. This report presents the Group's results and conclusions. Recommendations are made about the type and density of grid, which depend on many factors. Mixing-length turbulence models are unsuitable for turbomachines with their complex endwall flows; some kind of turbulent transport model is essential. No turbulence model was found which always gave good loss predictions.
Author
Computational Fluid Dynamics; Computer Programs; Turbulence Models; Mixing Length Flow Theory; Annular Flow

19980203739 Los Alamos National Lab., NM USA
Low-speed flow hydrodynamics
Cerutti, J. H., Los Alamos National Lab., USA; Kothe, D. B., Los Alamos National Lab., USA; Mosso, S. J., Los Alamos National Lab., USA; [1997]; 13p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2572; DE97-008681; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), 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 objective of this project was the inception and development of a new casting simulation tool that is founded in modern, high-order numerical algorithms, accurate physical models, and advanced computational science constructs needed to execute efficiently on parallel architectures. This project has therefore led to the development and application of a new simulation tool (known as Telluride) for the modeling of casting processes used in the manufacture of metal alloy components needed for various Department of Energy (DOE) and Defense Programs (DP) projects. As a result of the efforts undertaken in this project, Telluride can now model key foundry processes in the DOE/DP and in industry. Successes realized over the course of this project have secured funding for further Telluride development by the DOE Accelerated Strategic Computing Initiative (ASCI) Program.
DOE
Hydrodynamics; Computer Aided Design; Computerized Simulation; Casting; Manufacturing; Metals

19980203824 Los Alamos National Lab., NM USA
Dispersive water waves in one and two dimensions
Holm, D. D., Los Alamos National Lab., USA; Camassa, R. A., Los Alamos National Lab., USA; [1997]; 6p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2172; DE97-008580; 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 derived and analyzed new shallow water equations for one-dimensional flows near the critical Froude number as well as related integrable systems of evolutionary nonlinear partial differential equations in one spatial dimension, while developing new directions for the mathematics underlying the integrability of these systems. In particular, we applied the spectrum generating equation method to create and study new integrable systems of nonlinear partial differential equations related to our integrable shallow water equations. We also investigated the solutions of these systems of equations on a periodic spatial domain by using methods from the complex algebraic geometry of Riemann surfaces. We developed certain aspects of the required mathematical tools in the course of this investigation, such as inverse scattering with degenerate potentials, asymptotic reduction of the angle representations, geometric singular perturbation theory, modulation theory and singularity tracking for completely integrable equations. We also studied equations that admit weak solutions, i.e., solutions with discontinuous derivatives in the form of comers or cusps, even though they are solutions of integrable models, a property that is often incorrectly assumed to imply smooth solution behavior. In related work, we derived new shallow water equations in two dimensions for an incompressible fluid with a free surface that is moving under the force of gravity. These equations provide an estimate of the long-time asymptotic effects of slowly varying bottom topography and weak hydrostatic imbalance on the vertically averaged horizon-

tal velocity, and they describe the flow regime in which the Froude number is small -- much smaller even than the small aspect ratio of the shallow domain.
DOE
Partial Differential Equations; Mathematical Models; Water Waves; Flow Equations; Incompressible Fluids; Nonlinear Equations; Perturbation Theory; Water Flow

19980203846 Ohio State Univ., Research Foundation, Columbus, OH USA
Unsteady Fluid Motion in Liquid Filled Projectiles ***Final Report, Dec. 1990 - Sep. 1993***
Herbert, T., Ohio State Univ., USA; Mar. 1998; 18p; In English
Contract(s)/Grant(s): DAAA15-89-K-0002
Report No.(s): AD-A343142; ERDEC-CR-257; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

For spinning and coning cylinders with liquid payloads, we established the Unified Approach based on our spatial eigenfunction expansion method as a powerful tool for studies of two types of instability: instability caused by large viscous stresses at low Reynolds' numbers and instability owing to resonance with inertial waves at medium and high Reynolds numbers. The applications of the Unified Approach to completely filled cylinders, partially-filled cylinders, cylinders with a central rod, and cylinders with two immiscible fluids successfully demonstrated interesting physical mechanisms such as resonances and produced useful results for future experiments and designs. We also performed inviscid analyses and computations by spectral collocation method as complementary studies for the Unified Approach. We developed unsteady three-dimensional Navier Stokes codes and employed them to simulate spin down experiments. We made progress in the moment calculation for silicone fluids, and investigated multiple states and the stability of flows in loosely coiled pipes.
DTIC
Projectiles; Liquid Filled Shells; Payloads; Inviscid Flow

19980203849 Woods Hole Oceanographic Inst., MA USA
Electric Fields Induced by Turbulence in the Seabed Boundary Layer ***Final Report, 1 Dec. 1993 - 30 Nov. 1995***
Trowbridge, John H., Woods Hole Oceanographic Inst., USA; Williams, Albert J., III, Woods Hole Oceanographic Inst., USA; May 04, 1998; 3p; In English
Contract(s)/Grant(s): N00014-94-1-0436
Report No.(s): AD-A343325; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this work was to understand electrical fluctuations forced by turbulent velocity fluctuations in the bottom boundary layer of the coastal ocean. For this purpose, the Woods Hole Oceanographic Institution (WHOI) deployed two tripods containing novel acoustic vorticity sensors in the Strait of Juan de Fuca, in Washington state, for a period of approximately eight months. In a companion project funded under a separate grant, the Scripps Institution of Oceanography, deployed a sensor designed to measure electrical fluctuations at the same site during the same period. The vorticity measurements were successful, but the electrical instrumentation developed problems and did not produce usable data. In a follow up study, essentially the same set of instrumentation was deployed for a one month period on the continental shelf off Eureka, California. The flow measurements were successful, but the electrical fluctuations were too weak to be detected accurately.
DTIC
Turbulent Flow; Electric Fields; Boundary Layer Flow; Oceans; Flow Measurement

19980203853 Los Alamos National Lab., NM USA
Comparison of a spectral turbulence model with experimental data of Rayleigh-Taylor mixing
Clark, T. T., Los Alamos National Lab., USA; Harlow, F. H., Los Alamos National Lab., USA; Moses, R. W., Los Alamos National Lab., USA; [1997]; 9p; In English; Physics of Compressible Turbulent Mixing, Jun. 1997, Marseille, France
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2198; CONF-970657-4; DE97-008568; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

LLNL recent experiments by Dimonte et al. provide detail not present in older data; these data are used to evaluate some of the assumptions of the spectral model of Steinkamp et al., as well as single-point models such as that of Besnard, Harlow, Rauenzahn and Zemach 3. Also, simulations of Rayleigh-Taylor instabilities are used to augment the experimental data to give direct insight into the effects of fluctuating pressure correlations.
DOE
Turbulence Models; Spectral Theory; Pressure Effects

19980203922 Stanford Univ., Dept. of Mechanical Engineering, Stanford, CA USA

Large Eddy Simulation of Supersonic Inlet Flows ***Final Report, 1 Jan. 1995 - 30 Sep. 1997***

Moin, Parviz, Stanford Univ., USA; Lele, Sanjiva K., Stanford Univ., USA; Apr. 1998; 82p; In English

Contract(s)/Grant(s): F49620-95-1-0108

Report No.(s): AD-A343835; 2DJA423; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The interaction of a shock wave with a turbulent boundary layer is a central problem in supersonic inlet flows. This work uses numerical and analytical techniques to study shock/turbulence interaction in order to identify and explain factors important in shock/boundary layer interaction. Direct numerical simulation of a normal shock wave with an isotropic turbulent field of vorticity and entropy fluctuations showed that negative upstream correlation between the vorticity and entropy fluctuations enhances the turbulence across the shock. Positive upstream correlation has a suppressing effect. A new numerical method providing excellent high wavenumber resolution while reducing the computational cost was developed. A model with no adjustable constants was developed to study the vortex breakdown resulting from the interaction of canard or forebody vortices with the shock waves in a supersonic inlet flow. Very good agreement with both experiment and computation was obtained. A numerical method to compute shock/turbulence interaction using a conservative form of the Large Eddy Simulation (LES) equations has been developed and validated. LES of the interaction of isotropic turbulence with a normal shock was performed and comparisons with direct numerical simulation (DNS) results were favorable. A new FORTRAN 90 code has been developed for the computation of shock/turbulence interaction. The code is an improved version of codes used previously in shock/turbulence interaction simulations.
DTIC

Applications Programs (Computers); Boundary Layers; Canard Configurations; Computation; Direct Numerical Simulation; Entropy; Isotropic Turbulence

19980203986 Imperial Coll. of Science Technology and Medicine, Dept. of Mechanical Engineering, London, UK

Review of Optical Methods for Fluid Dynamics

Heyes, A. L., Imperial Coll. of Science Technology and Medicine, UK; Whitelaw, J. H., Imperial Coll. of Science Technology and Medicine, UK; May 1998; 18p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

There are many methods for measuring the velocity, pressure and temperature characteristics of the flows around solid bodies and this paper considers their relative advantages with special consideration of the needs of wind tunnels. The emphasis is on optical techniques for which brief descriptions of the principles and requirements are provided together with an indication of applications and their findings.
Author

Fluid Dynamics; Velocity Measurement; Pressure Measurement; Optical Flow (Image Analysis); Optical Measurement; Wind Tunnel Tests

19980203990 German-Dutch Wind Tunnel, Emmeloord, Netherlands

Application of PIV in the Large Low Speed Facility of DNW

Kooi, J. W., German-Dutch Wind Tunnel, Netherlands; Pengel, K., German-Dutch Wind Tunnel, Netherlands; Raffel, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Willert, C., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kompenhans, J., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 12p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Particle Image Velocimetry (PIV) is a non-intrusive measurement technique capable of measuring the instantaneous velocity field in a two-dimensional plane. This technique has matured to a state that it now can be employed on a routine basis in large industrial wind tunnels. For that reason, the German Dutch Wind Tunnel has acquired a two-component PIV system for its Large Low Speed Facility. The main components of the system are a high speed video camera, a powerful pulsed Nd:YAG laser and for evaluation of the recordings a software system. The tracer particles are introduced in the flow by means of a rake mounted in the wind-tunnel settling chamber. A first application of the PIV system was the measurement of the trailing wake of transport type aircraft model. The measurement plane was positioned perpendicular to the main flow direction and the video camera was mounted on a traversing system installed inside the test section far downstream of the model. One of the important results was that in the individual velocity plots an unsteady vortex was found almost absent in the time averaged results. The PIV system cannot only be used in the closed wall test section of the DNW-LLF, but also in the Open Jet test section. Because of the large size

of the facility the set-up requires both for the video camera and the pulse laser a stable support. This could be realised by using existing support systems.
Author
Particle Image Velocimetry; Nonintrusive Measurement; YAG Lasers; Low Speed Wind Tunnels; Velocity Measurement; Two Dimensional Flow

19980203991 Glasgow Univ., Dept. of Aerospace Engineering, UK
Analysis of Complex Flow Fields by Animation of PIV and High Resolution Unsteady Pressure Data
Coton, F., Glasgow Univ., UK; Galbraith, R., Glasgow Univ., UK; Grant, I., Heriot-Watt Univ., UK; Hurst, D., Glasgow Univ., UK; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper describes the use of animation in the analysis of data from unsteady aerodynamic tests where the phenomena of interest vary both temporally and spatially. Particular emphasis is given to results from an investigation of blade vortex interaction (BVI) where both flow field and surface pressure data were recorded. It is shown that animation can be used, in a manner akin to basic flow visualisation, to identify the interesting features of such a flow and to, thus, guide more detailed conventional analysis techniques. The method adopted in this study involved the acquisition of a series of PIV images which were then processed and subsequently interpolated onto a regular grid. The temporal variation in velocity at each grid point was then established by a further interpolation between PIV frames. Finally, particles were placed in the initial velocity field and their subsequent trajectory during the interaction process calculated using a multi-step integration method.
Author
Particle Image Velocimetry; Flow Distribution; Velocity Distribution; Unsteady Aerodynamics; Pressure Measurement; Velocity Measurement; Flow Visualization; Aerodynamics

19980203992 NASA Ames Research Center, Moffett Field, CA USA
Recent Advances in Particle Image Velocimetry
Lourenco, L., Florida State Univ., USA; Krothapalli, A., Florida State Univ., USA; Smith, C. A., NASA Ames Research Center, USA; May 1998; 12p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents new trends in Particle Image Velocimetry and practical aspects relevant to the application of the technique to large scale wind tunnel testing. The various problems and their solutions to the operation of PIV in large scale wind tunnels are discussed. Application of the technique in mapping complex flows are also presented.
Author
Particle Image Velocimetry; Wind Tunnel Tests; Trends; Flow Visualization; Imaging Techniques; Laser Doppler Velocimeters

19980203993 Wright Lab., FIMO, Wright-Patterson AFB, OH USA
Recent Developments in Doppler Global Velocimetry
Beutner, Thomas J., Wright Lab., USA; Baust, Henry D., Wright Lab., USA; May 1998; 10p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Doppler Global Velocimetry is a non-intrusive wind tunnel diagnostic technique which has the potential to make simultaneous three-component velocity measurements over entire planes in the flow field. Measurements of velocity are based on determining the Doppler shift of single frequency laser light scattered off particles in the flow field. This technique has been used in the Subsonic Aerodynamic Research Laboratory wind tunnel at Wright Laboratory to make qualitative measurements of the flow associated with a vortex-tail interaction. This flow field is typical of the flows seen on twin-tail fighter aircraft. This paper presents results obtained with the DGV instrument and reports the current progress and recommendations towards developing an improved diagnostic system.
Author
Aerodynamics; Velocity Measurement; Nonintrusive Measurement; Doppler Effect

19980203994 NASA Ames Research Center, Moffett Field, CA USA
Planar Doppler Velocimetry for Large-Scale Wind Tunnel Applications
McKenzie, Robert L., NASA Ames Research Center, USA; May 1998; 14p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Planar Doppler Velocimetry (PDV) concepts using a pulsed laser are described and the obtainable minimum resolved velocities in large-scale wind tunnels are evaluated. Velocity-field measurements are shown to be possible at ranges of tens of meters

and with single pulse resolutions as low as 2 m/s. Velocity measurements in the flow of a low-speed, turbulent jet are reported that demonstrate the ability of PDV to acquire both average velocity fields and their fluctuation amplitudes, using procedures that are compatible with large-scale facility operations. The advantages of PDV over current Laser Doppler Anemometry and Particle Image Velocimetry techniques appear to be significant for applications to large facilities.
Author
Particle Image Velocimetry; Velocity Measurement; Wind Tunnel Tests

19980203995 Institut de Mecanique des Fluides de Lille, France
The Advantage of Using a Tunable Laser Source for Global Doppler Velocity Measurement ***Interet de l'Utilisation d'une Source Laser Accordable en Velocimetrie Doppler Globale***
Leporcq, B., Institut de Mecanique des Fluides de Lille, France; LeRoy, J.-F., Institut de Mecanique des Fluides de Lille, France; Pinchemel, B., Universite des Sciences et Techniques de Lille, France; Hostyn, S., Institut de Mecanique des Fluides de Lille, France; May 1998; 12p; In French; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The global doppler velocity meter is a non-intrusive method based on measurement of the doppler shift of a light diffused by a flow made of particles illuminated by a flat laser beam at frequency nu. Observed through an iodine cartridge any doppler shift is translated immediately into a variation of light absorption. This technique allows one to obtain the velocity field of the embedded flow of particles at an acquisition rate which depends only on the recording equipment. The studies which have been carried out to date make use of a single-mode ionized argon laser in which the green emission line is fortuitously tuned to two unresolved absorption lines of the iodine whose strength depends greatly on temperature. In order to avoid this obstacle a continuous dye laser tunable by frequency was used, which gives one an extremely easy choice of an absorption line of a molecule in which the population is almost not dependent on temperature and the profile is more or less steep as a function of the velocity range to be measured. The first tests were conducted on a rotating disk, the speeds determined by a global doppler velocity meter are in good agreement with that measured by a tachometer, and then measurements were conducted in a wind tunnel. A summary is given of the improvements made to increase the precision.
Transl. by Schreiber
Tunable Lasers; Particle Image Velocimetry; Velocity Measurement; Nonintrusive Measurement; Doppler Effect; Continuous Wave Lasers

19980203998 Office National d'Etudes et de Recherches Aerospatiales, Palaiseau, France
Molecular Diagnostics for Rarefied Flows
Taran, J. P., Office National d'Etudes et de Recherches Aerospatiales, France; May 1998; 15p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The paper reviews the various optical techniques which can be applied for point, line of sight or imaging measurements. In the category of point measurements, light scattering methods like Raman, Rayleigh or Electron Beam Fluorescence (EBF) are treated first, but briefly since they are of little use, especially when enthalpy is very high and flow naturally bright. The emphasis is placed instead on nonlinear laser spectroscopy like Coherent anti-Stokes Raman Scattering (CARS), which has recently achieved great success at getting temperatures and density in high enthalpy shocks. Then, the diode laser absorption spectroscopy is described. A high data rate instrument now gives, on a routine basis, the static temperature and the velocity of the stream in the hot shot facility F4 of ONERA, at stagnation enthalpies in excess of 15 MJ/kg. EBF imaging in that same facility has permitted measurements of velocity to be performed across the external boundary layer into the flow core thanks to a high energy pulsed electron gun. Finally, the technique of Collective Light Scattering is briefly described and its capabilities demonstrated.
Author
Rarefied Gas Dynamics; Molecular Flow; Absorption Spectroscopy

19980203999 Office National d'Etudes et de Recherches Aerospatiales, Palaiseau, France
Rotational and Vibrational Temperatures and Density Measurements by Coherent Anti-Stokes Raman Scattering in a Nonequilibrium Shock Layer Flow
Grisch, F., Office National d'Etudes et de Recherches Aerospatiales, France; Bouchardy, P., Office National d'Etudes et de Recherches Aerospatiales, France; Koch, U., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Guelhan, A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Coherent anti-Stokes Raman scattering studies are carried out in a nonequilibrium shock layer air flow induced by a two-dimensional body. Rovibrational spectra of molecular nitrogen are recorded by scanning CARS in the free stream and within the

shock layer at moderately high enthalpy (7.3 MJ/kg). Difficulties peculiar to the application of the optical technique to a high enthalpy flow are discussed and flow parameters are given. The rotational temperature, vibrational temperature and number density are measured and compared to theoretical values predicted by a Navier-Stokes solver. A good agreement is found.
Author
Navier-Stokes Equation; Shock Layers; Vibration; Air Flow; Coherent Scattering

19980204001 Institute for Aerospace Research, Aerodynamics Lab., Ottawa, Ontario Canada
Time Resolved Measurements of the Energy Separation Process in a Transonic Turbine Vane Wake Flow
Carscallen, W. E., Institute for Aerospace Research, Canada; Hogg, S. I., Leicester Univ., UK; Gostelow, J. P., Leicester Univ., UK; Buttsworth, D. R., Oxford Univ., UK; May 1998; 12p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes the application of a new, fast response, stagnation temperature probe and the associated measurement technique to an unsteady transonic turbine vane wake flow in which energy separation occurs due to vortex shedding.
Author
Supersonic Turbines; Wakes; Turbulence; Time Measurement

19980204005 Technische Univ., Dept. of Aerospace Engineering, Delft, Netherlands
Holographic and Tomographic Interferometry for the Study of Unsteady Compressible Flows
Timmerman, B. H., Technische Univ., Netherlands; Bakker, P. G., Technische Univ., Netherlands; May 1998; 8p; In English; Also announced as 19980203985
Contract(s)/Grant(s): NSF ECS-89-10350; STW Proj. DLR33.3109; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A digital holographic interferometry technique is presented which provides non-intrusive, quantitative measurements of the density distribution in a compressible flow field. Using a pulsed laser, flow fields may be essentially frozen, so that a measurement is obtained for a whole field at a single instant. Thus, unsteady, turbulent flow fields may also be studied. The technique provides a measurement of the density projected along the light path, so that the local density may be determined for two-dimensional and axisymmetric flows. Even for relatively complicated flow fields, quantitative projection data may thus be obtained. by sending several probe beams through a flow field simultaneously at different angles, the instantaneous three-dimensional density distribution in unsteady fields may also be obtained using tomographic reconstruction techniques. to furthermore gain insight into the temporal behaviour of turbulent flows, quantitative differential recordings can also be made. Thus, the technique presented here may be used to examine the (instantaneous) three-dimensional structure of a density field as well as its fluctuations in time. to illustrate the technique, results are presented here for the supersonic flow around a re-entry body, for an under-expanded free jet flow and for an oscillating flow issued by a so-called pipe-collar nozzle.
Author
Compressible Flow; Supersonic Flow; Reentry Vehicles; Nonintrusive Measurement; Holographic Interferometry; Flow Distribution

19980204007 Technische Univ., Faculty of Aerospace Engineering, Delft, Netherlands
Wall-Shear Stress Measurement with Quantitative IR-Thermography
Mayer, R., Technische Univ., Netherlands; Henkes, R. A. W. M., Technische Univ., Netherlands; vanIngen, J. L., Technische Univ., Netherlands; May 1998; 12p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents a new non-intrusive and flexible measurement technique for wall-shear stresses, which is based on the theory of hot-films. To overcome the disadvantage of being limited to a single measurement position like the hot-film, the internal electrical heating and internal temperature detection is replaced by external heating using a laser and external temperature measurement using quantitative infrared thermography, respectively. In this technique the laser is generating a hot spot on the surface of an object. By choosing suitable materials for the solid object with a low thermal conductivity and a high emissivity of thermal radiation a geometrically small but clearly detectable temperature spot can be generated. After the temperature distribution in the solid has become steady, the laser is turned off and the temperature decay of the hot spot is monitored by the camera. From the measured surface-temperature distribution history, the heat transfer to the fluid and the wall-shear stress can be derived by using

a numerical procedure. This technique is demonstrated for a Blasius boundary layer in a wind-tunnel experiment, where an accuracy of about 10% has been achieved in the determination of the wall-shear stress.
Author
Shear Stress; Walls; Nonintrusive Measurement; Heating; Thin Films; Infrared Radiometers; Boundary Layers; Stress Measurement

19980204008 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Stroemungsmechanik, Goettingen, Germany
Skin Friction Measurement and Transition Detection Techniques for the Ludwieg-Tubes at DLR
Schuelein, E., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Koch, S., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Rosemann, H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Three different skin friction measurement and transition detection techniques have been developed and adapted to the specific test conditions in the Ludwieg-Tube facilities of DLR at Goettingen. The latter are: short run time and thin boundary layers for both, the hypersonic Ludwieg-Tube facility (RWG) and the Cryogenic Ludwieg-Tube (KRG), and low temperatures for the KRG, which can be operated down to 120 K to achieve high Reynolds numbers. An oil film technique has been developed and applied to measure skin friction and transition on a flat plate in the RWG at M = 5. The results are in good agreement with the Van Driest II and the Young correlation, respectively, and results from velocity profile measurements for the skin friction and hot-wire measurements for the transition location. Surface mounted hot-films, directly deposited on the model surface, have been used to study shock oscillations on a laminar type airfoil in the KRG down to cryogenic conditions. Further improvements of the deposition quality will make sensor arrays with about 20 sensors on an airfoil section with 150 mm chord available. It could be demonstrated that wall mounted thermocouples provide a simple method to determine transition on airfoils in the KRG by detecting the difference in heat flux between laminar and turbulent boundary layers. The results agree well with the interpretation of pressure distribution and wake measurements as well as with the transition location given by the MSES (Drela) code.
Author
Skin Friction; Airfoils; Airfoil Profiles; Friction Measurement; High Reynolds Number; Laminar Boundary Layer; Hypersonics

19980204009 Technische Univ., Inst. fuer Luft- und Raumfahrt, Berlin, Germany
Surface Forces Measurements with High Spatial and Temporal Resolution by Means of Liquid Crystal Foils, Piezofoils and Surface Hot-Film Arrays
Nitsche, W., Technische Univ., Germany; Suttan, J., Technische Univ., Germany; Haselbach, F., Technische Univ., Germany; Sturzebecher, D., Technische Univ., Germany; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Steady and unsteady surface measurement techniques for subsonic and transonic flows are surveyed emphasizing the capabilities, restrictions and applications of these techniques in experimental aerodynamics. The present paper investigates comparatively the status and capabilities of a number of surface measurement techniques (Liquid Crystals, HotFilm-Arrays, Piezofoil-Arrays,) which are necessary for the understanding of distributed flow phenomena. Based on exemplary results, some of the main features of the measurement techniques are discussed. Emphasis is on recent improvements to obtain higher temporal and spatial resolution. This concerns e.g. the employment of pyroelectrical capabilities for higher signal-to-noise ratios in piezofoil array measurements, or the development of a standard calibration method for multisensor hot-film arrays with small streamwise sensor spacing.
Author
Aerodynamics; Transonic Flow; Subsonic Flow; Signal to Noise Ratios; Liquid Crystals; Crystal Surfaces

19980204010 NASA Ames Research Center, Moffett Field, CA USA
Application of Oil Film Interferometry Skin-Friction to Large Wind Tunnels
Driver, David M., NASA Ames Research Center, USA; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The oil film interferometry skin-friction technique is described and applied to flows in some of the NASA Ames large wind tunnel facilities. Various schemes for applying the technique are discussed. Results are shown for tests in several wind tunnels which illustrate the oil film's ability to measure a variety of flow features such as shock waves separation, and 3D flow.
Author
Skin Friction; Interferometry; Thick Films; Oils; Three Dimensional Flow

19980204011 NASA Ames Research Center, Moffett Field, CA USA

Visualization and Measurement of Surface Shear Stress Vector Distributions Using Liquid Crystal Coatings

Reda, Daniel C., NASA Ames Research Center, USA; Wilder, Michael C., MCAT Inst., USA; May 1998; 10p; In English; Also announced as 19980203985; Original contains color illustrations

Contract(s)/Grant(s): NAS2-14109; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

When a shear-sensitive liquid crystal coating is illuminated from the normal direction by white light and observed from an oblique above-plane view angle, its color-change response to shear depends on both shear stress vector magnitude and the direction of the applied shear vector relative to the observer's in-plane line of sight. At any point, the maximum color change is always seen or measured when the local shear vector is aligned with, and directed away from, the observer; the magnitude of the color change at this vector/observer aligned orientation scales directly with shear stress magnitude. Conversely, any point exposed to a shear vector with a component directed toward the observer exhibits a noncolor-change response, always characterized by a rusty red or brown color, independent of both shear magnitude and direction. Based on this knowledge, full-surface shear stress vector visualization and measurement methodologies were formulated and successfully demonstrated. The present paper reviews the observations and measurements that led to the development of these methodologies and applications of both are discussed. Author

Liquid Crystals; Coating; Stress Distribution; Stress Measurement; Flow Visualization

19980204012 Pisa Univ., Dept. of Aerospace Engineering, Italy

Shear Sensitive Liquid Crystals in Subsonic and Transonic Wind Tunnel Testing

Lombardi, G., Pisa Univ., Italy; Morelli, M., Council for Scientific and Industrial Research, South Africa; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The present paper singles out the advantages connected with the use of the liquid crystal technique for the visualization of the surface flow phenomena during wind tunnel test; they appear significant, and can be summarized in reversibility, non-toxicity and low cost. The more significant benefits are that different types of analysis (boundary layer transition, separation and reattachment, shock wave position) can be performed with a single technique, and that the reversibility of the process gives the possibility to analyze several conditions in a single run of the wind tunnel. Therefore, the technique is characterized by low cost and time requirements. In any case, it is important to note that several effects can affect the images and this implies a degree of uncertainty in the interpretation of the results. It is therefore necessary to acquire a high confidence level in the technique in order to assure a good degree of repeatability and accuracy in the analysis of the results. Mainly, the use of the technique is related to the visualization of the main feature of the surface flow. In this regard, several examples showing the determination of the boundary layer transition, separation lines and the shock wave position on the surface, are presented. to enhance the knowledge on the boundary layer conditions a quantitative use of this technique will be a powerful tool . Several attempts to Have a quantification of the response of the liquid crystals were carried out and are discussed in the paper. Nevertheless, it is necessary to stress that, at the present state of the research, the technique is proabably non precise enough for an absolute determination of the local shear stress, and the indicated procedure seems applicable only for comparative tests.

Author

Liquid Crystals; Transonic Flow; Subsonic Flow; Wind Tunnels; Shock Waves; Shear Stress; Boundary Layer Transition; Flow Visualization

19980204728 Lawrence Livermore National Lab., Livermore, CA USA

Non-convex profile evolution in two dimensions using volume of fluids

Helmsen, J., Lawrence Livermore National Lab., USA; Colella, P., Lawrence Livermore National Lab., USA; Jan. 25, 1997; 30p; In English

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

Report No.(s): UCRL-ID-126402; DE97-053436; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A new Volume of Fluid (VoF) method is applied to the problem of surface evolution in two dimensions. The VoF technique is applied to problems that are representative of those that arise in semiconductor manufacturing, specifically photolithography and ion milling. The types of surface motion considered are those whose etch rates vary as a function of both surface position and orientation. Functionality is demonstrated for etch rates that are (non?)-convex in regard to surface orientation. A new method of computing surface curvature using divided differences of the volume fractions is also introduced and applied to the advancement of surfaces as a vanishing diffusive term.

DOE

Etching; Surface Diffusion; Curvature; Concentration (Composition)

19980204839 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

The Influence of Surface Roughness on Supersonic High Reynolds Number Turbulent Boundary Layer Flow

Latin, Robert M., Air Force Inst. of Tech., USA; Mar. 1998; 362p; In English

Report No.(s): AD-A344143; AFIT/DS/ENY-98M-02; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

A comprehensive study of rough-wall high speed (M=2.9) high Reynolds number (Re/m = 1.9 x 10(exp 7) turbulent boundary layer flow was performed consisting of experimental, analytical, and numerical methods. Six wall topologies consisting of a smooth and five rough surfaces (two and three dimensional machined roughness plates; and 80, 36, and 20 grit sand-grain roughened plates) were studied. A confocal laser scan microscope was used to measure the topography of the sand grain roughnesses. The experimental measurement techniques included a convention Pitot pressure probe, laser Doppler velocimetry, hot wire anemometry; color schlieren and laser sheet Mie scattering images. Mean measurements included velocity, Mach number, density, and mass flux. Turbulent measurements included velocity and mass flux turbulence intensities, kinematic Reynolds shear stress, compressible Reynolds shear stress in two planes, and the traverse apparent mass flux. Kinematic turbulent flow statistical properties were found to scale by local mean quantities and displayed a weak dependence on surface roughness. Turbulent flow statistical properties with the explicit appearance of density did not scale by local mean quantities, and had a strong linear dependence on roughness. Surface roughness also had a significant effect on the flow structure size, angles, and energy spectra. A theoretical analysis was performed and a new integral method for the estimation of skin friction was developed. The skin friction estimates were within 4% of compressible semi-empirical relations. A numerical study was performed which used a parabolized Navier Stokes solver with two algebraic turbulence models and the Rotta model for surface roughness. A new method for the estimation of momentum loss improved the numerical flow predictability.

DTIC

Surface Roughness; Turbulent Flow; Turbulent Boundary Layer; Supersonic Flow; Reynolds Number; Boundary Layer Flow

19980204845 New York Univ., Courant Inst. of Mathematical Sciences, New York, NY USA

Mathematical Analysis of Problems in Turbulence and Turbulent Diffusion with Many Statistical Scales ***Final Report, 1 Dec. 1995 - 30 Nov. 1997***

Majda, Andrew J., New York Univ., USA; Jan. 1997; 7p; In English

Contract(s)/Grant(s): DAAH04-95-1-0345

Report No.(s): AD-A344180; ARO-34699.22-MA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research program being funded here emphasizes problems in turbulence and turbulent diffusion which are inherently statistical and involve many spatio-temporal scales. One goal of the research is to achieve a better theoretical understanding of turbulent (reaction) diffusion which is crucial for many applications in environmental science and engineering such as the tracking of pollutants in the atmosphere, the behavior of chemical tracers in the ocean and porous media, and turbulent combustion. Other parts of the research emphasize the interaction and generation of both small scales and large scale coherent structure in various anisotropic turbulent flows from both a statistical and deterministic point of view. The approach to all of these issues involves a combination of asymptotic analysis, numerical computation, and theoretical analysis to gain insight into these complex and important phenomena.

DTIC

Turbulence; Diffusion; Numerical Analysis; Mathematical Models; Turbulent Diffusion; Research Management; Air Pollution; Statistical Analysis; Scale (Ratio)

19980204876 Ecole Nationale Superieure des Mines, Paris, France

Proceedings of the Twelfth International Workshop on Water Waves and Floating Bodies

Molin, B., Editor, Ecole Nationale Superieure des Mines, France; Jan. 1997; 343p; In English; 12th; Water Waves and Floating Bodies, 16-19 Mar. 1997, Marseille, France

Contract(s)/Grant(s): N00014-97-1-0517

Report No.(s): AD-A343312; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The Workshop was held at Vacanciel la Calanque in Carry le Rouet, near Marseille, from 16th to 19th March. It was followed by a Special Meeting dedicated to the memory of Georg Weinblum, in celebration of the 100th anniversary of his birth. The Workshop was attended by over 100 participants. This publication contains extended abstracts of the presentations, and summaries of the discussions. Appended are written abstracts of the Georg Weinblum lectures.

DTIC

Conferences; Ocean Currents; Floating

19980205003 Boston Univ., Dept. of Aerospace and Mechanical Engineering, Boston, MA USA
A New Approach to the Large-Eddy Simulation of High-Speed Compressible Flows, *1 Oct. 1997 - 1 Jan. 1998*
Speziale, Charles G., Boston Univ., USA; Jan. 05, 1998; 28p; In English
Contract(s)/Grant(s): DAAG55-97-1-0123
Report No.(s): AD-A344230; AM-98-002; ARO-36216.3-EG; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

All entirely new approach to the large-eddy simulation (LES) of high speed compressible turbulent flows is presented. In this new approach to large-eddy simulations, subgrid scale stress models go continuously to Reynolds stress models in the coarse mesh/infinite Reynolds number limit, where a Reynolds stress calculation (RANS) is done in parallel with the LES to get an estimate of the Kolmogorov length scale. Hence, this formally constitutes a combined LES/time dependent RANS capability. Here, the Reynolds stress model that is recovered in the coarse mesh limit has a dependence on rotational strains through strain-dependent coefficients as well as through anisotropic eddy viscosity terms which are usually neglected in subgrid scale models. Unlike in existing subgrid scale models, this new model has the correct dependence on the mesh size through the dimensionless ratio of the computational mesh size to the Kolmogorov length scale. It is this ratio that determines how well-resolved a computation is in the numerical simulation of turbulence and should be used to parameterize subgid scale models. Use is made of the Morkovin hypothesis in the formulation of compressible subgrid scale models. This allows for the description of supersonic turbulent flows provided that they are not in the hypersonic flow regime. A critical assessment of this new approach is provided along with a discussion of traditional approaches and the prospects for future applications to the high-speed compressible flows of technological importance.
DTIC
Large Eddy Simulation; Compressible Flow; Turbulent Flow; Supersonic Flow; Reynolds Stress; Computational Grids; Kolmogorov Theory; Stress Analysis; Computational Fluid Dynamics

19980205077 National Inst. of Standards and Technology, Physical and Chemical Properties Div., Boulder, CO USA
Metering of Fluids at High Velocities with Vortex Shedding Flowmeters
Siegwarth, J. D., National Inst. of Standards and Technology, USA; Feb. 1998; 46p; In English
Report No.(s): PB98-149065; NIST/TN-1501; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Vortex shedding flowmeters have been designed and tested for measuring liquid and gas flows to the maximum velocities found in the ducts of the Space Shuttle Main Engines. The flow velocities found in these ducts are several times greater than found in conventional metering applications. The shedder bar was narrowed relative to conventional vortex shedding flowmeter designs to reduce the head loss introduced at the extreme flow velocities. The presence of bends in the duct near the flowmeter, while expected to degrade the meter performance, rather improved it in terms of signal quality relative to the performance in a straight duct. The performance also improved with a decrease in viscosity of the measured fluid. The signal quality obtained approached that of the modified commercial vortex shedding meters used to provide flow calibration.
NTIS
Space Shuttle Main Engine; Flowmeters; Vortex Shedding; Flow Velocity

19980205532 Princeton Univ., Geophysical Fluid Dynamics Lab., NJ USA
Parallelization of a Spectral Atmospheric GCM
Balaji, Venkatramani, Silicon Graphics, Inc., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 115-128; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The spectral transform has proved a robust method for the treatment of the nonlinear adiabatic Navier-Stokes equations of fluid flow on a sphere. It is robust and the intrinsic shortcomings of spectral methods (dispersion and truncation, and the formation of Gibbs ripples in the presence of steep gradients) are well understood. It is therefore one of the preferred forms for global atmospheric models. In the spectral transform method each field has a representation in spectral coefficients of spherical harmonics, and a corresponding grid fields. The linear dynamics is generally treated in spectral space, while the physics (i.e. gridscale parameterization of sub-gridscale process and thermodynamics) and the non-linear terms are treated in grid space.
Author
Spectral Methods; Navier-Stokes Equation; Adiabatic Equations; Flow Equations; Fluid Flow

19980205775 California Inst. of Tech., Graduate Aeronautical Labs., Pasadena, CA USA
Aspects of Turbulent-Shear-Layer Dynamics and Mixing
Slessor, Michael D., California Inst. of Tech., USA; Mar. 06, 1998; 111p; In English
Contract(s)/Grant(s): F49620-98-1-0052; AF Proj. 2308

Report No.(s): AD-A345587; AFRL-SR-BL-TR-98-0455; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Experiments have been conducted in the GALCIT Supersonic Shear Layer Facility to investigate some aspects of high Reynolds number, turbulent, shear layer flows in both incompressible and compressible flow regimes. Experiments designed to address several issues were performed; effects of inflow conditions, freestream conditions (supersonic/subsonic flow), and compressibility, on both large scale dynamics and small scale mixing, are described. Chemically reacting and non reacting flows were investigated, the former relying on the (H2+NO)/F2 chemical system, in the fast-kinetic regime, to infer the structure and amount of molecular scale mixing through use of ”flip” experiments. Both inflow conditions and compressibility are found to have significant effects on the flow. In particular, inflow conditions are ”remembered” for long distances downstream, a sensitivity similar to that observed in low-dimensionality, nonlinear (chaotic) systems. A previously proposed mode selection rule for turbulent structure convection speeds, based on the presence of a lab frame subsonic freestream, was demonstrated to be incorrect. Compressibility, when decoupled from other parameters, e.g., Reynolds number, velocity and density ratios, reduces large scale entrainment and growth, but slightly enhances mixing, and changes the molecularly mixed fluid structure. This reduction in shear layer growth rate is examined and a new parameter that interprets compressibility as an energy exchange mechanism is proposed. The parameter reconciles and collapses experimentally observed growth rates.

DTIC

Turbulent Flow; Shear Layers; Mixing; Experimentation; High Reynolds Number

19980206005 Centre National de la Recherche Scientifique, Lab. de Mecanique des Fluides et d’Acoustique, Ecully, France

Laser Two-Focus Flow Field Investigation within a High-Speed High-Pressure Centrifugal Compressor

Trebinjac, I., Centre National de la Recherche Scientifique, France; Claudin, I., Centre National de la Recherche Scientifique, France; .Advanced Non-Intrusive Instrumentation for Propulsion Engines; May 1998; 8p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The results of measurements carried out in a transonic centrifugal compressor with splitter vanes are presented and discussed. The laser two-focus anemometry technique is described, including the seeding control which is a crucial issue in a high temperature level environment. Whereas a potential flow structure exists up to the high meridional curvature region, the through flow pattern is largely distorted in the radial part of the impeller. Noticeable differences in flow pattern between both channels are found, particularly through the low momentum fluid zone locations. A qualitative study of the vortical mechanisms ascribes them to the tin clearance effects.

Author

Centrifugal Compressors; Flow Distribution; Laser Anemometers; Transonic Compressors; Flow Measurement; Potential Flow; Velocity Measurement; Nonintrusive Measurement

19980206006 National Technical Univ., Lab. of Thermal Turbomachines, Athens, Greece

3-D LDA Measurements in an Annular Cascade for Studying Tip Clearance Effects

Doukelis, A., National Technical Univ., Greece; Mathiosdakis, K., National Technical Univ., Greece; Founti, M., National Technical Univ., Greece; Papailiou, K., National Technical Univ., Greece; May 1998; 12p; In English; Also announced as 19980206002; Original contains color illustrations; Sponsored in part by CEU

Contract(s)/Grant(s): AERO-CT2-0039; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Literature survey indicates the lack of detailed 3-D flowfield data for high-speed flows inside turbomachines, especially in the region of the tip clearance gap, and points out the difficulties in conducting this kind of measurements. Such information is nevertheless essential in order to validate CFD codes, which give the possibility of understanding the flow and finally producing better designs of efficient turbomachinery components. This paper aims at presenting a 3-D LDA measurement technique, as applied for the measurement of the flowfield in an annular cascade used to study tip clearance effects. First the measurement system layout, signal processing and data acquisition, and processing is presented in detail, together with an evaluation of the measuring accuracy and the measuring capabilities of the system in simple flows. Next the annular cascade configuration is described, together with a detailed account of all the aspects of execution of the measurements and the provisions taken in this study. Finally sample measurements results, demonstrating the kind of information provided, are presented.

Author

Flow Measurement; Turbomachinery; Annular Flow; Cascade Flow; Blade Tips; Clearances; Laser Anemometers; Velocity Measurement; Turbulence; Flow Distribution

19980206008 Centre National de la Recherche Scientifique, Lab. de Mecanique des Fluides et d'Acoustique, Ecully, France

Laser Two Focus Anemometry (L2F-3D) for Three-Dimensional Flow Analysis in an Axial Compressor

Vouillarmet, A., Centre National de la Recherche Scientifique, France; Charpenel, S., Centre National de la Recherche Scientifique, France; May 1998; 12p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

In order to improve the accuracy of numerical simulations applied to the new generation of high loaded, high-speed turbomachines, a thorough understanding of the 3D phenomena is needed. For that purpose, the use of 3D experimental techniques, like 3D-L2F anemometry, is now absolutely necessary. This paper deals with a statistical method for processing the data. The point is that, during the acquisition procedure, marginal and conditional probability density functions (p.d.f.) are obtained, but they are already integrated quantities. Hence, it becomes impossible to derive analytical relations between the p.d.f. and the 3D first and second order momenta. However, an issue can be found using an isotropic turbulence hypothesis. This method has been, first of all, tested in an axisymmetrical free jet. Furthermore, an experimental investigation of the three dimensional flow field within the tip area of a high loaded, low-speed axial compressor was performed.

Author

Three Dimensional Flow; Turbocompressors; Velocity Measurement; Laser Anemometers; Data Processing; Flow Velocity; Free Jets; Statistical Analysis

19980206013 Universitaet der Bundeswehr Muenchen, Inst. fuer Strahlantriebe, Neubiberg, Germany

Laser-2-Focus Measurements on a Turbine Cascade with Leading Edge Film Cooling

Ardey, S., Universitaet der Bundeswehr Muenchen, Germany; Fottner, L., Universitaet der Bundeswehr Muenchen, Germany; Beversdorff, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Weyer, H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 12p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

In order to increase the understanding of the aerodynamic processes dominating the flow field of turbine bladings with leading edge film cooling, isothermal investigations were carried out on a large scale high pressure turbine cascade. Close to the stagnation point the turbine cascade has one row of film cooling holes on the suction side and another one on the pressure side. Blowing ratio, turbulence intensity, Mach number, and Reynolds number are set to values typically found in modern gas turbines. Since a very sensitive flow pattern with high velocity gradients and reverse flow areas was to be expected near the blowing holes the Laser-2-Focus technique was selected for investigations in this area. Two independent systems were used: A standard two dimensional Laser-2-Focus system permanently installed in the wind tunnel and a temporarily set up three dimensional Laser-2-Focus system of the DLR-Institut fur Antriebstechnik, Koln. The results of the two systems are in good agreement. They indicate vortices in the exit plane of the film cooling holes developing into a flow pattern with upwinds directly behind the holes and downwinds further downstream. In the wake of the pressure side holes a large recirculation zone can be observed located below the coolant jet.

Author

Turbine Blades; Cascade Flow; Film Cooling; Optical Measuring Instruments; Aerodynamic Characteristics; Coolants; Leading Edges; Wind Tunnel Tests; Holes (Mechanics); Flow Measurement; Jet Flow

19980206017 Rolls-Royce Ltd., Applied Science Lab., Derby, UK

Recent Developments in the Application of Laser Doppler Anemometry to Compressor Rigs

Edmonds, Jonathan D., Rolls-Royce Ltd., UK; Harvey, David, Rolls-Royce Ltd., UK; Wiseall, Stephen S., Rolls-Royce Ltd., UK; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A 3D Laser Doppler Anemometry (LDA) system capable of measuring comprehensive in rotor flowfields on high-speed compressor rigs has been developed by the Rolls-Royce Applied Science Laboratory. This paper describes the system and presents data from a recent compressor rig test.

Author

Laser Anemometers; Compressors; Test Stands; Velocity Measurement; Flow Velocity; Data Acquisition; Nonintrusive Measurement

19980206018 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Abteilung Windkanael, Goettingen, Germany

PSP: Intensity and Lifetime Measurements for Steady and Nonsteady Flow

Engler, R. H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Klein, C., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

DLR started at 1995 with there own Pressure Sensitive-Paints (PSP) activities. A phase of extensive exploration of hard- and software-components followed and internal measurements using the intensity and lifetime method which includes spectra, calibration curves, etc. were performed. A repeatability study was made on the DASA HYTEX model, comparing the Inteco OPMS measurements from 1992/94 with the now existing DLR PSP system. Therefore, different lamps and laser illumination systems were tested. This included several cameras (intensified CCD and non-intensified CCD) for comparison of different paint samples in an external calibration chamber. After these pre-tests in the calibration chamber, measurements were performed in the Transonic Wind Tunnel Gottingen (TWG).
Author
Flow Measurement; Optical Measurement; Steady Flow; Paints; Life (Durability); Luminous Intensity; CCD Cameras; Wind Tunnel Tests; Pressure Measurement

19980206020 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Rotor Blade Pressure Measurement in a Rotating Machinery Using Pressure and Temperature Sensitive Paints
Torgerson, S., Purdue Univ., USA; Liu, T., Purdue Univ., USA; Sullivan, J., Purdue Univ., USA; May 1998; 12p; In English; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Pressure and temperature sensitive paints have been utilized for the measurement of blade surface pressure and temperature distributions in a high speed axial compressor and an Allied Signal F109 gas turbine engine. Alternate blades were painted with temperature sensitive paints and then pressure sensitive paint. This combination allows temperature distributions to be accounted for when determining the blade suction surface pressure distribution. Measurements were taken and pressure maps on the suction surface of a blade were obtained over a range of rotational speeds. Pressure maps of the suction surface show-strong shock waves at the higher speeds.
Author
Gas Turbine Engines; Turbocompressors; Pressure Measurement; Paints; Pressure; Surface Temperature; Compressor Blades; Suction; Temperature Measurement

19980206021 Oxford Univ., Dept. of Engineering Science, Oxford, UK
Use of Liquid Crystal Techniques to Measure Film Cooling Heat Transfer and Effectiveness
Guo, S. M., Oxford Univ., UK; Lai, C. C., Oxford Univ., UK; Jeong, J. H., Oxford Univ., UK; Jones, T. V., Oxford Univ., UK; Oldfield, M. L. G., Oxford Univ., UK; Lock, G. D., Bath Univ., UK; Rawlinson, A. J., Rolls-Royce Ltd., UK; May 1998; 18p; In English; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The transient liquid crystal technique has been used to measure the heat transfer coefficient and cooling effectiveness over heavily film cooled nozzle guide vanes (NGVs). The measurements were performed in the complex environment of a transonic annular cascade which simulates the flow in the gas turbine jet engine. Engine-representative Mach and Reynolds numbers were created and the aerodynamic and thermodynamic characteristics of the coolant flow (momentum flux and density ratio between the coolant and mainstream) have been modelled by using heavy foreign gases (SF6 /Ar mixture). The Red-Green-Blue (RGB) components have been separated from the colour response of wide-band encapsulated liquid crystals which react to changes of the NGV surface temperature during the transient experiment. Optical access to the test NGV was problematic and the thermochromic response of the crystals was sensitive to both the lighting and the wide range of viewing angles subtended at the camera. An in situ calibration is used to translate the RGB histories to measurements of the surface temperature history, and hence local heat transfer coefficient and adiabatic wall temperatures were obtained. The colour data has been gathered using a miniature CCD camera and recorded directly to computer memory without the use of video tape recorder. The transient liquid crystal technique is shown to be capable of accurately gathering data over any portion of the NGV surface visible to the camera used. As the data is collected in an environment which models the engine, the data is of benefit for both CFD code validation and directly to the engine designer.
Author
Liquid Crystals; Film Cooling; Heat Transfer; Guide Vanes; Cascade Flow; Annular Flow; Temperature Measurement; Surface Temperature; Coolants

19980206037 British Columbia Univ., Dept. of Mechanical Engineering, Vancouver, British Columbia Canada
Measurement of Unsteady Wake-Boundary Layer Interaction Using Hot Films
Gete, Zenebe, British Columbia Univ., Canada; Evans, R. L., British Columbia Univ., Canada; May 1998; 14p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Boundary layers developing on a surface subject to the intermittent passage of wakes, such as those on turbomachinery blading, are known to be highly unsteady. In this experimental study, a flat plate mounted in a wind tunnel downstream of a moving wake generator was used to model the wake-boundary layer interaction process in actual turbomachines. The boundary layer and the wall shear stress developing on the flat plate in this unsteady environment were measured using hot wire Anemometry and hot film sensors mounted on the plate surface. Measurements were taken at several locations downstream of the plate leading edge, and at several values of the reduced frequency. The results from the hot-film sensors showed that the unsteady boundary layer resulted in significantly higher losses in comparison to a steady boundary layer developing in the absence of passing wakes.
Author

Turbulent Boundary Layer; Wakes; Velocity Measurement; Wave Interaction; Turbomachinery; Flat Plates; Fluid-Solid Interactions; Wind Tunnel Tests; Shear Stress

19980206038 Technische Univ., Fachgebiet Gasturbinen und Flugantriebe, Darmstadt, Germany

Measurements With Surface Mounted Hot-Film Sensors on Boundary Layer Transition in Wake Disturbed Flow

Haueisen, Volkmar, Technische Univ., Germany; Schroeder, Thomas, Technische Univ., Germany; Hennecke, Dietmar K., Technische Univ., Germany; May 1998; 14p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Boundary layer transition with and without transitional separation bubbles on a circular cylinder in crossflow was investigated. Measurements were carried out in undisturbed, steadily disturbed, and periodically disturbed flow. Besides the surface static pressure distribution and besides the measurement of velocity profiles with a hot-wire probe the investigations were focussed on the signal distributions of surface mounted hot-films. The reaction of separation and transition to changes of the Reynolds number or the degree of disturbance can be observed. In comparison with the hot-wire traverses, which were carried out in parallel with the hot-film measurements, the experiments show that the surface-mounted hot-film-technique is suitable to obtain reliable information on transition and separation phenomena with both high spatial and temporal resolution. Measurements with surface-mounted hot-film sensors in a multistage aero-engine low-pressure turbine show that use of this technique is not only restricted to laboratory conditions but is as well suitable for complex geometry and engine condition.
Author

Boundary Layer Transition; Circular Cylinders; Cross Flow; Transition Flow; Turbines; Velocity Measurement; Wakes; Separated Flow; Hot-Film Anemometers; Static Pressure

19980206039 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Time Resolved Measurements of Turbine Blade Flow Phenomena

Diller, T. E., Virginia Polytechnic Inst. and State Univ., USA; Ng, W. F., Virginia Polytechnic Inst. and State Univ., USA; Schetz, J. A., Virginia Polytechnic Inst. and State Univ., USA; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The facility and instrumentation are described for studying the effects of time-dependent flow phenomena. The components of unsteadiness from upstream rotor blades and the combustor of a gas turbine engine are modeled individually as shocks, wakes, and freestream turbulence. The decomposition of the unsteadiness allows fundamental physical modeling of the effects on the flow structure and blade heat transfer. The strength and spacing of the shocks, the intensity and length-scale of the turbulence, and the wake velocity defect and turbulence can all be independently controlled. The blow-down facility provides 30 seconds of heated flow through a stationary blade cascade that matches the Reynolds number, Mach number, and temperature ratio characteristics of advanced gas turbine engines. Detailed observations are provided by spark shadowgraphs (10(exp -8) sec.), laser interferometry (10(exp -7) sec.) to obtain the instantaneous global density field, and surface pressure and heat flux measurements. The heat flux measurements have a time response of less than 10 micro-sec with a continuous voltage output. Because the sensors are less than 2 micro-m thick, they are non-intrusive to the flow and temperature fields. As one example of the capabilities, computer visualization from shadowgraphs of shock propagation through a blade passage with simultaneous surface pressure and heat flux measurements will be shown.
Author

Nonintrusive Measurement; Combustion Chambers; Turbine Blades; Wakes; Time Dependence; Flow Characteristics; Turbulence; Temperature Measurement; Pressure Measurement; Density Measurement; Shock Waves

19980206044 Defence and Evaluation Research Agency, Propulsion Dept., Pyestock, UK

Particle Image Velocimetry Measurements from the Stator-Rotor Interaction Region of a High Pressure Transonic Turbine Stage at the DERA Isentropic Light Piston Facility

Chana, K. S., Defence and Evaluation Research Agency, UK; Healey, N., Defence and Evaluation Research Agency, UK; Bryans-

ton-Cross, P. J., Warwick Univ., UK; May 1998; 8p; In English; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In high pressure turbines the flow in the stator-rotor interaction region is highly complex with periodic and random unsteady effects generated as the stator wakes impinge on the rotor blades. Measuring the flow in this region is difficult with conventional instrumentation, further complicated in a short duration facility. This paper discusses the application of particle image velocimetry to this region of flow and, outlines the technological advances made recently to demonstrate the technique in the short duration Isentropic Light Piston Facility (ILPF) at DERA Pyestock. A series of measurements have been made in the stator passage and the stator-rotor gap region of the MTI high pressure turbine stage, in the ILPF. The measurements have been made at full engine-representative flow conditions and provide an instantaneous quantitative whole field visualisation of this unsteady flow region. The measured velocity field is compared with computational fluid dynamics (CFD) predictions obtained using a three-dimensional viscous flow solver. Theses measurements are thought to be the first to be made in a rotating transonic facility.
Author

Particle Image Velocimetry; Supersonic Turbines; Pressure Dependence; Velocity Measurement; Unsteady Flow; Rotor Stator Interactions

19980206045 Wright Lab., Aero Propulsion and Power Directorate, Wright-Patterson AFB, OH USA

The Unsteady Structure of Simulated Turbine Film Cooling Flows From PIV

Rivir, Richard B., Wright Lab., USA; Gogineni, Sivaram, Innovative Scientific Solutions, Inc., USA; Goss, Larry P., Innovative Scientific Solutions, Inc., USA; Pestian, David J., Dayton Univ. Research Inst., USA; May 1998; 14p; In English; Also announced as 19980206002

Contract(s)/Grant(s): AF Proj. 2307; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Unsteady turbine film cooling flows are subjected to free stream disturbances which exceed those of a fully turbulent boundary layer. Hot wires, cold wires, and thermocouples have in the past been used to obtain local, time resolved point measurements of velocity, temperature, and mixing. The structure of the flow and its interaction with free stream structures remains largely hidden. Two-color, double pulsed, PIV (Particle Image Velocimetry) was used to investigate simulated turbine film-cooling flows with high free stream turbulence and wake passing. High resolution (3000 x 2000 pixels), instantaneous, velocity distributions obtained by CCD camera have been compared against those obtained from 35mm film digitized at 2700 ppi resulted in realizations with similar spatial resolution. Averages of 1 to 30 instantaneous PIV velocity measurements have been compared against simulated turbine film cooling flow velocity profiles measured by hot wire. The resulting PIV velocity profile measurements were mostly within the envelope of the mean and rms velocity measurements of the hot wire. The PIV images allow instantaneous estimates of the shear layer development, vertical cooling jet film spread, turning, and interactions with the free stream turbulence. Instantaneous vorticity, and dissipation distributions have also been obtained. The lateral jet spread of the film at the wall was measured with liquid crystals and thermocouples and compared with the vertical PIV spread. The centerline vertical film jet spread, turning angle, and shear layer growth has been characterized from the PIV realizations as a function of blowing ratio, Reynolds number, periodic forcing amplitude, frequency, and free stream turbulence.
Author

Film Cooling; Particle Image Velocimetry; Flow Velocity; Temperature Measurement; Velocity Measurement; Unsteady Flow; Turbulence; Wakes; Turbines

19980206048 Systelligence Consultants and Research Associates, Volos, Greece

Recent Progress in Whole-Field Non-Intrusive Measurements of 3-D Velocity Vectors and Particle Size

Moraitis, C. S., Systelligence Consultants and Research Associates, Greece; Tisserant, D., Von Karman Inst. for Fluid Dynamics, Belgium; Breugelmans, F. A. E., Von Karman Inst. for Fluid Dynamics, Belgium; May 1998; 8p; In English; Also announced as 19980206002

Contract(s)/Grant(s): CEC-MATI-CT93-0033; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Recent success in the implementation of particle image velocimetry (PIV) as a useful two-dimensional technique has encouraged efforts to develop three-dimension nonintrusive methods Holography appears to be a suitable technique to image three-dimensional flows seeded with small particles. A novel technique to process double or multiple exposure holograms has been developed during the last four years. Information about velocity and particle size is obtained by using an optical/digital processing technique. The interference pattern due to light-waves emanating from particles images is imaged and then processed digitally. Applicability of the concept is first demonstrated by processing a double-exposed hologram of a synthetic particles field submitted to a known displacement. For different ratios between the depth (out-of-plane) displacement component and the lateral (in-plane) one, results are discussed. They show that the accuracy is strongly related to the choice of the digital processing parameters, especially the number of fringes which are contained in the interference pattern. Additional benchmarking of the technique has been

carried out by applying it to a real flow of which velocity and direction are well known. Therefore, a jet flow facility with adjustable yaw and pitch angle has been designed. Various flow configurations have been investigated. At present state of work, processing result have to be improved. The diffraction halo of the particle images is so small that a limited number of fringes are available at the output of the optical processing part. Thus results of the digital processing algorithm are affected by a large uncertainty.
Author
Particle Image Velocimetry; Nonintrusive Measurement; Three Dimensional Flow; Velocity Measurement; Holography; Flow Velocity; Imaging Techniques; Jet Flow

19980206050 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Propulsion Technologie, Cologne, Germany
Applications of Three Dimensional Doppler Global Velocimetry to Turbo Machinery and Wind Tunnel Flows
Roehle, I., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Schodl, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 14p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Doppler Global Velocimetry is an imaging anemometer. A DGV system optimised for time averaged three component velocity measurements was designed and set up. The first application of the system was the investigation of the flow field of a swirl spray nozzle in a cylindrical casing. The flow field in the whole volume of the combustor was measured. The DGV System was also applied to investigate the wake region of a car model in a wind tunnel. An arrangement with three light sheets was chosen. The 3D-DGV results are in a good agreement with 3D-LDA measurements of the same flow. 3D-DGV measurements were carried out inside the model of the inlet of a fighter aircraft. A flexible endoscope was used to overcome the serious problems of the optical excess of this fully capsuled flow.
Author
Laser Doppler Velocimeters; Flow Characteristics; Flow Velocity; Velocity Measurement; Wind Tunnels; Turbomachinery; Equipment Specifications; Imaging Techniques

19980206082 Oak Ridge National Lab., Solid State Div., TN USA
Effect of a solid/liquid interface on bulk solution structures under flow
Butler, P. D., Oak Ridge National Lab., USA; Hamilton, W. A., Oak Ridge National Lab., USA; Hayter, J. B., Oak Ridge National Lab., USA; Magid, L. J., Tennessee Univ., USA; Slawecki, T. M., National Inst. of Standards and Technology, USA; Jul. 15, 1997; 8p; In English; Neutron Scattering, 17 - 21 Aug. 1997, Toronto, Canada
Contract(s)/Grant(s): DE-AC05-96OR-22464; NSF DMR-91-22444
Report No.(s): CONF-970814-7; DE97-008460; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

It has been known for some time that a shear field can impart enough energy to a liquid system for it to exhibit a phase change. Not as well appreciated is the fact that non Newtonian solutions can be driven into a quasi phase separation due to the vastly different shear rates between the bulk and near surface regions. Using a variety of scattering techniques the authors have probed the interfacial and near surface region of a system of wormlike colloidal particles under flow separately from the bulk. They find that the hexagonal phase which forms under flow near the surface, does not persist into the bulk. They also present data showing substantial differences in the kinetics of alignment and relaxation of the two phases.
DOE
Fluid Flow; Liquid-Solid Interfaces; Shears; Newtonian Fluids

19980206095 Naval Undersea Warfare Center, Newport, RI USA
Vorticity Transport by Electromagnetic Forces
Hendricks, Peter J., Naval Undersea Warfare Center, USA; Feb. 02, 1998; 22p; In English
Report No.(s): AD-A345445; NUWC-NPT-TR-10712; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The principal focus of this work is the use of the Lorentz force to alter the turbulence in the flow or, more generally, the vorticity. An analysis of the Lorentz force in a conducting fluid flowing over an array of magnets and electrodes predicts the amplitude of the vorticity transport in the boundary layer due to the Lorentz force field. These predictions are used to estimate the performance of an electromagnetic array for sea water flows at several meters per second. This investigation demonstrates that an analysis of the Lorentz force distribution in a flow above a flat plate shows that many of the features of the fields and their effect on the flow can be deduced without solving the governing equations. Moreover, many fundamental conclusions can be derived from

order of magnitude scaling analysis and symmetry arguments. The effect of the Lorentz force on the flow is evaluated by equating the curl of the Lorentz force to the transport of vorticity.
DTIC
Vortices; Magnetohydrodynamics; Lorentz Force; Force Distribution; Field Theory (Physics); Conducting Fluids

19980206134 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Appropriate Sizes of Porous and Solid Blocks for Heat Transfer Under and Impinging Jet
Fu, Wu-Shung, National Chiao Tung Univ., Taiwan, Province of China; Huang, Hsin-Chien, National Chiao Tung Univ., Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 159-169; In English
Contract(s)/Grant(s): NSC86-2212-E-009-042; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A study of appropriate sizes of both porous and solid blocks mounted on a heated region impinged by a laminar slot jet was investigated numerically. A numerical method of SIMPLEC is adopted to solve governing equations, and a one-equation thermal model with Van Driest's wall function is considered for solving the energy equation of the porous block. The results indicated that enhancement of heat transfer is obtained for both shorter porous and solid block cases and a decrease of heat transfer occurs for longer block cases. Compared with the without block case, there exists an appropriate length of the porous block to gain the maximum thermal enhancement efficiency. As for the solid block case, as the length becomes shorter, the thermal enhancement efficiency becomes better.
Author
Thermodynamic Efficiency; Jet Impingement; Porosity; Blocks; Wall Flow; Wall Jets; Mathematical Models; Heat Transfer; Solids; Computerized Simulation; Flow Visualization

19980206181 General Motors Inst., Dept. of Mechanical Engineering, Flint, MI USA
Computational Modeling of Multi-Phase/Multi-Species Flows with Applications to Liquid Rocket Engines
Navaz, Homayun K., General Motors Inst., USA; Oct. 1996; 10p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Accurate prediction of all physical phenomena in a combustion chamber is essential for better understanding of the system performance. Atomization, evaporation, combustion, chemical kinetics, and turbulence are those processes of great importance that need to be well understood. Processes involving the liquid phase in a combustion chamber will be further complicated under supercritical conditions. More advanced and accurate numerical techniques are required to extend our understanding of the above phenomena. A computer program for multi-species/multi-phase flow was developed for NASA/MSFC in 1992. This code, called Liquid Thrust Chamber Performance (LTCP) program takes an Eulerian- Eulerian approach and is based on the Total Variation Diminishing (TVD) technique with Lax-Friedrichs upwind method. Under the NASA/ASEE SFFP the LTCP code was used to predict the performance characteristics of several engines that were of particular interest to NASA. This code was also successful in a combustion detonation study. Converting the program to the PC platform was accomplished which extends usability and makes it available to a wider range of users. The Eulerian formulation of the liquid phase provides a suitable model that can be extended to include combustion modeling under supercritical conditions. The results have been compared against the ones of other codes and available measured data. The algorithm proved to be robust and efficient for problems with stiff source terms.
Derived from text
Multiphase Flow; Liquid Propellant Rocket Engines; Combustion Chambers; Combustion Chemistry; Reaction Kinetics; Mathematical Models

19980206205 NASA Lewis Research Center, Cleveland, OH USA
Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines
LaGraff John E., Editor, Syracuse Univ., USA; Ashpis, David E., Editor, NASA Lewis Research Center, USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998; 541p; In English; 2nd; 1997 Workshop on Boundary Layer Transition in Turbomachines, 7-10 Sep. 1997, Syracuse, NY, USA, Held at Minnowbrook Conference Center, New York; Sponsored by Syracuse Univ., USA; Also announced as 19980206206 through 19980206236
Contract(s)/Grant(s): RTOP 522-31-23
Report No.(s): NASA/CP-1998-206958; E-11100; NAS 1.55:206958; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

The volume contains materials presented at the Minnowbrook II - 1997 Workshop on Boundary Layer Transition in Turbomachines, held at Syracuse University Minnowbrook Conference Center, New York, on September 7-10, 1997. The workshop fol-

lowed the informal format at the 1993 Minnowbrook I workshop, focusing on improving the understanding of late stage (final breakdown) boundary layer transition, with the engineering application of improving design codes for turbomachinery in mind. Among the physical mechanisms discussed were hydrodynamic instabilities, laminar to turbulent transition, bypass transition, turbulent spots, wake interaction with boundary layers, calmed regions, and separation, all in the context of flow in turbomachinery, particularly in compressors and high and low pressure turbines. Results from experiments, DNS, computation, modeling and theoretical analysis were presented. Abstracts and copies of viewgraphs, a specifically commissioned summation paper prepared after the workshop, and a transcript of the extensive working group reports and discussions are included in this volume. They provide recommendations for future research and clearly highlight the need for continued vigorous research in the technologically important area of transition in turbomachines.
Author
Conferences; Boundary Layer Transition; Turbomachinery; Boundary Layers; Computer Programs; Mathematical Models; Computerized Simulation; Transition Flow; Turbulence Effects; Turbulent Flow

19980206206 Tasmania Univ., Hobart, Australia
Transition in Turbomachines: An Overview
Walker, G. J., Tasmania Univ., Australia; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 25-44; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The practical importance of the study of transition in turbomachines is that they are used in most energy conversion and propulsion systems. Boundary layer transition can significantly affect performance (operating range and efficiency) and aeroelastic behaviour of blades. Performance improvements can provide significant economic and environmental benefits. It presents a challenging and stimulating problem. Study in transition has advanced basic understanding of transition physics (calming, concentrated breakdown, pressure gradient effects, sub-transitions). These topics are outlined and discussed in the presentation.
Derived from text
Boundary Layer Transition; Turbomachinery; Transition Flow; Boundary Layer Flow; Rotor Blades (Turbomachinery); Flow Characteristics

19980206207 NASA Lewis Research Center, Cleveland, OH USA
The NASA Low-Pressure Turbine Flow Physics Program
Ashpis, David E., NASA Lewis Research Center, USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 45-52; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

An overview of the NASA Lewis Low-Pressure Turbine (LPT) Flow Physics Program will be presented. The program was established in response to the aero-engine industry's need for improved LPT efficiency and designs. Modern jet engines have four to seven LPT stages, significantly contributing to engine weight. In addition, there is a significant efficiency degradation between takeoff and cruise conditions, of up to 2 points. Reducing the weight and part count of the LPT and minimizing the efficiency degradation will translate into fuel savings. Accurate prediction methods of LPT flows and losses are needed to accomplish those improvements. The flow in LPT passages is at low Reynolds number, and is dominated by interplay of three basic mechanisms: transition, separation and wake interaction. The affecting parameters traditionally considered are Reynolds number, freestream turbulence intensity, wake frequency parameter, and the pressure distribution (loading). Three-dimensional effects and additional parameters, particularly turbulence characteristics like length scales, spectra and other statistics, as well as wake turbulence intensity and properties also play a role. The flow of most interest is on the suction surface, where large losses are generated as the flow tends to separate at the low Reynolds numbers. Ignoring wakes, a common flow scenario, there is laminar separation, followed by transition on the separation bubble and turbulent reattachment. If transition starts earlier the separation will be eliminated and the boundary layer will be attached leading to the well known bypass transition issues. In contrast, transition over a separation bubble is closer to free shear layer transition and was not investigated as well, particularly in the turbine environment. Unsteadiness created by wakes complicates the picture. Wakes induce earlier transition, and the calmed regions trailing the induced turbulent spots can delay or eliminate separation via shear stress modification. Three-dimensional flow physics and geometry will have strong effects. Altogether a very complex and challenging problem emerges. The objective of the program is to provide improved models and physical understanding of the complex flow, which are essential for accurate prediction of flow and losses in the LPT. Experimental, computational and analytical work as complementing and augmenting approaches are used. The program involves industry, universities and research institutes, and other government laboratories. It is characterized by strong interaction among participants, quick dissemination of results, and responsiveness to industry's needs. The presentation will describe the work elements. Highlighting some activities in progress are experiments on simulated blade suction surface in low-speed wind tunnels, on curved wall, and on a flat-plate, both with pressure gradient. In the area of computation, assessment of existing models is per-

formed using RANS (Reynolds Averaged Navier Stokes) simulations. Laminar flow DNS was completed. Analytical studies of instability and receptivity in attached and separated flows were started. In the near future the program is moving to include wake effects and development of improved modeling. Experimental work in preparation stages are: (1) Addition of wakes to the curved tunnel experiment; (2) Low-speed rotating rig experiment on GE90 engine LPT; and (3) Transonic cascade. In the area of computation, it is expected to move from model assessment towards development of improved models. In addition, a new project of Large Eddy Simulation (LES) of LPT is to begin and will provide numerical data bases. It is planned to implement the emerging improved models in a multistage turbomachinery code and to validate against the GE90 engine LPT.
Author
NASA Programs; Low Pressure; Turbomachinery; Transition Flow; Boundary Layer Transition; Three Dimensional Flow; General Overviews; Government/Industry Relations; Research Projects

19980206208 General Electric Co., Aircraft Engines, Cincinnati, OH USA
The Technical and Economic Relevance of Understanding Boundary Layer Transition in Gas Turbine Engines
Wisler, David C., General Electric Co., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 53-64; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This presentation addresses the technical and economic relevance of understanding boundary layer transition in gas turbine engines from two perspectives. The first is the micro perspective of the technologist and designer whose principal task is to untie (or even cut) the Gordian knot of transition and thus, hopefully, produce better component designs. The second is the macro perspective of overall engine economics and reliability where the benefits of ”this better component design obtained from improved understanding of transition” are compared to the benefits that could potentially be realized from improvements in other areas. From the micro perspective, we have now reached the point where our lack of ability to predict the location of boundary layer transition for components in gas turbine engines is impeding our ability to gain maximum benefit from our design effort. This is especially true for compressor and turbine blade rows with their respective relative motion between rotors and stators. Clearly the numerics for 2-D and 3-D Reynolds-averaged N-S solutions are in hand. So too is CPU computing power. What’s missing is an adequate turbulence model, one that provides a practical, CFD design tool that will consistently and accurately predict transition and other boundary layer features for arbitrary flows. This missing link impedes designers in their efforts to tailor airfoil shapes to achieve increased loading and/or increased efficiency. With increased airfoil loading, engine part count can be reduced. With increased efficiency, engine fuel consumption is reduced. The presentation discusses the magnitudes of the benefits one might potentially achieve in these micro endeavors. From a macro perspective there are issues that are far more significant to engine economics than those involving the resolution of boundary layer transition. Understanding the relative importance of these issues enables one to get a better understanding of why the gas turbine industry is moving in its current direction. We are approaching a mature technology. Thus, we are becoming more of a cost-driven business and less of a technology-driven business, although our product is still ”very high tech”. With more maturity comes a focus on manufacturing costs, quality, product reliability and total cost of engine ownership. Design for Manufacture, Design for Reliability, Error Proofing Design, and Low Maintenance are heavy hitters economically. This presentation discusses the relative magnitudes of the benefits one might potentially achieve in these macro endeavors. Understanding transition phenomena is certainly important, but its importance also needs to be viewed in the context of total engine economics. With this understanding, the roles of industry, universities and government laboratories in finding solutions to the transition issue are discussed.
Author
Boundary Layer Transition; Gas Turbine Engines; Economics; Cost Effectiveness; Design Analysis; Technology Assessment

19980206209 Pratt and Whitney Aircraft, East Hartford, CT USA
Impact of Reynolds Number on LP Turbine Performance
Sharma, Om, Pratt and Whitney Aircraft, USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 65-69; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Experimental and numerical methods developed over the past twenty five years have permitted the designs of low pressure turbines, utilized in aircraft gas turbine engines, which yield very high efficiencies at sea level take off conditions. These turbines, however, encounter large loss in performance at the altitude cruise operating condition. This loss in performance can be attributed to the impact of Reynolds Number on the behavior of boundary layers on airfoil suction surfaces. Experimental and analytical results are shown in this paper to elucidate the problem encountered by the turbine design engineers. Experimental data consists of those acquired in an engine and a model rig environment. Analysis of these experimental data demonstrate shortcomings of models, criteria and correlations used in the current design procedures and point towards lack of current understanding of the actual operating environment in the gas turbine engine. Analytical results demonstrate limitations of turbulence/transition models

used in a low Reynolds Number environment of low pressure turbines. Areas of further research are identified to provide support to the design community.
Author
Gas Turbine Engines; Aircraft Engines; Low Reynolds Number; Boundary Layer Transition; Turbulence Effects; Reattached Flow; Boundary Layer Separation; Turbulent Boundary Layer

19980206210 Leicester Univ., UK
Beneficial Effects of the Calmed Region on Flat Plate and Blade Boundary Layers
Gostelow, J. P., Leicester Univ., UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 73-81; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The calmed region behind triggered wave packets and turbulent spots on a flat plate under a strong controlled diffusion adverse pressure gradient is investigated. The results are compared with equivalent transition behavior resulting from incident wakes on the suction surface of a turbine cascade blade. Comparisons are also made with measurements from the stator blades of an axial flow compressor, where turbulent spots are induced by the passing of rotor wakes. The purpose is to gain an appreciation of turbulent spot behavior under an adverse pressure gradient as a foundation for the more accurate modeling of spots and their environment in predictions of transitional boundary layer flows. Under a strong, adverse pressure gradient the calmed region behind a triggered turbulent spot is extensive; its interaction with the surrounding natural boundary layer is complex and its behavior is dependent on whether that boundary layer is laminar or turbulent. Conditional intermittency profiles are used to investigate the spot and its calmed region in more detail. In particular, a new relaxation parameter is used to quantify and describe the calmed region behind the triggered spots and on the compressor blading. Wavelet analysis of triggered spots and wake-induced turbulent patches demonstrates similar calmed region behavior. Boundary layer profiles are also presented through the triggered spot in order to validate the author's modeling of transition based on the physics of turbulent spots. The calmed region has beneficial effects in delaying both laminar separation and transition in wind tunnel flows and on the blade surfaces of turbomachinery. In the calmed region, the boundary layer velocity profiles are more stable than those of the laminar boundary layer. This has the effect of delaying laminar separation. The amplitude of Tollmien-Schlichting instabilities is reduced in the calmed region and the consequent progression to harmonic breakdown and transition to turbulence are delayed in that region.
Author
Boundary Layer Flow; Laminar Boundary Layer; Flow Characteristics; Wave Packets; Pressure Gradients; Transition Flow; Boundary Layer Transition; Blade-Vortex Interaction; Velocity Distribution

19980206211 Cambridge Univ., Cambridge, UK
The Calmed Region and Its Significance in Low Pressure Turbines
Hodson, H. P., Cambridge Univ., UK; Schulte, V., Cambridge Univ., UK; Howell, R. J., Cambridge Univ., UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 83-93; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper will describe progress in understanding and modelling of some of the important details of the flow and the loss generation processes that arise in low pressure turbines. Particular emphasis will be placed on the unsteady transitional and separated flows that arise in these turbines. It will be shown how their effects may be exploited in controlling the laminar-turbulent attached and separated flow transition processes to the benefit of the design. It is argued that in many low pressure turbines, transition to turbulent flow takes place via the formation of turbulent spots. Recent attention has focused on the so called 'calmed region' that follows the turbulent spots that have been observed inside the boundary layers of turbomachinery blading. The nature and the significance of the calmed region are examined using experimental observations and computational studies. It is shown that the calmed region may be modelled using the unsteady laminar boundary layer equations. It is found that the calmed region produces about the same amount of entropy as would a laminar boundary. Because the becalmed region is less prone to separation than a conventional laminar boundary layer, it may be exploited to increase the lift of low pressure turbine blades by preventing boundary layer separation and the increase in loss that this entails. A spot-based unsteady intermittency model is proposed with an extension allowing for the 'calming effect' of passing wakes. Predictions of the effect of the calmed region are obtained using a well known blade-blade flow solver. The predictions utilize an algebraic turbulence model in conjunction with the prescribed unsteady intermittency model. Comparisons are made with experiments using surface mounted hot-film measurements from unsteady cascade as well as full scale rig testing in an Altitude Test Facility. Comparisons with data on the profile losses in low

pressure turbine blades at low Reynolds-numbers suggests that the method is capable of predicting the variation of loss with Reynolds-number and with wake-passing frequency.
Author
Low Reynolds Number; Boundary Layer Separation; Laminar Boundary Layer; Mathematical Models; Turbulent Flow; Turbulent Wakes; Low Pressure; Transition Flow; Boundary Layer Transition; Intermittency; Unsteady Flow

19980206212 Oxford Univ., Oxford, UK
The Becalmed Region in Turbulent Spots
Hofeldt, Albert, Oxford Univ., UK; Clark, John, Oxford Univ., UK; LaGraff, John, Syracuse Univ., USA; Jones, Terry, Oxford Univ., UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 95-98; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

A series of detailed turbulent spot experiments were conducted in two facilities. The freestream pressure gradient and Mach number was varied over a wide range. A theory was developed which explains the properties of the becalmed region of the turbulent spot as the regrowth of a disturbed laminar boundary layer. The time for which the becalmed region persists may be predicted and the heat transfer rate within the region calculated using time dependent CFD. Experimental results for unsteady heat transfer are presented and are used to substantiate the theory.
Author
Laminar Boundary Layer; Turbulent Heat Transfer; Pressure Gradients; Mach Number; Boundary Layer Transition; Unsteady Flow

19980206213 Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel
Spot Calming Effect on Boundary Layer Transition
Seifert, A., Tel-Aviv Univ., Ramat-Aviv, Israel; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 99-109; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A turbulent spot, triggered in a laminar boundary layer, was followed into the transitional and turbulent regions of the boundary layer. It was found experimentally that its calming region is manifested as an island of laminar flow in an otherwise turbulent surrounding. This region is maintained for hundreds of boundary layer thicknesses downstream of natural transition. Assumptions concerning the production and maintenance of the calming region are presented. Possible means of using it for transition management were tested. It was found that transition length could be tripled and phase locked laminar periods could be maintained further downstream of mean transition location.
Author
Boundary Layer Transition; Laminar Boundary Layer; Turbulent Boundary Layer; Wind Tunnel Tests; Intermittency

19980206214 Case Western Reserve Univ., Cleveland, OH USA
Roughness-Induced Transition
Reshotko, Eli, Case Western Reserve Univ., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 113-136; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Surface roughness can have a profound effect on boundary layer transition. The mechanisms associated with single roughness elements are only partially understood while those responsible for transition with distributed roughness are not yet known. This has led to a large body of empirical information in the literature that is not fully consistent. These correlations are generally based on two-dimensional parameters such as Re(sub k), k/delta(sup *), and k/delta whereas the distributed roughness is inherently three-dimensional. The three-dimensionality is introduced by providing separate curves for each three-dimensional shape and distribution. Nevertheless, these correlations are still the operative data base for dealing with distributed roughness. Experimental studies have elucidated some of the physical observations of flow over distributed roughness. It is generally agreed that roughness displaces the mean flow outward affecting profiles only within the roughness height. Subcritical amplification is observed principally at low frequencies and the growth can easily reach nonlinear levels quickly. It is suspected that in common with single 3D roughness elements, the distributed roughness gives rise to vortex structures emanating from the elements. Aside from a weak horseshoe vortex in front of each element, there are chimney vortices arising behind each element that are turned horizontally at the crests of the roughness and lead to an upwash or lift of the vortices. These vortices are primarily streamwise. A possible unifying explanation for these observations is in the mechanism of transient growth. Transient growth arises through the coupling between slightly damped, highly oblique (nearly streamwise) Orr-Sommerfeld and Squire modes leading to algebraic growth followed by decay outside the T-S neutral curve. A weak transient growth can also occur for two-dimensional or axisymmetric modes

since the Orr-Sommerfeld operator is not self-adjoint, therefore its eigenfunctions are not strictly orthogonal. Transient growth is certainly a candidate mechanism for many examples of bypass transition. While it may be difficult to quantify its influence, the qualitative trends are consistent attesting to the possible role of transient growth in roughness-induced transition.
Author
Boundary Layer Transition; Horseshoe Vortices; Orr-Sommerfeld Equations; Surface Roughness; Transient Response; Flow Characteristics; Turbulent Flow; Flow Theory

19980206215 Ceskoslovenska Akademie Ved, Inst. of Thermomechanics, Prague, Czechoslovakia
Experimental Investigation of By-Pass Transition in the Institute of Thermomechanics in Prague
Jonas, Pavel, Ceskoslovenska Akademie Ved, Czechoslovakia; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 137-154; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Rather pure is the knowledge on the effect of mixed disturbances (turbulent and periodic) on the by-pass transition. This encouraged us to arrange experiments to compare the boundary layer transition in a facility with an invariable configuration of walls surrounding the flow field, with a given value of time averaged free stream velocity (Ue approx. = 10 m/s) and with independently acting generators of the outerstream velocity disturbances (random, harmonic, mixed). The investigated flat-plate boundary layer develops itself in flow with either natural turbulence (intensity 0, 12 percent) or with grid-turbulence (intensity amplified up to 4 percent). by means of a rotating flap inserted into the sonic throat, the periodic pulsations are generated. The frequency and the amplitude have been chosen so, as to reach low subcritical (1200 and 3000) and high supercritical (approx. 50000) values of the non-steady Reynolds number. It has been observed that periodic disturbances cause the alterations of the velocity gradient in space and during every period of oscillations even though the time-mean velocity is constant. Owing to this are the alterations of turbulence production and decay inside the oscillations. Consequently the time-averaged turbulence intensity amplifies; above all in the arrangement without the turbulence generator. The courses of the skin-friction coefficient (Cf) reveal that the flows with turbulent or harmonic or mixed disturbances force the onset of transition sooner than an undisturbed flow. Also, the final stage of the transition process is carried out more quickly. The alterations of turbulence production and decay manifest themselves in the alterations of the phase-averaged value of Cf mentioned and further effects are more important of supercritical non-steady Reynolds number and in the case without a turbulence generator. The effect of the wall constraint and the viscous sticking of the fluid to the surface on the structure of the external turbulent flow and the fact that the effect of outer stream turbulence on turbulent boundary layer depend not only on the intensity but also on the length scale of outer stream turbulence. From this follows to a certain degree that the length scale should influence the by-pass transition. to examine the above mentioned notion and to assemble the data of the Test Case T3A+ specified by the COST-ERCOFTAC Special Interest Group on Transition the effect of variable dissipative length scale Le (from approx. 3 to approx. 40 mm) and 3 percent turbulence level of the incoming flow (Ue = 5 or 10 m/s) on a zero pressure gradient boundary layer has been investigated. From the measured distributions of the shape parameter H12 and of the skin-friction coefficient Cf it is obvious that the dissipative length scale Le influences the by-pass transition. At the given turbulence level of the incoming flow the onset of the last stage of the transition is coming later in the fine-grain turbulence. The length of the last part of transitional layer appears to be independent of Le. An attempt to study the modification of the turbulence structure of the investigated layers, namely of the bursting phenomenon has been done. Further effort should be devoted to make precise the investigated effect, especially the receptivity of a boundary layer to disturbance near the region where the layer is loosing stability.
Author
Boundary Layer Transition; Boundary Layer Stability; Turbulent Boundary Layer; Flow Characteristics; Wall Flow; Turbulent Flow; Laminar Boundary Layer; Scale Effect; Vortices

19980206216 Arizona State Univ., Tempe, AZ USA
Influence of High-Amplitude Noise on Boundary-Layer Transition to Turbulence
Saric, William S., Arizona State Univ., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 155-174; In English; Also announced as 19980206205
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This work continues detailed experiments of boundary layers undergoing transition to turbulence with the major effort directed toward the most important issue facing the understanding of fundamental causes of transition, i.e., the receptivity to free-stream disturbances. The present effort concentrates on effects of large-amplitude freestream noise that are characteristic of gas turbine engines. As such, it is a significant departure from the usual linear receptivity mechanisms. Oblique and broad-band sound waves are used along with 3-D roughness elements to determine how the unstable waves are initiated. Techniques for control and cancellation of the unstable waves will be developed as part of this work. The experiment utilizes multiple hot-wire measurements

in combination with recently developed flow visualization and computational techniques. The use of in-house developed phase-correlated and conditionally sampled measurements permits the separation of the acoustic signals from the unstable waves. The goal is to establish the framework for the active control of such fluid motions and to provide the initial conditions for computational modeling.
Author
Boundary Layer Transition; Turbulence; Surface Roughness; Sound Waves; Sine Waves; White Noise

19980206217 Tohoku Univ., Sendai, Japan
Control of Crossflow Instability Field by Selective Suction System
Egami, Yasuhiro, Tohoku Univ., Japan; Kohama, Yasuaki, Tohoku Univ., Japan; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 175-203; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A full turbulent transition process is created on a yawed flat plate using a displacement body system in a wind tunnel. It was found that high frequency secondary instability drives the crossflow dominant boundary layer into a full turbulent state. Taking into account such transition structures, effective control of the flow field to delay the transition is possible. That is, by placing grooving line suction holes along each streamwise crossflow vortex, and in so doing causing selective suction in the low momentum flow, the appearance of the secondary instability is successfully delayed. This suction system also has an advantage over a uniform suction system in that the amount of suction air volume required to control the flow field is much less than in uniform suction. Thus, a great deal of energy needed for flow control is saved. We also attempted to determine the most appropriate condition for selective suctioning.
Author
Boundary Layers; Vortices; Cross Flow; Flow Characteristics; Turbulence; Boundary Layer Transition; Flow Stability; Suction; Pressure Effects

19980206218 Abertay Univ., Dundee, UK
A Layer Averaged Two-Equation Model for the Prediction of Boundary Layer Transition Onset
Fraser, C. J., Abertay Univ., UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 207-216; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Current industrial practice in the UK makes use of relatively simplistic empirical correlations to predict the onset of the breakdown to fully developed turbulent flow in the boundary layer. While these methods work after a fashion, they still do little more than correlate the original experimental data on which they are based. When applied to other cases there is often considerable error between predicted and actual transition onset position. This is particularly the case when laboratory based experimental correlations are used to predict transition onset in industrial gas turbine blade flows. Recent research work has been concentrated on the development of a two-equation transition model where the production and dissipation rates of turbulent energy have been expressed in the forms of ordinary non-linear differential equations. These equations were formulated from the classic turbulence energy equations which are obtained by multiplying the Navier-Stokes equations by the fluctuating velocity in the main flow direction. An order of magnitude analysis eliminates the lesser terms and integration across the boundary layer produces a set of layer averaged ordinary differential equations. Within these equations a considerable amount of further simplification and empirical modelling results in the particular forms that are currently being investigated. The basic concept being tested is that the intensity of the turbulent energy associated with the velocity fluctuations will grow or decay depending upon the prevailing influences like the external freestream turbulence intensity and the streamwise pressure gradient. In all cases the general tendency is that the intensity of the turbulent energy will grow, but that the growth rate will be limited or enhanced by these external influences. The current transition onset model makes use of the assumption that when the turbulent energy reaches a maximum critical value then the final breakdown process, in the form of turbulent spot generation, will be initiated.
Author
Boundary Layer Transition; Turbulent Flow; Navier-Stokes Equation; Mathematical Models; Integral Equations; Kinetic Energy; Boundary Layer Separation

19980206219 Liverpool Univ., UK
Physical Modelling of Bypass Transition
Johnson, Mark W., Liverpool Univ., UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 217-227; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Empirical correlations are used extensively for predicting transition in turbomachines. A disadvantage of such correlations is that they only account for some of the factors affecting transition (typically freestream turbulence level and streamwise pressure

gradient), but other important factors are neglected (e.g., turbulent length scale, blade curvature and blade sweep). The formulation of correlations which will accurately account for all such factors would seem implausible. The objective of the work at Liverpool has been to improve the understanding of how freestream turbulence induces turbulent spots within a transitional boundary layer and to utilize this knowledge to derive a physical model of the transition process. This alleviates the need for empirical correlation and hence simplifies the task of predicting transition accurately in complex turbomachinery geometries. to this end, extensive wind tunnel experiments on flat plates have been performed. These experiments have established that freestream turbulence induces velocity fluctuations in the near wall region (y/delta <0.2)ofthelaminarboundarylyer primarily through the unsteady pressure field. These fluctuations increase in strength as the laminar boundary layer develops until the instantaneous velocities minima are sufficiently low to induce transient local separation of the flow. This separation, which has also been predicted elsewhere through Direct Numerical Simulation, is believed to be the mechanism through which turbulent spots are induced. This mechanism has been modelled and incorporated within a simple boundary layer integral code, which has been successfully used for predicting many of the ERCOFTAC test cases (T3A-, T3A, T3B, T3C1-5) and also the measurements of Gostelow and co-workers. Currently, experimental work is in progress on concave surfaces and future work is planned on swept surfaces. The model will also be developed to predict transition in these flows. Work is also in progress in measuring and predicting relaminarizing boundary layers.

Author

Boundary Layer Transition; Laminar Boundary Layer; Free Flow; Turbulent Boundary Layer; Turbulent Flow; Mathematical Models; Boundary Layer Separation; Applications Programs (Computers)

19980206220 Idaho National Engineering Lab., Idaho Falls, ID USA

Forced Transition Measurements in the New INEEL Matched Index-of-Refraction Flow System

McEligot, Donald M., Idaho National Engineering Lab., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 229-233; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

A joint project is underway to measure the structure of the laminar-to-turbulent transition induced by roughness elements. A goal is provide benchmark data for the assessment and guidance of numerical predictive techniques for the effects of two- and three-dimensional geometries in inducing transition. In addition to applications to enhance heat, mass and momentum transfer, to assist in controlling lift and drag on laminar airfoils and to improve fundamental understanding, the geometries can provide qualitative simulation of the effects of injection of fluid into laminar boundary layers on turbine blades (film cooling). Preliminary data have been obtained in the wind tunnel at the Lehrstuhl fuer Stroemungsmechanik (LSTM) using a two-dimensional rectangular rib roughness element on a flat plate with a NACA 0009 airfoil shape as the leading edge. Angle-of-attack was adjusted to yield a negligible streamwise pressure gradient. Benchmark data will be obtained in the liquid tunnel of the new Matched-Index-of-Refraction (MIR) flow system at the Idaho National Engineering and Environmental Laboratory (INEEL). The INEEL MIR flow system is considerably larger than other MIR facilities, the square cross section is 60 cm on each side and about 2-1/2 meters long. Its low velocity and large size give good spatial resolution at a given Reynolds number and, in turn, good temporal resolution. Refractive-index-matching leads to reduction of noise in near-wall laser Doppler velocimeter measurements, a key benefit in the present program. In addition to flows in internal or external turbine blade passage configurations, experiments that can benefit from use of the MIR facility include complex flows in engine compartments, in electronic assemblies, in tube bundles, near sharply-concave surfaces, through porous media and in or around other complicated geometries plus two-phase particulate flow. The initial experiments, preliminary results, ongoing studies and plans will be discussed.

Author

Laminar Boundary Layer; Turbulent Boundary Layer; Boundary Layer Transition; Refractivity; Surface Roughness; Wind Tunnel Tests; Flow Measurement; Turbulent Flow; Boundary Layer Flow

19980206221 General Electric Co., Aircraft Engines Div., Cincinnati, OH USA

Flowfield Unsteadiness and Turbulence in Multistage Low Pressure Turbines

Halstead, David E., General Electric Co., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 237-250; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Experiments were conducted to measure flowfield unsteadiness and turbulence in a multistage, axial-flow, low pressure turbine. Measurements were obtained at inter-blade-row stations extending from the inlet to exit of the machine. The streamwise and transverse velocity components were resolved using an X hot-film probe. Characteristics of the turbulence environment are quantified in terms of intensity, length scale, and the turbulence energy spectrum. For the first time, measurements of length scale from a low pressure turbine are reported. A procedure to calculate turbulence length scale based on the frequency-averaged spectra

is presented. In the low pressure turbine, levels of turbulence intensity are found to increase progressively across the two stages of blading. Length scales measure nominally thirty percent of the throat width of the upstream bladerow. The complexity of the time-unsteady flowfield between bladerows is shown to increase markedly through the turbine. At the inlet to the second stage nozzle, the unsteadiness correlates directly to the circumferential clocking position of the upstream nozzle bladerow. At the exit of the turbine, there is no discernible ”freestream” region in the time-varying distribution of turbulence intensity. This suggests simulation experiments carried out using wake generators upstream of an airfoil cascade or using a single stage turbine will not simulate many features of the flowfield in multistage machines. The measurements are presented in a manner that they can be used readily to establish relevant inlet conditions for experimental facilities and for CFD analyses.
Author
Low Pressure; Turbine Blades; Turbulence; Unsteady Flow; Free Flow; Boundary Layer Transition; Boundary Layer Flow; Blade-Vortex Interaction; Computerized Simulation

19980206222 Minnesota Univ., Minneapolis, MN USA
An Experimental Investigation of Transition as Applied to Low Pressure Turbine Suction Surface Flows
Qiu, Songgang, Minnesota Univ., USA; Simon, Terrence W., Minnesota Univ., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 251-282; In English; Also announced as 19980206205
Contract(s)/Grant(s): NAG3-1732; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Results of an experimental study of flow separation and transition in either attached boundary layers or separated shear layers over the suction surface of a simulation of a low-pressure turbine airfoil flow are presented. Detailed velocity profiles were measured with the hot-wire technique. Static pressure distributions are also presented. Flow transition is documented using measured intermittency distributions in the boundary layer and the separated shear layer. Cases for Reynolds numbers of 50,000, 100,000, 200,000 and 300,000 are reported. These Reynolds numbers are based on suction surface length and exit velocity. Three Free Stream Turbulence Intensity values, 0.5%, 2.5% and 10%, are represented. Flow separation is observed for all the low-FSTI cases. Of these, the lowest Reynolds number case was not able to complete transition of the shear layer and the separation bubble persisted over the entire blade surface. For the other low-FSTI cases, transition is observed in the shear layer over the separation bubble. This transition proceeded quickly, spreading rapidly toward the wall. Elevated FSTI drives an earlier transition than in the low-FSTI cases and the separation bubbles are smaller. For the highest Reynolds number cases with 2.5% and 10% FSTI, transition is of the attached boundary layer and no separation exists. Flow separation with shear flow transition is observed for the lower-Re cases. Models for intermittency and transition length and location from the modern literature are assessed.
Author
Boundary Layer Separation; Boundary Layer Transition; Boundary Layer Flow; Intermittency; Low Pressure; Gas Turbines; Suction; Surface Roughness Effects; Separated Flow; Turbulent Boundary Layer; Blade-Vortex Interaction; Wind Tunnel Tests; Reattached Flow

19980206223 General Motors Inst., Engineering and Management Inst., Flint, MI USA
Numerical Simulations of Steady and Unsteady Transition in Low-Pressure Turbine Blade Rows
Dorney, Daniel, General Motors Inst., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 283-301; In English; Also announced as 19980206205
Contract(s)/Grant(s): NAG3-1668; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Transition plays an important role in the prediction of losses and performance in low-pressure turbines. The transition location on a turbine blade may vary significantly because of the wakes from upstream blade rows, and intermittent flow separation can also affect the transition process in an unsteady flow environment. In the present investigation, an unsteady Navier-Stokes analysis is used to predict transition in a low-pressure turbine cascade and a low-pressure turbine stage. The numerical flow analysis is third-order spatially accurate and second-order temporally accurate, and the equations of motion are integrated using an implicit time-marching procedure. The Baldwin-Lomax and k-epsilon turbulence models, in conjunction with several algebraic transition models, have been used to predict the location of transition. Predicted results include unsteady blade loadings, time-histories of the pressure, transition locations and boundary layer quantities, as well as performance quantities and comparisons with the available experimental/design data.
Author
K-Epsilon Turbulence Model; Baldwin-Lomax Turbulence Model; Computerized Simulation; Turbulent Boundary Layer; Navier-Stokes Equation; Separated Flow; Unsteady Flow; Blade-Vortex Interaction; Turbine Blades; Boundary Layer Transition; Boundary Layer Separation; Transition Flow; Cascade Flow; Computational Fluid Dynamics

19980206224 Syracuse Univ., NY USA

Wavelet Analysis of Turbulent Spots and Other Coherent Structures in Unsteady Transition

Lewalle, Jacques, Syracuse Univ., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 303-312; In English; Also announced as 19980206205

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This is a secondary analysis of a portion of the Halstead data. The hot-film traces from an embedded stage of a low pressure turbine have been extensively analyzed by Halstead et al. In this project, wavelet analysis is used to develop the quantitative characterization of individual coherent structures in terms of size, amplitude, phase, convection speed, etc., as well as phase-averaged time scales. The purposes of the study are (1) to extract information about turbulent time scales for comparison with unsteady model results (e.g. k/epsilon). Phase-averaged maps of dominant time scales will be presented; and (2) to evaluate any differences between wake-induced and natural spots that might affect model performance. Preliminary results, subject to verification with data at higher frequency resolution, indicate that spot properties are independent of their phase relative to the wake footprints: therefore requirements for the physical content of models are kept relatively simple. Incidentally, we also observed that spot substructures can be traced over several stations; further study will examine their possible impact.
Author

Wavelet Analysis; Turbulence; Reynolds Averaging; Navier-Stokes Equation; Computational Fluid Dynamics; K-Epsilon Turbulence Model; Boundary Layer Transition; Transition Flow; Unsteady Flow

19980206225 Cambridge Univ., Cambridge, UK

Transition in Leading-Edge Separation Bubbles

Khan, Rajesh, Cambridge Univ., UK; Cumptsy, Nick, Cambridge Univ., UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 315-321; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Separation bubbles are very common near the leading edge of airfoils. Although extending over a few percent of chord (normally less than 5 percent) they are of technological importance because they can determine the development of the boundary layer over the remainder of the chord. Measurements have shown that freestream turbulence has a very large effect on the nature of the bubble, with raised levels of turbulence leading to a pronounced shortening of the bubble. Quite different transition processes appear to be involved, depending on the level of turbulence and the incidence onto the airfoil. At low incidence no evidence of spot transition could be seen, but at higher incidence and low freestream turbulence spots are clearly visible in the bubble shear layer.
Author

Bubbles; Boundary Layers; Boundary Layer Transition; Leading Edges; Low Turbulence; Free Flow; Airfoils; Transition Flow; Boundary Layer Separation

19980206226 Clemson Univ., SC USA

Laminar-Turbulent Transition in Separated Boundary Layers

Wang, Ting, Clemson Univ., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 323-336; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Experiments were conducted to investigate the laminar-turbulent transition process in separated boundary layers. Fifteen different cases of separated-flow transition have been analyzed in detail. The objectives were to: (a) clarify the confusing and inconsistent views of short and long separation bubbles, (b) clearly distinguish the difference of the short laminar bubble and the transitional separation bubble, (c) establish new criteria to describe separation flow structure, and (d) provide new empirical correlations for predicting various modes of separation bubbles. In this study, laminar separation is defined as the separation which starts in the laminar boundary layer and transition occurs between the separation point and the reattachment point but outside the dividing streamline. The reattachment of a laminar separation bubble is usually attributed to the completion of the transition process when the mixing of turbulent flow overcomes the adverse pressure gradients. Therefore, the laminar separation bubble is usually completed with a turbulent flow reattachment. The turbulent separation is defined as a separation which starts in the turbulent boundary layer, and reattachment is usually attributed to reduced adverse pressure gradients. The transitional separation is defined as the separation which starts in the transitional boundary layer and the reattachment occurs while still in the transitional boundary layer or in the fully turbulent boundary layer. The overall outlook of the configuration of the laminar bubble is almost identical to that of the transitional bubble; however, their structures are different and the flow conditions (such as Reynolds numbers and pressure gradient parameters) in which they occur are very different. A hypothesized model for transition process in different modes of separation bubbles is proposed. It can be seen that the structure of the laminar short bubble is different from the transitional separation bubble. For example, in the laminar short bubble, the onset of transition occurs near the maximum displace-

ment location, and the maximum turbulence energy (u') occurs near the reattachment point. However, in the transitional separation bubble, the transition starts upstream of the separation point and the maximum u' occurs near the maximum displacement point. The prediction model to be developed would specifically identify the regions in which various separation models prevail. A preliminary attempt to develop a separation prediction model is shown. The data points shown in are compiled from the open literature. It can be seen from that the combination of the pressure parameter at separation (Ks) and various Reynolds numbers, namely at separation point (Re(sub S)), at the maximum displacement point (Re(sub MD)), and at the reattachment point (Re(sub R)), constitute specific relations for various separation modes. For example, the reattachment Reynolds number (Re(sub R)) is greater than the separation Reynolds number (Re(sub S)) in the laminar long bubble mode, whereas (Re(sub R)) <(Re(subS))inthetransitionl separation mode even though the reattachment point is downstream of the separation point. It must be noted that the pressure parameter (K) alone cannot determine the separation mode. Spectra and wavelet analyses were also performed to study the unsteady features of the bubble pulsation, vortex shedding, and bubble ejections.
Author
Boundary Layer Transition; Laminar Boundary Layer; Turbulent Boundary Layer; Bubbles; Transition Flow; Reynolds Number; Laminar Flow; Boundary Layer Separation; Turbulence Models

19980206227 University Coll., London, UK
Free Transition Onset in Separations or Wakes
Smith, Frank T., University Coll., UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 337-352; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This is current work aimed at further theoretical and physical understanding of transition in the approach to separation, within separation itself, and in near-wakes. The common theme is the onset of effectively inviscid inflectional growth and the associated influence of nonlinear effects in two or three dimensions. The research starts with transition near a wall. Here, three-dimensional nonlinear initial-value (spot) problems are derived concerning the onset of transition, in inflectional flow over a surface roughness buried within a boundary layer and in many related flow configurations. This is for the free evolution of general disturbances rather than forced, fixed frequency or fixed wavelength evolutions. An integral criterion of earlier nonlinear work holds at leading order. The nonlinear amplitude-evolution equation then obtained at the next order is for quite general initial conditions of the disturbance, not just wave packets. Three or four such initial-value problems are developed, along with analytical and computational solution properties which include nonlinear bounded behaviour leading to persistent vortex effects as time increases, or quasi-linear decay, or nonlinear finite-time blowups of the disturbance amplitude. Overall, the spot behaviour depends on local conditions, e.g. whether adverse or not, but also on the incident disturbance size. Induced longitudinal vortices play a key role. The discussion includes the connections between the different cases present, and the links with roughness-transition experiments. Recent study has begun on inflectional onset for an entire boundary layer at or near the start of a section of adverse pressure gradient on an airfoil. Again the nonlinear initial-value or spot problem is of concern. Work is also in progress on short-scale and fast-time transition at the start of a separation or a wake, from the initial-value viewpoint. Developments will be described as appropriate at the workshop. Areas currently being investigated in this theoretical research are on transitions in (1) near-wakes, (2) adverse-pressure-gradient boundary layers, (3) roughness flows, (4) larger-scale separating flows. All these are addressing initial-value problems, producing spots. Area (2) will be mentioned in section 5; (3) has connections with (2); and (4) is partly related to (1). Here the main focus is on area (1), for the incompressible range.
Author
Boundary Layer Separation; Boundary Layer Transition; Near Wakes; Nonlinear Evolution Equations; Inviscid Flow; Boundary Value Problems; Surface Roughness; Transition Flow; Mathematical Models; Incompressible Boundary Layer; Blade-Vortex Interaction

19980206228 Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel
Laminar-Turbulent Transition in Pipe Poiseuille Flow and its Similarity to Transition in Boundary Layers
Eliahou, S., Tel-Aviv Univ., Ramat-Aviv, Israel; Han, G., Tel-Aviv Univ., Ramat-Aviv, Israel; Tumin, A., Tel-Aviv Univ., Ramat-Aviv, Israel; Wygnanski, I., Tel-Aviv Univ., Ramat-Aviv, Israel; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 353-365; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Transition in fully developed circular pipe flow was investigated experimentally by introduction of periodic perturbations. The simultaneous excitation of the azimuthal periodic modes m = +2 and m = -2 was chosen for detailed analysis. The experiments were carried out at three amplitudes. At the smallest amplitude the disturbances decayed in the direction of streaming. At the intermediate amplitude a transient growth of the disturbances was observed, and it was accompanied by higher harmonics. At still higher amplitudes transition occurred. A mean velocity distortion corresponding to azimuthal index of m = 4 was observed before

occurrence of transition to turbulence. When four stationary jets were introduced through the wall to emulate a similar mean velocity distortion, transition was observed at smaller amplitudes of forcing at the same azimuthal modes (i.e. m = +/- 2). Thus, weak stationary longitudinal vortices provide an added instability needed to generate a secondary disturbance which, in turn, amplifies the steady vortical structures introduced by the jets. The phenomenon described above is responsible for the concomitant development of azimuthal variations in mean velocity and in the amplitude of the disturbance. Peaks and valleys are generated as in "K"-type of breakdown in boundary layers. Analysis of temporal records of velocity disturbances revealed the presence of spikes prior to transition and these spikes are associated with the largest amplitudes observed. The spectrum of the spikes comprises the fundamental frequency, its higher harmonics, and a geometric progression factor corresponds to the values obtained in boundary layers. It follows that a similarity exists between the latest stages of transition in Poiseuille pipe flow and in boundary layers. The main difference is that the pipe flow is linearly stable and requires sufficiently large input to trigger a nonlinear mechanism.
Author
Boundary Layer Transition; Pipe Flow; Turbulent Boundary Layer; Laminar Boundary Layer; Transition Flow; Nonlinearity; Vortices; Laminar Flow; Wall Jets; Jet Mixing Flow

19980206229 Pennsylvania State Univ., University Park, PA USA
Prediction of Unsteady Transitional Layers in Turbomachinery Using Navier Stokes Equations
Lakshminarayana, B., Pennsylvania State Univ., USA; Chernobrovkin, A., Pennsylvania State Univ., USA; Kang, D. J., Pennsylvania State Univ., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 369-384; In English; Also announced as 19980206205
Contract(s)/Grant(s): NAG3-2025; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The objective of the research reported in this presentation is to develop computational techniques for the prediction of unsteady transitional flows associated with the rotor stator interaction in turbomachinery. Three low-Reynolds number turbulence models are incorporated in two unsteady Navier-Stokes codes (one is pressure based and the other is time marching with Runge-Kutta time stepping) and evaluated for accuracy in predicting the onset and the end of unsteady transitional patches due to wake passing. The best model is then used for modification and improvement for the leading edge effect. An existing steady Navier-Stokes code was modified to include pseudo-time stepping, which provided acceleration from 5 to 25 times that of the original code. A systematic validation procedure was implemented to assess the effects of the grid, artificial dissipation, physical, and the pseudo-time step for an accurate prediction of transitional flows resulting from the rotor-stator interaction. The ability of the Navier-Stokes code to predict the unsteady transitional flow on a turbomachinery blade is demonstrated. The unsteady pressure and velocity fields are in good agreement with the experimental data and the prediction from the Euler/boundary layer approach. The numerical solver was able to capture all zones (wake induced transitional strip, wake induced turbulent strip, calmed region, etc.) associated with wake induced transition in a compressor cascade. Another significant step is the assessment of k-epsilon turbulence models, including the leading edge modifications. Best results were obtained from the FLB model. The LB model predicted earlier inception of the transition and shorter transition length. Modification of the k-epsilon model was found to be essential for an accurate prediction of the unsteady transitional flow in a compressor cascade. The CH model failed to predict the unsteady transitional flow. Predicted boundary layer was turbulent from the leading edge, even with the modification of the k-epsilon model near the stagnation point. A comparison of the instantaneous shape factor, the skin friction coefficient, and the momentum thickness indicates that the Navier-Stokes predictions are reasonably good. Interaction between the upstream wake and stator wake results in shedding of unsteady vortices from the trailing edge and increased dissipation in the stator wake and, as a consequence, increased rate of decay of the stator wake. The procedure developed at Penn State should aid the designers of turbomachinery in allowing for the unsteady transitional flows due to rotor-stator interaction.
Author
Computational Fluid Dynamics; Navier-Stokes Equation; K-Epsilon Turbulence Model; Runge-Kutta Method; Unsteady Flow; Transition Flow; Boundary Layer Transition; Stators; Turbomachinery; Computerized Simulation; Rotors; Rotor Stator Interactions

19980206230 NASA Lewis Research Center, Cleveland, OH USA
Direct Numerical Simulations of Boundary Layer Transition on a Flat Plate
Rai, Man Mohan, NASA Lewis Research Center, USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 385-394; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In recent years the techniques of computational fluid dynamics (CFD) have been used to compute flows associated with geometrically complex configurations. However, success in terms of accuracy and reliability has been limited to cases where the effects of turbulence and transition could be modeled in a straightforward manner. Even in simple flows, the accurate computation

of skin friction and heat transfer using existing turbulence models has proved to be a difficult task, one that has required extensive fine-tuning of the turbulence models used. In more complex flows (for example, in turbomachinery flows in which vortices and wakes impinge on airfoil surfaces causing periodic transitions from laminar to turbulent flow) the development of a model that accounts for all scales of turbulence and predicts the onset of transition is an extremely difficult task. Fortunately, current trends in computing suggest that it may be possible to perform direct simulations of turbulence and transition at moderate Reynolds numbers in some complex cases in the near future. This presentation will focus on direct simulations of transition and turbulence using high-order accurate finite-difference methods. The advantage of the finite-difference approach over spectral methods is that complex geometries can be treated in a straightforward manner. Additionally, finite-difference techniques are the prevailing methods in existing application codes. An application of high-order-accurate finite-difference methods to direct simulations of transition and turbulence in a spatially evolving boundary layer subjected to high levels of freestream turbulence will be presented.
Author
Computational Fluid Dynamics; Boundary Layer Transition; Direct Numerical Simulation; Finite Difference Theory; Euler Equations of Motion; Turbulence; Compressible Flow; Flat Plates; Mathematical Models

19980206231 Queen Mary and Westfield Coll., London, UK
Direct Numerical Simulations of Transition to Turbulence
Sandham, N. D., Queen Mary and Westfield Coll., UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 395-403; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Advances in computer hardware make direct numerical simulations (DNS) of the full Navier-Stokes equations a convenient source of data for studies of the final stages of transition to turbulence. The objective of this contribution is to review recent advances in techniques, outlining the range of problems that can currently be simulated, and to present results from some of the latest simulations. Several of the earlier simulations followed the route to turbulence initiated by a vibrating ribbon, starting the simulations with quite large amplitude (e.g. 3%) two-dimensional disturbances. This was useful as the simulations could be validated against previous experiments and against the emerging theories of secondary instability. End-stage transition studies from such simulations have been reported in detail for incompressible channel flow and for supersonic (Mach 2 and Mach 5 respectively) boundary layers. Such studies have focused primarily on the role of vorticity stretching and shear-layer roll-up as the physical mechanisms that lead from Lambda or quasi-streamwise vortices to the formation of a regeneration cycle of near-wall turbulence. Once the regeneration cycle is established a relaxation to the expected time-averaged statistics of turbulent flow is observed. Simulations of transition induced by local disturbances are more computationally intensive, owing to the larger physical domains that must be used to capture the evolving turbulent spot. Simulations can be validated against theory for linear propagation and growth of a wave packet. The initial stages of turbulent spot formation have been studied in some detail. Although the initiation, via fluid injection from the surface, is completely different from the vibrating-ribbon method, similarities occur in the end-stage of transition, as the turbulent spot establishes itself. Formation of new vortices can be followed using the same conceptual framework. Another transition scenario that can be simulated by DNS is that of laminar separation bubbles. Alain & Sandham carry out spatial simulations with 256 x 128 x 12O grid points for separation of a laminar boundary layer, transition of the separated shear layer triggered by oblique disturbances, reattachment as a turbulent boundary layer with slow downstream relaxation to log-law behaviour. Such simulations do not require excessively long run times on current supercomputers as the problems parallelize very efficiently. Data from the simulations are being used to assess the capability of turbulence models to predict the reattachment and relaxation regions of the flow.
Author
Boundary Layer Transition; Laminar Boundary Layer; Navier-Stokes Equation; Direct Numerical Simulation; Computational Fluid Dynamics; Turbulence; Turbulence Models; Turbulent Boundary Layer; Vortices; Bubbles; Incompressible Flow

19980206232 Ohio State Univ., Columbus, OH USA
Transition in Turbine Flows
Herbert, Thorwald, Ohio State Univ., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 405-416; In English; Also announced as 19980206205
Contract(s)/Grant(s): NAS3-27010; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We have further developed our capabilities to analyze transition in turbine boundary layers from first principles by integrating the nonlinear parabolized stability equations (PSE) with improved initial and boundary conditions. With modified iteration schemes, we are able to proceed deeper into the transition region where skin friction coefficient and heat transfer coefficient significantly increase. Initial and boundary conditions at elevated turbulence levels can be derived by receptivity analysis. Test runs for ERCOFTAC test case T3A at 2.4\% turbulence level provide results in good agreement with the experimental data. The sharper

minimum of the skin coefficient also shown by DNS results is likely due to the missing intermittency. The method has been applied to various experimentally studied turbine blades (UTRC, VKI, Zierke, Langston, Hippensteele, and others). The PSE results, though physically reasonable, do not agree as well as expected with the experimental findings. We have, therefore, performed an extensive search for the reasons of the seemingly systematic deviations. A first source of uncertainty has been found in the often insufficient documentation of the experiments (e.g. on blockage by end-wall boundary layers). However, variation of the relevant parameters does not lead to more satisfactory agreement. A second reason has been found in the ”standard procedure” which considers a 2D flow at midspan and uses a panel code and subsequent boundary-layer code to obtain the laminar basic flow for the transition analysis. Comparison with the pressure distribution obtained with a 3D design code (RVC3D) shows significant three-dimensionality of the flow (e.g. in the UTRC experiments). The spanwise variation has been neglected in our original PSE code. to overcome this problem, we have developed the PSE/3D for fully 3D boundary layers to account for streamwise and spanwise variations. Since the design code does not provide the boundary-layer flow with sufficient resolution, we have generated the Euler solution and employed a 3D boundary-layer code to obtain the viscous basic flow. Although only the linear stability level of PSE/3D has been implemented so far, the discrepancies with the experiments change but do not disappear. We still find deviations between the computed and experimental variations of C(sub f), and St along the blade for laminar flow. The main reason can be seen by comparing the solution of the boundary-layer code with the viscous results of the design code. The conventional boundary-layer solution exhibits an asymptotic behavior appropriate in external aerodynamics but does not match the steep gradients of the inviscid flow through the passage and consequently provides biased results for C(sub f), and St. An attempt is currently being made to correct this deficiency. Before attempting to perform the transition analysis for the viscous flow provided by the design code, we have analyzed the implementation and ”best possible” results. Code and results exhibit flaws that may negatively affect the design and are intolerable for transition analysis. Therefore, we have decided to develop a new code to obtain a reliable basis for stability and transition studies. We expect to report improved results by the time of the meeting.
Author

Transition Flow; Boundary Layer Flow; Boundary Layer Transition; Computational Fluid Dynamics; Three Dimensional Boundary Layer; Mathematical Models; Turbulence; Flow Visualization; Parabolic Differential Equations; Blade-Vortex Interaction; Computerized Simulation

19980206233 Imperial Coll. of Science and Technology, London, UK

Vortex Particle in Cell Computations of Vortex-Surface Interactions

Doorly, D. J., Imperial Coll. of Science and Technology, UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 419-426; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The eruption process in a turbulent boundary layer is responsible for the production of turbulence. The problem is extremely complex, but certain essential features can be represented by studying model problems. Such model problems can provide inspiration and guidance for improved theoretical modelling of the essential dynamics. to start, we consider the problem of an eddy modelled as a single region of vorticity in the outer flow interacting with a boundary layer. The problem is common to other areas, such as the interaction of trailing aircraft vortices with the ground and their behaviour in cross-flow. Hence, we examine the role of the viscous and inviscid dynamics in the eruption of the shear layer. In the work to be presented, a vortex particle-in-cell method based on the velocity-vorticity formulation of the Navier-Stokes equations is applied to the problem. The method is equally suitable for 2 or 3D flows, and since convection is treated as a Lagrangian particle move, the approach shares the favorable stability and low diffusive nature of the grid-free vortex particle method. The ability to track the evolution of strong vortical regions, and scalar concentrations which the procedure possesses are particularly important for these applications. The method is described and applied to the above problem. In particular the relative importance of viscous and inviscid effects in the initiation and subsequent development of the wall layer eruption are examined by contrasting the solutions of the full and reduced equations.
Author

Vortex In Cell Technique; Particle In Cell Technique; Turbulent Boundary Layer; Surface Reactions; Navier-Stokes Equation; Inviscid Flow; Wall Flow; Vortices; Computational Fluid Dynamics; Mathematical Models; Computerized Simulation; Turbulence

19980206234 Ghent Univ., Belgium

Modelling of By-Pass Transition with Conditioned Navier-Stokes Equations

Steelant, J., Ghent Univ., Belgium; Dick, E., Ghent Univ., Belgium; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 427-433; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

By-pass transition emanates mainly from high free-stream turbulence and leads to a transition far further upstream than what would be expected for natural transition. From the start until the end of transition, the flow is characterized by changing gradually from laminar to turbulent flow. This intermittency zone can be evaluated by an intermittency factor lambda which has an almost universal character for different flow patterns. Also, near the edge of the laminar boundary layer, the turbulence in the free stream interacts intermittently with the outer layer of the pre-transitional boundary layer. This behavior can be evaluated by a freestream factor omega. When modelling transition, it is essential to take these factors into account. Global time averaging used for classical turbulence modelling is not valid in intermittently changing flows. to describe the transitional zone and the outer layer zone, it is necessary to use conditional time averaging. These averages are taken during the fraction of time the flow is laminar or turbulent respectively. Conditionally averaged Navier-Stokes equations lead both for the laminar and turbulent part to a set of equations for mass, momentum and energy. These conditioned equations differ from the original Navier-Stokes equations by the presence of source terms which are functions of the weighting factor tau, which is the sum of the intermittency factor lamda and the free-stream factor omega. For the workshop, the method will be derived and tested on test cases with zero, favorable and adverse pressure gradient. The strength of the method will be demonstrated by comparison of experimental and numerical results on the basis of global (C(sub f),theta,...) and detailed (u, k, lamda) flow parameters.
Derived from text

Turbulent Boundary Layer; Boundary Layer Transition; Navier-Stokes Equation; Computational Fluid Dynamics; Laminar Boundary Layer; Intermittency; Turbulent Flow; Transition Flow; Mathematical Models; Pressure Gradients; Flow Equations

19980206235 NASA Lewis Research Center, Cleveland, OH USA

Transition Heat Transfer Modeling Based on the Characteristics of Turbulent Spots

Simon, Fred, NASA Lewis Research Center, USA; Boyle, Robert, NASA Lewis Research Center, USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 435-449; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

While turbulence models are being developed which show promise for simulating the transition region on a turbine blade or vane, it is believed that the best approach with the greatest potential for practical use is the use of models which incorporate the physics of turbulent spots present in the transition region. This type of modeling results in the prediction of transition region intermittency which when incorporated in turbulence models give a good to excellent prediction of the transition region heat transfer. Some models are presented which show how turbulent spot characteristics and behavior can be employed to predict the effect of pressure gradient and Mach number on the transition region. The models predict the spot formation rate which is needed, in addition to the transition onset location, in the Narasimha concentrated breakdown intermittency equation. A simplified approach is taken for modeling turbulent spot growth and interaction in the transition region which utilizes the turbulent spot variables governing transition length and spot generation rate. The models are expressed in terms of spot spreading angle, dimensionless spot velocity, dimensionless spot area, disturbance frequency and Mach number. The models are used in conjunction with a computer code to predict the effects of pressure gradient and Mach number on the transition region and compared with VKI experimental turbine data.
Author

Blade-Vortex Interaction; Mach Number; Boundary Layer Transition; Transition Flow; Turbulence Models; Turbulent Boundary Layer; Turbulence; Intermittency; Turbulent Heat Transfer; Computational Fluid Dynamics; Computerized Simulation; Pressure Gradients

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Prediction of Transitional Flows in the Low Pressure Turbine

Huang, George, Kentucky Univ., USA; Xiong, Guohua, Kentucky Univ., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 451-463; In English; Also announced as 19980206205
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Current turbulence models tend to give too early and too short a length of flow transition to turbulence, and hence fail to predict flow separation induced by the adverse pressure gradients and streamline flow curvatures. Our discussion will focus on the development and validation of transition models. The baseline data for model comparisons are the T3 series, which include a range of free-stream turbulence intensity and cover zero-pressure gradient to aft-loaded turbine pressure gradient flows. The method will be based on the conditioned N-S equations and a transport equation for the intermittency factor. First, several of the most popular 2-equation models in predicting flow transition are examined: k-e [Launder-Sharina], k-w [Wilcox], Lien-Leschiziner and SST [Menter] models. All models fail to predict the onset and the length of transition, even for the simplest flat plate with zero-pressure gradient(T3A). Although the predicted onset position of transition can be varied by providing different inlet turbulent energy dissipation rates, the appropriate inlet conditions for turbulence quantities should be adjusted to match the decay of

the free-stream turbulence. Arguably, one may adjust the low-Reynolds-number part of the model to predict transition. This approach has so far not been very successful. However, we have found that the low-Reynolds-number model of Launder and Sharma [1974], which is an improved version of Jones and Launder [1972] gave the best overall performance. The Launder and Sharma model was designed to capture flow re-laminarization (a reverse of flow transition), but tends to give rise to a too early and too fast transition in comparison with the physical transition. The three test cases were for flows with zero pressure gradient but with different free-stream turbulent intensities. The same can be said about the model when considering flows subject to pressure gradient(T3C1). to capture the effects of transition using existing turbulence models, one approach is to make use of the concept of the intermittency to predict the flow transition. It was originally based on the intermittency distribution of Narasimha [1957], and then gradually evolved into a transport equation for the intermittency factor. Gostelow and associates [1994,1995] have made some improvements to Narasimha's method in an attempt to account for both favorable and adverse pressure gradients. Their approach is based on a linear, explicit combination of laminar and turbulent solutions. This approach fails to predict the overshoot of the skin friction on a flat plate near the end of transition zone, even though the length of transition is well predicted. The major flaw of Gostelow's approach is that it assumes the non-turbulent part being the laminar solution and the turbulent part being the turbulent solution and they do not interact across the transitional region. The technique in condition averaging the flow equations in intermittent flows was first introduced by Libby [1975] and Dopazo [1977] and further refined by Dick and associates [1988, 1996]. This approach employs two sets of transport equations for the non-turbulent part and the other for the turbulent part. The advantage of this approach is that it allows the interaction of non-turbulent and turbulent velocities through the introduction of additional source terms in the continuity and momentum equations for the non-turbulent and turbulent velocities. However, the strong coupling of the two sets of equations has caused some numerical difficulties, which requires special attention. The prediction of the skin friction can be improved by this approach via the implicit coupling of non-turbulent and turbulent velocity flelds. Another improvement of the interrmittency model can be further made by allowing the intermittency to vary in the cross-stream direction. This is one step prior to testing any proposal for the transport equation for the intermittency factor. Instead of solving the transport equation for the intermittency factor, the distribution for the intermittency factor is prescribed by Klebanoff's empirical formula [1955]. The skin friction is very well predicted by this new modification, including the overshoot of the profile near the end of the transition zone. The outcome of this study is very encouraging since it indicates that the proper description of the intermittency distribution is the key to the success of the model prediction. This study will be used to guide us on the modelling of the intermittency transport equation.
Author
Boundary Layer Separation; Boundary Layer Transition; Turbulent Boundary Layer; Computational Fluid Dynamics; Flow Equations; Turbulence Models; Turbulence; Intermittency; Computerized Simulation; Transition Flow

19980206261 Iowa State Univ. of Science and Technology, Dept. of Aerospace Engineering, Ames, IA USA
Analysis and Computation of Viscous Flows: 3D Flows, Separation and Transition ***Final Report, 1 May 1995 - 28 Feb. 1998***
Rothmayer, Alric P., Iowa State Univ. of Science and Technology, USA; May 14, 1998; 7p; In English
Contract(s)/Grant(s): F49620-95-1-0275
Report No.(s): AD-A345579; AFRL-SR-BL-TR-98-0472; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
A triple-deck theory was developed for thermo-mechanical interaction of air, ice and water. A novel interaction regime was found in which the low speed lower - deck flow can interact with both the liquid - film/droplets and the ice growth through a Stephan condition. A new broad band icing instability was observed, which is believed can lead to the creation of complex short scale roughness and provide a mechanism to explain the sensitive dependence on initial conditions often observed in icing experiments. DTIC
Ice Formation; Viscous Flow; Three Dimensional Flow; Computational Fluid Dynamics

19980206325 Los Alamos National Lab., NM USA
Regular and chaotic flow patterns upon impulsive spin-up of a Rayleigh-Benard convection cell
Vorobieff, P., Los Alamos National Lab., USA; Ecke, R. E., Los Alamos National Lab., USA; 1997; 7p; In English; 4th; Experimental Chaos Conference, 6 - 8 Aug. 1997, Boca Raton, FL, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3463; CONF-970851; DE98-000268; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche
A cylindrical, completely enclosed Rayleigh-Benard convection cell with radius-to-height ratio (Gamma)=(1/2) is subjected to impulsive spin-up about its vertical axis. The authors study produces TLC (thermochromic liquid crystal) temperature measurements and PIV (particle image velocimetry) velocity reconstruction of the transient state between the two regimes of turbulent convection corresponding to the cell at rest and in steady rotation. The most persistent transient feature emerging is a sharply

defined ringlike pattern characterized by a decrease in temperature and high azimuthal shear. The latter leads to formation of Kelvin-Helmholz vortices. Initially azimuthally regular, the pattern of these vortices loses its regularity and thus completes the transition to rotating convection state.
DOE
Convection Cells; Rayleigh-Benard Convection; Temperature Measurement; Particle Image Velocimetry; Flow Distribution

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INSTRUMENTATION AND PHOTOGRAPHY

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

19980203214 Communications Research Lab., Tokyo, Japan
Calibration System for Charged Particle Analyzer
Miyake, Wataru, Communications Research Lab., Japan; Sagawa, Eiichi, Communications Research Lab., Japan; Kawabe, Akira, Communications Research Lab., Japan; Yoshioka, Risa, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 277-284; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

A new system has been developed for calibration of charged particle analyzers, including ion mass spectrometers, on board spacecraft. The system provides a spatially uniform, parallel, and mono-energetic beam of a single ion species over the energy per charge range up to 30 keV. The mass per charge of ions can be selected to be as large as or larger than 4 (He(+)). The system includes an imaging ion beam monitor and an automatic control of acquiring the transmission characteristics of a charged particle analyzer as a function of incident angles and energy of ion beams. This paper describes the outline and the obtained characteristics of the system.
Author
Charged Particles; Ion Beams; Calibrating; Analyzers

19980203414 Technical Univ. of Denmark, Inst. for Kemiteknik, Lyngby, Denmark
Development and test of an alkali probe for pressurized combustion and gasification conditions
Hansen, J., Technical Univ. of Denmark, Denmark; Dam-Johansen, K., Technical Univ. of Denmark, Denmark; Jan. 1997; 13p; In English
Contract(s)/Grant(s): ENS-1323/93-0006; JOU2/CT93-0431
Report No.(s): CHEC-R-9622; DE98-701653; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A positioning device for inserting and withdrawing gas sample probes from pressurized gasification/combustion vessels during operation has been developed. In this work the device has been applied to the measuring of alkali metal compounds, but it is readily applicable to other purposes. The alkali measurement system is based on the condensation principle: Water samples used for rinsing the probe system are analysed by ion chromatography. The system was calibrated in the ranges 0-30 ppbv and 5-15 ppmv. In order to separate fly ash particles from the sample gas, a number of different hot gas filters were tested in the laboratory and on full-scale atmospheric boilers. It was found that all the tested filters were capturing alkali and therefore not suited for the measurements. However, the system is able to measure total alkali concentration down to 30 ppbv, without the use of a particle filter. The system was tested under cold pressurized conditions and under hot atmospheric conditions firing biomass, coal and cofiring coal and biomass.
DOE
Alkali Metals; Combustion; Gas Analysis; Flue Gases; Gasification; Gas Detectors; High Temperature Gases

19980203722 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
High Transition-Temperature SQUID Magnetometers and Practical Applications
Dantsker, E., California Univ., USA; May 1997; 190p; In English
Contract(s)/Grant(s): DE-AC03-76SF-00098
Report No.(s): LBNL-40406; DE97-008855; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The design, fabrication, and performance of SQUID magnetometers based on thin films of the high-transition temperature superconductor YBa2Cu3O(7-x) (YBCO) are described. Essential to the achieving high magnetic field resolution at low frequencies is the elimination of 1/f flux noise due to thermally activated hopping of flux vortices between pinning sites in the superconducting films. Through improvements in processing, 1/f noise in single layer YBCO thin films and YBCO-SRTiO3-YBCO trilayers was systematically reduced to allow fabrication of sensitive SQUID magnetometers. Both single-layer directly coupled SQUID magnetometers and multilayer magnetometers were fabricated, based on the dc SQUID with bicrystal grain boundary Josephson junctions. Multilayer magnetometers had a lower magnetic field noise for a given physical size due to greater effective sensing areas. A magnetometer consisting of a SQUID inductively coupled to the multiturn input coil of a flux transformer in a flip-chip arrangement had a field noise of 27 fT Hz(sup (-1/2)) at 1 Hz and 8.5 fT Hz(sup (-1/2)) at 1 kHz. A multiloop multilayer SQUID magnetometer had a field noise of 37 fT Hz(sup (-1/2)) at 1 Hz and 18 fT Hz(sup (-1/2)) at 1 kHz. A three-axis SQUID magnetometer for geophysical applications was constructed and operated in the field in the presence of 60 Hz and radiofrequency noise. Clinical quality magnetocardiograms were measured using multilayer SQUID magnetometers in a magnetically shielded room.

DOE

Squid (Detectors); Magnetometers; YBCO Superconductors; Superconducting Films; Thin Films; Fabrication

19980203808 Computer Sciences Corp., Lanham, MD USA

A transition matrix approach to the Davenport gryo calibration scheme

Natanson, G. A., Computer Sciences Corp., USA; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 373-387; In English; Also announced as 19980203775

Contract(s)/Grant(s): GS-35F-4381G; NASA Order S-03365-Y

Report No.(s): AAS-98-334; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The in-flight gyro calibration scheme commonly used by NASA Goddard Space Flight Center (GSFC) attitude ground support teams closely follows an original version of the Davenport algorithm developed in the late seventies. Its basic idea is to minimize the least-squares differences between attitudes gyro- propagated over the course of a maneuver and those determined using post- maneuver sensor measurements. The paper represents the scheme in a recursive form by combining necessary partials into a rectangular matrix, which is propagated in exactly the same way as a Kalman filters square transition matrix. The nontrivial structure of the propagation matrix arises from the fact that attitude errors are not included in the state vector, and therefore their derivatives with respect to estimated a parameters do not appear in the transition matrix gyro defined in the conventional way. In cases when the required accuracy can be achieved by a single iteration, representation of the Davenport gyro calibration scheme in a recursive form allows one to discard each gyro measurement immediately after it was used to propagate the attitude and state transition matrix. Another advantage of the new approach is that it utilizes the same expression for the error sensitivity matrix as that used by the Kalman filter. As a result the suggested modification of the Davenport algorithm made it possible to reuse software modules implemented in the Kalman filter estimator, where both attitude errors and gyro calibration parameters are included in the state vector. The new approach has been implemented in the ground calibration utilities used to support the Tropical Rainfall Measuring Mission (TRMM). The paper analyzes some preliminary results of gyro calibration performed by the TRMM ground attitude support team. It is demonstrated that an effect of the second iteration on estimated values of calibration parameters is negligibly small, and therefore there is no need to store processed gyro data. This opens a promising opportunity for onboard implementation of the suggested recursive procedure by combining, it with the Kalman filter used to obtain necessary attitude solutions at the beginning and end of each maneuver.

Author

Calibrating; Kalman Filters; Gyroscopes

19980203838 Naval Postgraduate School, Monterey, CA USA

Evaluation of the Impact of Multispectral Image Fusion on Human Performance in Global Scene Processing

White, Brice Landreau, Naval Postgraduate School, USA; Mar. 1998; 66p; In English

Contract(s)/Grant(s): N00014-97-WR-30078; N00014-97-WR-0091

Report No.(s): AD-A343639; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An observer extracts local and global information from a natural scene to form a visual perception. Neisser and Treisman demonstrated that a natural scene contains different types of features, i.e., color, edges, luminance, and orientation to aid visual search. Infrared and visible sensors present nighttime images to an observer to aid target detection. These sensors present the observer an adequate representation of a nighttime scene, but sometimes fail to provide quality features for accurate visual perception. The purpose of this thesis is to investigate whether color features (combining an infrared and visible sensor image) improve visual scene comprehension compared to single band grayscale features during a signal detection task. Twenty three scenes were

briefly presented in four different sensor formats (infrared, visible, fused monochrome, and fused color) to measure subjects global visual ability to detect whether a natural scene was right side up or upside down. Subjects are significantly more accurate at detecting scene orientation for an infrared and fused color scene compared to a fused monochrome and visible scene. Both the infrared and fused color sensor formats provide enough essential features to allow an observer to perceptually organize a complex nighttime scene.
DTIC
Night Vision; Color Vision; Infrared Detectors; Image Processing; Human Performance; Space Perception

19980203913 Texas Univ., Computer and Vision Research Center, Austin, TX USA
Multisensor Tracking and Recognition of Animate and Inanimate Objects ***Final Report, 30 Sep. 1994 - 31 Dec. 1997***
Aggarwal, J. K., Texas Univ., USA; Ghosh, Joydeep, Texas Univ., USA; Mar. 31, 1998; 23p; In English
Contract(s)/Grant(s): DAAH-04-94-G-0417
Report No.(s): AD-A344840; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report on final results arising from this project, in which we proposed to establish a new paradigm for multisensor tracking and recognition of animate and inanimate objects, fusing a model-based methodology with a neural network-based methodology in an integrated and synergistic manner. Important results are report for the four major project areas: (1) Hybrid ATR systems, (2) Human Motion; (3) Multiple Feature Representation; and (4) Detection and Tracking of Moving Obstacles in the Path of a Navigating Robot. Major accomplishments include the development of: (1) a hybrid intelligent architecture that exploits the complementary nature of symbolic and connection/neural reasoning methodologies for more effective object recognition; (2) a comprehensive mathematical framework to measure the gain in classification performance when several classifiers are combined in a linear fashion; (3) the use of localized gating networks in the mixture-of-experts framework; (4) a Bayesian segmentation framework for textured visual images; (5) a multiple fixed camera system for automatic tracking of human motion in indoor environments; (6) the use of stereo fish-eye lenses for autonomous mobile robot navigation and environment mapping, and (7) an algorithm for moving obstacle detection from a navigating robot.
DTIC
Image Processing; Target Recognition; Autonomous Navigation; Robots; Pattern Recognition

19980203918 Wright State Univ., Dayton, OH USA
Automatic Target Recognition using High-Range Resolution Data ***Final Report***
Shaw, Arnab K., Wright State Univ., USA; Mar. 1998; 90p; In English
Contract(s)/Grant(s): F49620-97-1-0157
Report No.(s): AD-A343438; WSU-OHIO-TR-1; AFRL-SR-BL-TR-98-0331; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A new algorithm is presented for Automatic Target Recognition (ATR) using High Range Resolution (HRR) profiles as opposed to traditional Synthetic Aperture Radar (SAR) images. ATR performance using SAR images degrades considerably in case of moving targets due to blurring caused in the cross-range domain. ATR based on HRR profiles, which are formed without Fourier transform in the cross-range, is expected to have superior performance for moving targets with the proposed method. One of the major contributions of this project so far has been the utilization of Eigen-templates as ATR features that are obtained via Singular Value Decomposition (SVD) of HRR profiles. SVD analysis of a large class of HRR data revealed that the Range-space eigenvectors corresponding to the largest singular value accounted for more than 90% of target energy. Hence, it has been proposed that the Range-space Eigen-vectors be used as templates for classification. The effectiveness of data normalization and Gaussianization of profile data in improving classification performance is also studied. With extensive simulation studies it is shown that the proposed Eigen-template based ATR approach provides consistent superior performance with recognition rate reaching 99.5% for the four class XPATCH database. This research project is being conducted in direct collaboration with the Sensors Directorate's ATR Assessment Branch, Wright Laboratories, Wright-Patt AFB, Dayton, Ohio, where it is being monitored by Dr. Rob Williams. A primary objective df this collaborative effort is to complement and augment various other ongoing research activities being conducted or supported by the Wright Labs ATR research team.
DTIC
Target Recognition; Algorithms; Radar Targets; Radar Imagery; Simulation; Moving Target Indicators

19980203969 Oak Ridge National Lab., TN USA
Upgrade of the wide-angle neutron diffractometer at the high flux isotope reactor
Katano, S., Japan Atomic Energy Research Inst., Japan; Morii, Y., Japan Atomic Energy Research Inst., Japan; Child, H. R., Oak Ridge National Lab., USA; Jul. 15, 1997; 8p; In English; Neutron Scattering, 17 - 21 Aug. 1997, Toronto, Canada

Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-970814-8; DE97-008554; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Wide-Angle Neutron Diffractometer (WAND) is a flat-cone geometry diffractometer located at the High Flux Reactor (HFIR). This instrument is currently being upgraded. The central part of this upgrade is the development of a new curved one-dimensional position sensitive detector which covers a 125 degree angular range with an effective radius of 71 cm. This detector will be a multi-anode (624 anodes on a 0.2 degree pitch) (sup 3)He gas-filled proportional counter. This totally new system will give high resolution, good uniformity and high counting range - a maximum capability of 10(sup 5) cps/pixel and a 10(sup 7) cps overall. A prototype of this detector has shown that these design targets can be met. The new WAND will greatly broaden its capabilities for single-crystal diffraction experiments and for time-resolved measurements.
DOE
Time Measurement; Diffractometers; Single Crystals; Proportional Counters; Neutrons; High Resolution; High Flux Isotope Reactors

19980203987 NASA Langley Research Center, Hampton, VA USA
Advanced Measurement Technology at NASA Langley Research Center
Antcliff, Richard R., NASA Langley Research Center, USA; May 1998; 12p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Instrumentation systems have always been essential components of world class wind tunnels and laboratories. Langley continues to be on the forefront of the development of advanced systems for aerospace applications. This paper will describe recent advances in selected measurement systems which have had significant impact on aerospace testing. to fully understand the aerodynamics and aerothermodynamics influencing aerospace vehicles, highly accurate and repeatable measurements need to be made of critical phenomena. However, to maintain leadership in a highly competitive world market, productivity enhancement and the development of new capabilities must also be addressed aggressively. The accomplishment of these sometimes conflicting requirements has been the challenge of advanced measurement developers. However, several new technologies have recently matured to the point where they have enabled the achievement of these goals. One of the critical areas where advanced measurement systems are required is flow field velocity measurements. These measurements are required to correctly characterize the flowfield under study, to quantify the aerodynamic performance of test articles and to assess the effect of aerodynamic vehicles on their environment. Advanced measurement systems are also making great strides in obtaining planar measurements of other important thermodynamic quantities, including species concentration, temperature, pressure and the speed of sound. Langley has been on the forefront of applying these technologies to practical wind tunnel environments. New capabilities in Projection Moire Interferometry and Acoustics Array Measurement systems have extended our capabilities into the model deformation, vibration and noise measurement arenas. An overview of the status of these techniques and recent applications in practical environments will be presented in this paper.
Author
Aerospace Engineering; Aerodynamics; Aerospace Vehicles; Aerothermodynamics; Wind Tunnels; Thermodynamics; Flow Distribution; Mechanical Measurement

19980204004 MetroLaser, Irvine, CA USA
Advances in Aerodynamic Holography
Trolinger, James D., MetroLaser, USA; Millerd, James, MetroLaser, USA; Weber, David, MetroLaser, USA; Brown, Michael, MetroLaser, USA; May 1998; 18p; In English; Also announced as 19980203985
Contract(s)/Grant(s): F33615-96-C-2656; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Researchers continue to find new ways to employ holography to measure aerodynamic parameters in almost all flow regimes. Since holography provides a method to store optical wavefronts in such a fashion as to allow their reconstruction and analysis at a later time, it is a natural intermediate step for many conventional optical diagnostic procedures that employ interferometry, schlieren, deflectometry, particle image velocimetry, and three-dimensional visualization. For example, optical wavefronts representing one condition of a flow can be interfered directly with those representing a second condition, simply by storing the wavefronts holographically, providing at the same time a simple mechanism to subtract out all non varying conditions (such as optical defects). The result is a powerful method for the study of turbulent flow. These procedures have now been in use for many years and are reaching maturity, but the field is by no means stagnant. More recently, holographic techniques have been extended to include multiple wavelength recording holography at a wavelength tuned to include a resonance of a constituent in the flow, real-time holography (four wave mixing), and recording in photorefractive materials, SLM's, and CCD's. Also, new ways of using holograms to record, reconstruct and produce unique wavefronts for measurement have evolved. For example, holograms can be

placed directly on a model surface to aid in measurement (optically smart surfaces). In resonance interferometry, sensitivity is enhanced by tuning the light to the resonance line of a substance, exploiting the large refractive index change caused by anomalous dispersion at resonance. Holography enhances this unique form of interferometry by allowing useful interference between two beams (of different wavelength) that pass through exactly the same paths at the same time. This further allows interferograms to be recorded in photorefractive materials in such a way that a cineholographic interferometry movie of the selected substance in the field of interest can be recorded. Four wave mixing (sometimes called real-time holography) provides a unique way to measure temperature in high pressure flows, where other optical methods usually fail. This paper will describe the principles behind holographic flow diagnostics with emphasis on the more recently developed methods, and will consider the future potential of holographic diagnostics in aerodynamics.
Author
Aerodynamics; Holographic Interferometry; Particle Image Velocimetry; Four-Wave Mixing

19980204017 Technische Univ., Darmstadt, Germany
The Status of Internal Strain Gage Balance Development for Conventional and for Cryogenic Wind Tunnels
Ewald, B., Technische Univ., Germany; May 1998; 10p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The measurement of the aerodynamic forces is still the most important task in the wind tunnel at least for aircraft development work. Accuracy and reliability of the balance are key factors in this test technology. The urgent requirement for more and more accurate force testing leads to a demand for more and more balance accuracy. The most urgent demand in this field comes from the Cryogenic Tunnels like the NTF and the new European Wind Tunnel. The outcome of effort at the Darmstadt University of Technology is not only a cryogenic balance technology, which allows transport performance measurements in the ETW with a repeatability of less than one drag count with variable tunnel temperature but also a considerable improvement of balances for conventional tunnels. For this result all aspects of the balance technology had to be treated. For the balance design a computerized method was developed, which allows an optimization of the structural design in a short time. Principal aspects of the design were studied with Finite Element analysis for optimized solutions. The technique of the electron beam welded balance was established successfully. This construction method gives considerable advantages with respect to design for optimum structure stiffness and low interference. The difficult problem of strain gaging and wiring for cryogenic environment with severe moisture conditions was solved as a result of lengthy efforts. For cryogenic balances a novel axial force measurement system was developed, which solves the problem of temperature gradient induced error signals. For residual errors of this type numerical correction methods are proven. u For balance calibration a new strategy is used. A novel mathematical algorithm extracts a third order measuring matrix (no matrix inversion necessary) from the calibration data set. In a mathematical sense this is the best possible closed solution. In cooperation with Deutsche Airbus and the Carl Schenck Company a fully automatic calibration machine was developed for ETW. A smaller and simplified version of this machine is under construction at the Darmstadt University of Technology. Finite element analysis turned out to be a powerful tool in the development of optimized balance structures. Novel balance structures with minimized linear and non-linear interference and with minimized sensitivity against temperature gradients have been developed. For half model testing, which is a more and more important technique in transport development, compact half model balances have been developed and constructed. The crucial problem of temperature sensitivity of such balances was successfully solved by FEM optimization.
Author
Cryogenic Wind Tunnels; Wind Tunnel Apparatus; Strain Gage Balances; Finite Element Method; Aerodynamic Forces; Aircraft Design

19980204018 NASA Langley Research Center, Hampton, VA USA
Summary Report of the First International Symposium on Strain Gauge Balances and Workshop on AoA/Model Deformation Measurement Techniques
Tripp, John S., NASA Langley Research Center, USA; Tcheng, Ping, NASA Langley Research Center, USA; Burner, Alpheus W., NASA Langley Research Center, USA; Finley, Tom D., NASA Langley Research Center, USA; May 1998; 12p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The first International Symposium on Strain Gauge Balances was sponsored under the auspices of the NASA Langley Research Center (LaRC), Hampton, Virginia. Held at the LaRC Reid Conference Center, the Symposium provided an open international forum for presentation, discussion, and exchange of technical information among wind tunnel test technique specialists and strain gauge balance designers. The Symposium also served to initiate organized professional activities among the participating and relevant international technical communities. The program included a panel discussion, technical paper sessions, tours of local facilities, and vendor exhibits. Over 130 delegates were in attendance from 15 countries. A steering committee was formed

to plan a second international balance symposium tentatively scheduled to be hosted in the United Kingdom in 1998 or 1999. The Balance Symposium was followed bv the half-day, Workshop on Angle of Attack and Model Deformation on the afternoon of October 25. The thrust of the Workshop was to assess the state of the art in angle of attack (AoA) and model deformation measurement techniques and to discuss future developments.
Author
Strain Gage Balances; Wind Tunnel Tests; Pressure Measurement; Density Measurement

19980204842 California Univ., Sponsored Projects Office, Berkeley, CA USA
Experimental Evaluation of Loss Perception in Continuous Media
Wijesekera, D., California Univ., USA; Srivastava, J., California Univ., USA; Nerode, A., California Univ., USA; Foresti, M., California Univ., USA; Mar. 31, 1998; 22p; In English
Contract(s)/Grant(s): DAAH04-96-1-0341
Report No.(s): AD-A344170; TR-98-02; ARO-35873.67-MA-MUR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Perception of multimedia quality, specified by quality of service metrics can be used by system designers to optimize customer satisfaction within resource bounds enforced by general purpose computing platforms. Media losses, rate variations and transient synchronization losses have been speculated to affect human perception of multimedia quality. This paper presents metrics to measure such defects and results of a series of user experiments that justify such speculations. Results of the study provide bounds on losses, rate variations and transient synchronization losses as a function of user satisfaction, in the form of Likert values. It is shown how these results can be used by algorithm designers of underlying multimedia systems.
DTIC
Media; Perception; Performance Tests; Evaluation; Losses; Multimedia

19980204844 California Univ., Sponsored Projects Office, Berkeley, CA USA
Performance Evaluation of Media Losses in the Continuous Media Toolkit
Wijesekera, D., California Univ., USA; Varadarajan, S., California Univ., USA; Parikh, S., California Univ., USA; Srivastava, J., California Univ., USA; Nerode, A., California Univ., USA; Mar. 31, 1998; 22p; In English
Contract(s)/Grant(s): DAAH04-96-1-0341
Report No.(s): AD-A344178; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper shows a methodology for user driven, top down approach to research in Quality of Service (QoS) Issues in multimedia systems. As a case study, we show a development of metrics, validation by means of a user study, and a performance evaluation of prototyping environments. What is used, the Berkeley Continuous Media Toolkit (CMT), is a popular environment that satisfies this need. From a human user's perspective, in order for multimedia demonstrations to be comprehensible, the number of audio or video frames dropped and the timing delays in the ones that are displayed, need to be kept to a minimum. Therefore, it is important to know the frame dropping characteristics of CMT. In a series of experiments we monitored the variation of these parameters with respect to processor and network loads. It was observed that loads affect aggregate frame drops at lower rates and consecutive frame drops at higher rates. because at higher rates a large number of consecutive frames are dropped, the ones that are played appear in a more timely manned. As a solution to observed problems, we present some QoS based approaches to control drop and delay parameters.
DTIC
Performance Tests; Media; Losses; Evaluation; Tools

19980204847 NASA Johnson Space Center, Houston, TX USA
Retractable Visual Indicator Assembly
Hackler, George R., Inventor, NASA Johnson Space Center, USA; Gamboa, Ronald J., Inventor, NASA Johnson Space Center, USA; Dominquez, Victor, Inventor, NASA Johnson Space Center, USA; Mar. 17, 1998; 7p; In English
Patent Info.: Filed 13 Feb. 1996; NASA-Case-MSC-22525-1; US-Patent-5,727,498; US-Patent-Appl-SN-613737; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A retractable indicator assembly may be mounted on a container which transmits air through the container and removes deleterious gases with an activated charcoal medium in the container. The assembly includes: an elongate indicator housing has a chamber therein; a male adaptor with an external threads is used for sealing engagement with the container; a plug located at the upper end of the housing; a housing that includes a transparent wall portion for viewing at least a portion of the chamber; a litmus indicator, moveable by a retractable rod from a retracted position within the container to an extended position within the chamber of the housing; and an outer housing that is secured to the upper end of the rod, and protects the indicator housing while the litmus

indicator is in its normally retracted position. The assembly may be manually manipulated between its extended position wherein the litmus indicator may be viewed through the transparent wall of the indicator housing, and a retracted position wherein the outer housing encloses the indicator housing and engages the exterior of the container.
Official Gazette of the U.S. Patent and Trademark
Contamination; Visual Observation; Activated Carbon; Retractable Equipment; Air Filters; Gas Analysis

19980205054 National Inst. of Standards and Technology, Optical Technology Div., Gaithersburg, MD USA
Spectroradiometric Detector Measurements, Part 1, Ultraviolet Detectors
Larason, T. C., National Inst. of Standards and Technology, USA; Bruce, S. S., National Inst. of Standards and Technology, USA; Parr, A. C., National Inst. of Standards and Technology, USA; Feb. 1998; 128p; In English
Report No.(s): PB98-149073; NIST/SP-250-41; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This document describes the National Institute of Standards and Technology (NIST) Measurement Service for providing calibrated photodiodes for absolute spectral responsivity in the ultraviolet (UV), visible, and near-infrared (NIR) spectral regions (200 nm to 1100 nm) and the special service of measuring photodetectors sent to NIST in the 200 nm to 1800 nm spectral region. The theory, measurement system, operation, and transfer standards of the Spectroradiometric Detector Measurement Service are described in this publication. The traceability of the absolute spectral power responsivity scale to the High Accuracy Cryogenic Radiometer (HACR) and detailed uncertainty estimates are discussed. Also presented are the recently expanded list of absolute spectral power responsivity measurement services provided by NIST and the enhancements to its quality system to comply with ANSI/NCSL Z540-1-1994.
NTIS
Cryogenic Equipment; Spectroradiometers; Photodiodes; Calibrating; Spectral Bands

19980205597 Louisiana State Univ., Baton Rouge, LA USA
Alignment System for Anorad X-Ray Exposure Tool ***Final Report, 6 Sep. 1993 - 6 Mar. 1997***
Feldman, Martin, Louisiana State Univ., USA; Jan. 15, 1998; 10p; In English
Contract(s)/Grant(s): DAAH04-93-G-0411
Report No.(s): AD-A344528; ARO-32281.1-EL; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An X-ray exposure tool has been completed, based on a commercially available stage system. All of the individual functions, including mask and wafer loading, coarse and fine alignment, and exposure, have been demonstrated. The development of a user friendly software package to control the sequence of operations is continuing. In addition, an interferometer has been developed which performs absolute distance measurements with nanometer resolution. By switching between several optical fibers a single such interferometer may be used to make accurate measurements along a multiplicity of axes.
DTIC
Lithography; Fabrication; Tools; X Rays; Applications Programs (Computers)

19980205686 MetroLaser, Irvine, CA USA
Novel Organic Polymer Films for Real-time Holographic Processing ***Final Report, 15 Aug. 1997 - 14 Feb. 1998***
Millerd, James E., MetroLaser, USA; May 04, 1998; 19p; In English
Contract(s)/Grant(s): F29620-97-C-0051
Report No.(s): AD-A345594; AFRL-SR-BL-TR-98-0460; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Phase I Small Business Technology Transfer (STTR) was to develop and commercialize new technologies based on state-of-the-art photorefractive organic polymer films recently developed at the University of Arizona. During Phase I emphasis was placed on developing an optical device that can perform fast, high resolution, whole field (imaged), profile measurements of three-dimensional (3D) objects. A breadboard system was constructed that could be switched between a digital holographic arrangement and a real-time holographic interferometer which incorporated the photopolymer. A number of objects were measured and the best results were obtained with the digital holographic arrangement. A multi-wavelength processing algorithm was implemented to process the discontinuous changes in height of the objects. The profile measurements had a resolution of 80 microns in the z direction and was limited by the tuning range of the laser diode. For future systems the resolution is expected to be improved down to 0.4 microns. The fast unwrapping of discontinuous fringes across the object was a major milestone for the Phase I research. The quantitative 3D measurement system has numerous commercial applications in the aerospace, manufacturing and medical industries.
DTIC
Photopolymers; Holography; Polymeric Films; Holographic Interferometry

19980205795 Sandia National Labs., Albuquerque, NM USA

Weighted partial least squares method to improve calibration precision for spectroscopic noise-limited data

Haaland, D. M., Sandia National Labs., USA; Jones, H. D. T., Sandia National Labs., USA; 1997; 5p; In English; 11th; Fourier Transform Spectroscopy, 10 - 15 Aug. 1997, Athens, GA, USA

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

Report No.(s): SAND-97-2226C; CONF-970812-1; DE97-009353; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Multivariate calibration methods have been applied extensively to the quantitative analysis of Fourier Transform InfraRed (FT-IR) spectral data. Partial Least Squares (PLS) methods have become the most widely used multivariate method for quantitative spectroscopic analyses. Most often these methods are limited by model error or the accuracy or precision of the reference methods. However, in some cases, the precision of the quantitative analysis is limited by the noise in the spectroscopic signal. In these situations, the precision of the PLS calibrations and predictions can be improved by the incorporation of weighting in the PLS algorithm. If the spectral noise of the system is known (e.g., in the case of detector-noise-limited cases), then appropriate weighting can be incorporated into the multivariate spectral calibrations and predictions. A Weighted PLS (WPLS) algorithm was developed to improve the precision of the analysis in the case of spectral-noise-limited data. This new PLS algorithm was then tested with real and simulated data, and the results compared with the unweighted PLS algorithm. Using Near-InfraRed (NIR) calibration precision when the WPLS algorithm was applied. The best WPLS method improved prediction precision for the analysis of one of the minor components by a factor of nearly 9 relative to the unweighted PLS algorithm.

DOE

Procedures; Calibrating; Spectroscopic Analysis; Fourier Transformation; Infrared Spectroscopy; Chemical Analysis

19980206009 Institute for Aerospace Research, Combustion Research Group, Ottawa, Ontario Canada

Non-Intrusive Measurement Technique for Propulsion Engines

Mulligan, M. F., Institute for Aerospace Research, Canada; MacLeod, J. D., Institute for Aerospace Research, Canada; May 1998; 12p; In English; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

With financial contributions from the Canadian Department of National Defence, the Structures, Materials, and Propulsion Laboratory of the National Research Council of Canada (NRC) established a program for evaluating the effects of component deterioration on gas turbine engine performance. The effort was aimed at investigating the performance changes resulting from typical in-service faults. An important aspect of the engine test program was the use of non-intrusive sensors to supplement conventional instrumentation. Combined gas and metal thermal patterns in the infrared radiation spectra, recorded using infrared thermography, were used to evaluate gas path patterns to identify possible fault conditions. Exhaust plane thermal patterns can be classified as ”healthy” for no-fault conditions, and ”distressed” where known faults are in existence. Several defective engine components, including fuel nozzles, combustor cans, turbine nozzles, and thermocouple probes were used to evaluate the effectiveness of this technique on an engine test bed. This paper covers the project objectives, the experimental installation, and the results of the tests. Descriptions of the infrared thermography system, the data reduction and analysis methodology are also included.

Author

Nonintrusive Measurement; Infrared Instruments; Thermography; Engine Tests; Engine Parts; Gas Turbine Engines; Nondestructive Tests; Temperature Measurement

19980206022 Rolls-Royce Ltd., Commercial Aero Engines, Derby, UK

Surface Temperature Measurement in Turbines

Bird, C., Rolls-Royce Ltd., UK; Mutton, J. E., Rolls-Royce Ltd., UK; Shepherd, R., Rolls-Royce Ltd., UK; Smith, M. D. W., Rolls-Royce Ltd., UK; Watson, H. M. L., Rolls-Royce Ltd., UK; May 1998; 10p; In English; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper reports on some of the turbine surface temperature measurement techniques and instrumentation currently in use and under development in Rolls-Royce. Firstly, thermal paints are reviewed highlighting the development of new computer aided analysis and interpretation techniques. Thin film thermocouples are described with their applicability to gas turbine engine components, especially those with thin skins. Finally, the novel technique of photoluminescence thermometry using so-called ”thermographic phosphors” is described. Examples of measurements on static engine components and developments for measurements on rotating turbine blades are given.

Author

Temperature Measurement; Paints; Surface Temperature; Photoluminescence; Thermocouples; Temperature Measuring Instruments; Turbines

19980206030 Wright Lab., Aero Propulsion and Power Directorate, Wright-Patterson AFB, OH USA

Meeting the Advanced Instrumentation the Needs of the Integrated High Performance Turbine Engine Technology and High Cycle Fatigue Programs

Strange, William A., Wright Lab., USA; May 1998; 8p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper presents an overview of current research efforts aimed at improving turbine engine structural instrumentation capabilities. Emphasis is placed on nonintrusive concepts which will be applicable to the advanced engines currently in use, or being designed for initial operational testing shortly after the turn of the century. Technologies to be described include; blade tip deflection sensors to determine dynamic stress, thermographic phosphors to measure metal temperature, pressure sensitive paints and air etalons to measure dynamic pressure, and micro electro mechanical systems to assess a variety of parameters. Advantages of the various systems, potential problems and limitations, as well as, an assessment as to their applicability to either the Integrated High Performance Turbine Engine Technology or the High Cycle Fatigue initiative is discussed.
Author

Measuring Instruments; Nonintrusive Measurement; Engine Parts; Temperature Measurement; Stress Measurement; Dynamic Pressure; Pressure Measurement; Surface Temperature

19980206040 Rhode Island Univ., Dept. of Chemical Engineering, Kingston, RI USA

Overcoats for the Improved Performance of PdCr High Temperature Thin Film Strain Gages

Gregory, Otto J., Rhode Island Univ., USA; Dyer, S. E., Rhode Island Univ., USA; Cooke, James D., Rhode Island Univ., USA; May 1998; 12p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Overcoat protection schemes for thin film devices have typically focused on inhibiting the growth of native oxides formed on the sensor surface, rather than on improving the passivating nature of these native oxides. Here, thin sputtered Cr overcoats and heat treatments in varying oxygen partial pressures enhanced the passivating nature of native Cr203 films formed on PdCr thin film strain gages. Results of strain tests using sensors protected using this approach are presented and the implications are discussed. PdCr gages with sputtered Cr overcoats withstood 12,000 dynamic strain cycles of 1100 micro-epsilon during 100 hours of testing at a temperature of 1000 C in air. Gage factors of 1.3 with drift rates as low as 0.1 Omega/hr were achieved for devices having a nominal resistance of approximately 100 Omega's. TCR's ranging from +550 ppm/C to +798 ppm/C were realized depending on the overcoat and thermal history. Possible mechanisms for an anomaly in the electrical characteristics of these films at 800 C and improvements in stability due to the use of overcoats are presented.
Author

Protective Coatings; Strain Gages; High Temperature; Palladium Compounds; Chromium Compounds; Thin Films; Oxides

19980206041 Rhode Island Univ., Dept. of Chemical Engineering, Kingston, RI USA

High Temperature - Thin Film Strain Gages Based on Alloys of Indium Tin Oxide

Gregory, Otto J., Rhode Island Univ., USA; Cooke, James D., Rhode Island Univ., USA; Bienkiewicz, Joseph M., Rhode Island Univ., USA; May 1998; 12p; In English; Also announced as 19980206002

Contract(s)/Grant(s): NAG3-1428; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A stable, high temperature strain gage based on reactively sputtered indium tin oxide (ITO) was demonstrated at temperatures up to 1050 C. These strain sensors exhibited relatively large, negative gage factors at room temperature and their piezoresistive response was both linear and reproducible when strained up to 700 micro-in/in. When cycled between compression and tension, these sensors also showed very little hysteresis, indicating excellent mechanical stability. Thin film strain gages based on selected ITO alloys withstood more than 50,000 strain cycles of +/- 500 micro-in/in during 180 hours of testing in air at 1000 C, with minimal drift at temperature. Drift rates as low as 0.0009%/hr at 1000 C were observed for ITO films that were annealed in nitrogen at 700 C prior to strain testing. These results compare favorably with state of the art 10 micro-m thick PdCr films deposited by NASA, where drift rates of 0.047%/hr at 1050 C were observed. Nitrogen annealing not only produced the lowest drift rates to date, but also produce the largest dynamic gage factors (G = 23.5). These wide bandgap, semiconductor strain sensors also exhibited moderately low temperature coefficients of resistance (TCR) at temperatures up to 1100 C, when tested in a nitrogen ambient. A TCR of +230 ppm/C over the temperature range 200 C <T469 ppm/C over the temperature range 600 C <T1560 ppm/C was obtained over the temperature range of 200 C <T.
DTIC

Laser Mode Locking; Laser Outputs; Microwaves; Spectrum Analysis; Optical Activity

19980203663 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Optical Physics of Microcavity Surface Emitting Lasers

Noble, Michael J., Air Force Inst. of Tech., USA; Mar. 18, 1998; 190p; In English

Report No.(s): AD-A344256; AFIT/DS/ENG/98-03; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This dissertation consists of an in-depth theoretical analysis of the optical impact of transverse index confinement on the lasing modes of microcavity surface emitting lasers. Two different variational techniques were employed to calculate the relevant optical laser parameters: (1) modal resonance, field profile, (2) confinement factor, and (3) threshold gain. Through a semianalytic field analysis, two new confinement related effects were discovered: (1) a polarization dependent change in mirror reflectance with aperture radius, and (2) a mode dependent blueshift. Through a numerical field analysis, the physical mechanisms governing diffraction were ascertained. These are: (1) the transverse confinement of the optical mode, the degree of tilt of the mode propagation vector away from normal to the mirror surfaces, and (2) the density of parasitic modes in the spectral vicinity of the lasing mode. Based on these results, a new semianalytic technique was derived for estimating diffraction loss via rigorous coupling to the parasitic modes. Finally, this model was combined with a gain model and a new mode density model to compute spontaneous emission rate, light verses current, threshold current, and spontaneous emission factors for a low threshold oxide-apertured device. DTIC

Surface Emitting Lasers; Semiconductor Lasers; Microelectronics; Laser Cavities

19980203721 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

Energy Coupling and Plume Dynamics During High Power Laser Heating of Metals

Jeong, S., California Univ., USA; May 1997; 193p; In English

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

Report No.(s): LBNL-40364; DE97-008859; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

High power laser heating of metals was studied utilizing experimental and numerical methods with an emphasis on the laser energy coupling with a target and on the dynamics of the laser generated vapor flow. Rigorous theoretical modeling of the heating, melting, and evaporation of metals due to laser radiation with a power density below the plasma shielding threshold was carried out. Experimentally, the probe beam deflection technique was utilized to measure the propagation of a laser induced shock wave. The effects of a cylindrical cavity in a metal surface on the laser energy coupling with a solid were investigated utilizing photothermal deflection measurements. A numerical calculation of target temperature and photothermal deflection was performed to compare with the measured results. Reflection of the heating laser beam inside the cavity was found to increase the photothermal deflection amplitude significantly and to enhance the overall energy coupling between a heating laser beam and a solid. Next, unsteady vaporization of metals due to nanosecond pulsed laser heating with an ambient gas at finite pressure was analyzed with a one dimensional thermal evaporation model for target heating and one dimensional compressible flow equations for inviscid fluid for the vapor flow. Lastly, the propagation of a shock wave during excimer laser heating of aluminum was measured with the probe beam deflection technique. The transit time of the shock wave was measured at the elevation of the probe beam above the target surface; these results were compared with the predicted behavior using ideal blast wave theory. The propagation of a gaseous material plume was also observed from the deflection of the probe beam at later times. DOE

Laser Heating; Metals; Plumes; Laser Ablation; Energy Absorption; Laser Plasmas; Melting; Surface Energy; High Power Lasers; Laser Beams

19980203855 Oak Ridge National Lab., TN USA

Optical power limiting for eye protection from tunable lasers

Chen, C. H., Oak Ridge National Lab., USA; Golovlev, V. V., Oak Ridge National Lab., USA; Garrett, W. R., Oak Ridge National Lab., USA; Goedert, R. V., Army Tank-Automotive Command, USA; Whittaker, T. A., Army Tank-Automotive Command, USA; Templeton, D. W., Army Tank-Automotive Command, USA; [1997]; 9p; In English; Annual Meeting of the Society of Photo-optical Instrumentation Engineers, 18 Jul. - 1 Aug. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA

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

Report No.(s): CONF-970706-4; DE97-008482; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Reversible saturable absorption of C(sub 60) and sacrificial mirrors with double path were examined for eye protection from laser beams of picosecond and nanosecond lasers. Both approaches can achieve significant attenuation to protect eyes from serious or permanent damage although the clamped energy is still higher than the permissible values of ANSI standards. The combination

of these two approaches can eliminate the need to replace sacrificial mirrors. The phenomena of absorbing 100 photons in a single picosecond pulse definitely deserves further study for its mechanism.
DOE
Eye Protection; Tunable Lasers; Photons; Mirrors

19980204712 Research Inst. of National Defence, Avdelningen foer Sensorteknik, Linkoeping, Sweden
Visualization of Laser Simulation ***Visualisering av Lasersimulering***
Ahlberg, S., Research Inst. of National Defence, Sweden; Rystedt, B., Research Inst. of National Defence, Sweden; Dec. 1997; 92p; In Swedish
Report No.(s): PB98-147465; FOA-R-97-00636-612-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report discusses how laser beam simulation can be performed. As the base for developing a simple prototype, the 3D hardware and software markets have been examined in the search for useful products. A number of algorithms for calculating the reflection of a laser beam in a virtual world have been developed. These algorithms have been implemented in the prototype and can be summarized into what can be called a 'Beam-Tracer'. A laser beam is visualized as a volume or a target area on an object. The prototype has been implemented using OpenGL Optimizer, a tool from Silicon Graphics that visualizes complex 3D graphics.
NTIS
Laser Beams; Scientific Visualization; Prototypes; Laser Applications; Target Recognition; Computer Programs; Algorithms

19980204875 Academy of Sciences (USSR), Moscow, USSR
Experimental and Theoretical Search of Conditions for Maximum Efficiency and for Frequency Tunability of IR Overtone CO Laser, Phase 1, ***Jul. 1997 - Mar. 1998***
Ionin, A., Academy of Sciences (USSR), USSR; Kotkov, A., Academy of Sciences (USSR), USSR; Seleznev, L., Academy of Sciences (USSR), USSR; Sinitsyn, D., Academy of Sciences (USSR), USSR; Klimachev, Y., Academy of Sciences (USSR), USSR; Mar. 1998; 47p; In English
Contract(s)/Grant(s): F61708-97-W-0215
Report No.(s): AD-A343159; EOARD-SPC-97-4066; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The main objective of the scientific work was an experimental and theoretical search of conditions for maximal efficiency of the first overtone (FO) CO laser and a study of a feasibility of lasing band broadening. In (lonin et al, 1997) a comprehensive study of FO CO laser with suppressed fundamental band (FB) lasing has been done. by using an intracavity spectral filter suppressing FB lasing, output efficiency of 3% and specific output energy of approximately 10 J/l Amagat were obtained, lasing taking place from 13 yields 11 up to 25 yields 23 vibrational transitions (lambda = 2.7-3.3 micrometers). Some recommendations were formulated. In particular, there were proposed a decrease of intracavity useless optical lasses.
DTIC
Infrared Lasers; Tuning; Carbon Monoxide Lasers; Laser Outputs

19980205608 Lawrence Livermore National Lab., Livermore, CA USA
The use of beam propagation modeling of Beamlet and Nova to ensure a "safe" National Ignition Facility laser system design
Henesian, M. A., Lawrence Livermore National Lab., USA; Renard, P., Lawrence Livermore National Lab., USA; Auerbach, J., Lawrence Livermore National Lab., USA; Mar. 17, 1997; 15p; 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-124891; CONF-9610225-37; DE97-053166; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

An exhaustive set of Beamlet and Nova laser system simulations were performed over a wide range of power levels in order to gain understanding about the statistical trends in Nova and Beamlet's experimental data sets, and to provide critical validation of propagation tools and design "rules" applied to the 192-arm National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL). The experiments considered for modeling were at 220-ps FWHM duration with unpumped booster slabs on Beamlet, and 100-ps FWHM with pumped 31.5-cm and 46-cm disk amplifiers on Nova. Simulations indicated that on Beamlet, the AB (the intensity pendent phase shift parameter characterizing the tendency towards beam filamentation) for the booster amplifier stage without pumping, would be nearly identical to the AB expected on NIF at the peak of a typical 20-ns long shaped pulse intended for ICF target irradiation. Therefore, with energies less than I kJ in short-pulses, we examined on Beamlet the comparable AB-driven filamentation conditions predicted for long ICF pulseshapes in the 18 kJ regime on the NIF, while avoiding

fluence dependent surface damage. Various spatial filter pinhole configurations were examined on Nova and Beamlet. Open transport spatial filter pinholes were used in some experiments to allow the direct measurement of the onset of beam filamentation. Schlieren images on Beamlet of the far field irradiance measuring the scattered light fraction outside of 33-(micro)radians were also obtained and compared to modeled results.
DOE
Systems Engineering; Safety; Nova Laser System; Research Facilities; Design Analysis; Statistical Analysis; Plant Design

19980205610 Lawrence Livermore National Lab., Livermore, CA USA
Developing beam phasing on the Nova laser
Ehrlich, R. B., Lawrence Livermore National Lab., USA; Amendt, P. A., Lawrence Livermore National Lab., USA; Dixit, S. N., Lawrence Livermore National Lab., USA; Hammel, B. A., Lawrence Livermore National Lab., USA; Kalantar, D. H., Lawrence Livermore National Lab., USA; Pennington, D. M., Lawrence Livermore National Lab., USA; Weiland, T. L., Lawrence Livermore National Lab., USA; Mar. 10, 1997; 9p; 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-124513; CONF-9610225-39; DE97-053163; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We are presently adding the capability to irradiate indirectly-driven Nova targets with two rings of illumination inside each end of the hohlraum for studies of time-dependent second Legendre (P2) and time- integrated fourth Legendre (P4) flux asymmetry control. The rings will be formed with specially designed Kinoform Phase Plates (KPPs), which will direct each half of each beam into two separate rings that are nearly uniform azimuthally. The timing and temporal pulse shape of the outer rings will be controlled independently from those of the inner rings, allowing for phasing of the pulse shapes to control time dependent asymmetry. Modifications to the Incident Beam Diagnostics (IBDs) will enable us to verify that acceptable levels of power balance among the contributing segments of each ring have been achieved on each shot. Current techniques for precision beam pointing and timing are expected to be sufficiently accurate for these experiments. We present a design for an affordable retrofit to achieve beam phasing on Nova, results of a simplified demonstration, and calculations highlighting the anticipated benefits.
DOE
Irradiation; Beams (Radiation); Laser Fusion; Asymmetry; Nova Laser System

19980205612 Lawrence Livermore National Lab., Livermore, CA USA
CW and Q-switched performance of a diode end-pumped Yb:YAG laser
Bibeau, C., Lawrence Livermore National Lab., USA; Beach, R., Lawrence Livermore National Lab., USA; Ebbers, C., Lawrence Livermore National Lab., USA; Emanuel, M., Lawrence Livermore National Lab., USA; Skidmore, J., Lawrence Livermore National Lab., USA; Feb. 19, 1997; 7p; In English; Advanced Solid-state Lasers, 26 - 29 Jan. 1997, Orlando, FL, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-124042-Rev.1; CONF-970103-3; DE97-053160; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Using an end-pumped technology developed at LLNL we have demonstrated a Yb:YAG laser capable of delivering up to 434 W of CW power and 226 W of Q-switched power. In addition, we have frequency doubled the output to 515 nm using a dual crystal scheme to produce 76 W at 10 kHz in a 30 ns pulse length.
DOE
Diodes; Q Switched Lasers; Performance Tests; Solid State Lasers

19980205615 Lawrence Livermore National Lab., Livermore, CA USA
Polarization effects in active Fresnel rhomb zig-zag slab amplifier
Bikmatov, R. G., Troitsk Inst. for Innovation, Russia; Chernyak, V. M., Troitsk Inst. for Innovation, Russia; Ignat'ev, L. P., Troitsk Inst. for Innovation, Russia; Kuznetsov, V. G., Troitsk Inst. for Innovation, Russia; Pergament, M. I., Troitsk Inst. for Innovation, Russia; Smirnov, R.V., Troitsk Inst. for Innovation, Russia; Sokolov, V.I., Troitsk Inst. for Innovation, Russia; Hunt, J. T., Lawrence Livermore National Lab., USA; Manes, K., Lawrence Livermore National Lab., USA; Jan. 27, 1997; 10p; 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-126343; CONF-9610225-36; DE97-053153; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The concept to use a slab as active element, working in zig-zag geometry, and also as Fresnel rhomb, seems to be rather attractive. However, in this case different depolarization effects in active element arc of crucial importance. We have carried out the estimations of depolarization effects arising both due to mechanical loading of an active element at its fastening and due to thermo-optical distortions. to check up these rigid requirements to depolarization (0.1 % - 0.01 %) careful measurements of depolarization effects and their sources are being carried out. Mechanical loading gives one of the main contributions in depolarization at fastening of active element. Using model experiments with glass Fresnel rhomb under mechanical loading we have measured depolarization effects. It is proposed to use additional glass plate to compensate beam depolarization in zig-zag slab. The received results allow to expect successful use of the slab amplifier as a Fresnel rhomb providing rather high quality of optical material of active clement.
DOE
Amplifiers; Lasers; Geometry; Estimating; Optical Polarization; Loads (Forces)

19980205620 Lawrence Livermore National Lab., Livermore, CA USA
A tunable, single frequency, fiber ring at 1053 nm
Wilcox, R. B., Lawrence Livermore National Lab., USA; Feb. 21, 1997; 5p; 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-124515; IL-10087; CONF-9610225-34; DE97-053204; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This laser is a tunable source designed for applications where a shorter pulse will be chopped from a long Q-switched pulse by electrooptic modulators, then amplified in Nd:phosphate glass. The laser employs ytterbium-doped silica fiber as the gain medium, pumped by a laser diode at 980 nm. Gain in Yb:silica is distributed over an 90 nm range, making it suitable for operation at many wavelengths. Our previous experiments with this medium demonstrated oscillation over a 50 nm wide band. In addition, pumping at 980 nm allows the use of stable pump diodes used in Erbium-Doped Fiber Amplifiers (EDFA's). We designed the laser to take advantage of this wideband gain medium, and yet operate on a single cavity mode. A circulator causes unidirectional operation, and allows use of a fiber grating in reflection. This grating has a 0.2 Angstrom bandwidth, and defines the coarse tuning of the laser. It is piezoelectrically stretch tuned to the desired wavelength band. A single mode of the cavity is selected by a piezoelectrically tuned fiber grating Fabry-Perot etalon with 64 MHz bandwidth. The laser is Q-switched by a bulk acousto-optic device at 1 kHz reprate. The loss is controlled to allow the oscillator to laser close to threshold for 500(micro)s before the Q-switch is turned off completely, creating a pulse. This ''pre-lasing'' stabilizes the single mode, since Q-switch pulse builds up from the prelase level. to prevent mode hopping during long term operation, cavity length is feedback controlled. Another piezoelectric device stretches a fiber in the cavity according to an error signal derived from the output optical signal. Due to the long, high loss cavity, the Q-switched pulse is about 3OO ns long. The central part of this pulse will be gated by an electrooptic modulator to produce a 30 ns square pulse, used for further amplification and modulation.
DOE
Design Analysis; Lasers; Laser Materials; Oscillations; Q Switched Lasers; Solid State Lasers

19980205622 Lawrence Livermore National Lab., Livermore, CA USA
High-power laser diodes at various wavelengths
Emanuel, M. A., Lawrence Livermore National Lab., USA; Feb. 19, 1997; 8p; 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-126513; CONF-970231-43; DE97-053189; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

High power laser diodes at various wavelengths are described. First, performance and reliability of an optimized large transverse mode diode structure at 808 and 941 nm are presented. Next, data are presented on a 9.5 kW peak power array at 900 nm having a narrow emission bandwidth suitable for pumping Yb:S-FAP laser materials. Finally, results on a fiber-coupled laser diode array at (approx)730 nm are presented.
DOE
Diodes; Semiconductor Lasers; Wavelengths; Reliability Analysis; Performance Prediction

19980205663 National Inst. of Standards and Technology, Optoelectronics Div., Boulder, CO USA
Calibration Service for Laser Power and Energy at 248 nm
Leonhardt, R. W., National Inst. of Standards and Technology, USA; Jan. 1998; 44p; In English

Report No.(s): PB98-149057; NIST/TN-1394; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document describes the calibration service provided by the National Institute of Standards and Technology (NIST) for laser power and energy at the excimer laser wavelength of 248 nm. The service supports the calibration of laser-power meters from 400 microwave W to 7.5 W, and energy meters from 80 microwave J to 150 mJ per pulse. Typical expanded measurement uncertainties range from 1.6 to 2 percent. The measurement system, which includes a source laser, beam optics, and NIST reference standard calorimeters, is reviewed. Theory and design considerations for the reference calorimeters that correlate optical energy to NIST electrical standards are discussed. Critical components of the calorimeters and beam delivery system are specified. Measurement-system parameters and calibration procedures are examined. Types of laser meters suitable for calibration are delineated. A detailed analysis of sources of error, estimates of uncertainty, and expanded uncertainty are presented.

NTIS

Excimer Lasers; Beam Splitters; Laser Outputs; Calibrating; Wavelengths; Colorimetry

19980205695 Lawrence Livermore National Lab., Livermore, CA USA

Analysis of SR(5-x)Ba(x)(PO4)(sub 3)F:Yb(3+) crystals for improved laser performance with diode-pumping

Schaffers, K. I., Lawrence Livermore National Lab., USA; Bayramian, A. J., Lawrence Livermore National Lab., USA; Marshall, C. D., Lawrence Livermore National Lab., USA; Tassano, J. B., Lawrence Livermore National Lab., USA; Payne, S. A., Lawrence Livermore National Lab., USA; Feb. 19, 1997; 8p; In English; Advanced Solid-state Lasers, 26 - 29 Jan. 1997, Orlando, FL, USA

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

Report No.(s): UCRL-JC-126339; CONF-970103-4; DE97-053170; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Crystals of Yb(3+):SR(1-x)Ba(x)(PO4)(sub 3)F (0 less than x less than 5) have been investigated as a means to obtain broader absorption bands than are currently available with Yb(3+):S-FAP (Yb(3+): SR5(PO4)(sub 3)F), thereby improving diode-pumping efficiency for high peak power applications. Large diode-arrays have a FWHM pump band of greater than 5 nm while the FWHM of the 900 nm absorption band for Yb:S-FAP is 5.5 nm; therefore, a significant amount of pump power can be wasted due to the nonideal overlap. Spectroscopic analysis of Yb:SR(5-x)Ba(x)-FAP crystals indicates that adding barium to the lattice increases the pump band to 13-16 run which more than compensates for the diode-array pump source without a detrimental reduction in absorption cross section. However, the emission cross section decreases by approximately half with relatively no effect on the emission lifetime. The small signal gain has also been measured and compared to the parent material Yb:S-FAP and emission cross sections have been determined by the method of reciprocity, the Filchtbauer-Ladenburg method, and small signal gain. Overall, Yb(3+):SR(5-x)Ba(x)(PO4)(sub 3)F crystals appear to achieve the goal of nearly matching the favorable thermal and laser performance properties of Yb:S-FAP while having a broader absorption band to better accommodate diode pumping.

DOE

Strontium Compounds; Strontium Fluorides; Laser Materials; Diodes; Solid State Lasers; Barium Fluorides; Yttrium; Performance Prediction; Laser Pumping

19980205696 Lawrence Livermore National Lab., Livermore, CA USA

Demonstrations of diode-pumped and grating-tuned ZnSe:Cr(2+) lasers

Page, R. H., Lawrence Livermore National Lab., USA; Skidmore, J. A., Lawrence Livermore National Lab., USA; Schaffers, K. I., Lawrence Livermore National Lab., USA; Beach, R. J., Lawrence Livermore National Lab., USA; Payne, S. A., Lawrence Livermore National Lab., USA; Krupke, W. F., Lawrence Livermore National Lab., USA; Feb. 14, 1997; 6p; In English; Advanced Solid-state Lasers, 26 - 29 Jan. 1997, Orlando, FL, USA

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

Report No.(s): UCRL-JC-125353-Rev.1; CONF-970103-5; DE97-053169; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A diode-side-pumped ZnSe:Cr(2+) laser was operated with a 75 - Watt peak power 1.65 (micro)m InGaAsP/InP pump array. The laser was configured with a ”single-bounce” architecture to maximize its round-trip gain. Peak output powers of (approx)0.3 Watt were obtained with a 10% - transmitting output coupler and a lightly-doped crystal. The estimated ”mode fill” of (approx)0.06 will increase with Cr(2+) concentration, raising the output power and extraction efficiency. With a grating tuner and MgF2:Co(2+) laser pumping, the laser tuned throughout the 2134 - 2799 nm range.

DOE

Diodes; Laser Pumping; Optical Pumping; Semiconductor Lasers; Infrared Radiation; Tuners; Gratings (Spectra); Carbon Monoxide Lasers

19980205697 Lawrence Livermore National Lab., Livermore, CA USA

1-watt composite-slab Er:YAG laser

Page, R. H., Lawrence Livermore National Lab., USA; Bartels, R. A., Lawrence Livermore National Lab., USA; Beach, R. J., Lawrence Livermore National Lab., USA; Sutton, S. B., Lawrence Livermore National Lab., USA; Furu, L. H., Lawrence Livermore National Lab., USA; LaSala, J. E., Lawrence Livermore National Lab., USA; Feb. 13, 1997; 6p; In English; Advanced Solid-state Lasers, 26 - 29 Jan. 1997, Orlando, FL, USA

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

Report No.(s): UCRL-JC-125351-Rev.1; CONF-970103-6; DE97-053168; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A diode-side-pumped discrete-optic Er(3+) :YAG laser employs pump-light coupling through a sapphire plate diffusion-bonded to the laser slab, removing heat directly at the pump face of the slab instead of requiring conduction through to its far side. This lowers the temperature in the gain region and gives reduced thermal lensing, which produces exceptional beam quality (M(sup 2) (approx) 1.3) at output powers (approx) 0.3 Watt. Powers above 1 Watt have been demonstrated with peak slope efficiencies (approx)20%. The novel architecture is also applicable to other side-pumped lasers.

DOE

Erbium; YAG Lasers; Light Beams; Laser Outputs; Diffusion Welding; Solid State Lasers; Design Analysis

19980206024 National Research Council of Canada, Ottawa, Ontario Canada

Development and Application of Laser Induced Incandescence (LII) as a Diagnostic for Soot Particulate Measurements

Snelling, D. R., National Research Council of Canada, Canada; Smallwood, G. J., National Research Council of Canada, Canada; Campbell, I. G., National Research Council of Canada, Canada; Medlock, J. E., National Research Council of Canada, Canada; Guelder, O. L., National Research Council of Canada, Canada; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

LII is a promising diagnostic for in-situ measurements of particulates. The LII signal is shown to be proportional to soot volume fraction. Due to the large dynamic range of the LII technique, we have been able to measure time averaged soot concentrations in the part per billion range with a spatial resolution of approx. 0.5 mm in each dimension. The decay of the LII signal in the post evaporative region is shown to be a sensitive measure of primary particle size. A numerical model has been developed which accurately predicts post evaporative LII signal decay rates. The prediction of the excitation curve is unsatisfactory, with more work needed to correctly model the particle behaviour during the soot evaporation phase. Also, the model predicts that the prompt LII signal will vary as the 3.33 power of particle diameter. However, this predicted departure from strict proportionality between LII signal and soot volume fraction was not experimentally observed.

Author

Soot; Concentration (Composition); Incandescence; Laser Applications; Measuring Instruments; Diffusion Flames; Particulates

19980206025 Institut de Mecanique des Fluides de Lille, France

Use of Iodine Fluorescence Induced by Laser for Measurements of Pressure, Temperature, and Speed *Application de la Fluorescence de l'Iode Induite par Laser aux Mesures de Pression, Temperature et Vitesse*

Lefebvre, X., Institut de Mecanique des Fluides de Lille, France; Leporcq, B., Institut de Mecanique des Fluides de Lille, France; May 1998; 24p; In French; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Laser-induced iodine fluorescence, referred to as LIIF, is a non-intrusive optical method which allows one not only to visualize a flow, but to obtain local and instantaneous magnitudes such as pressure, temperature, and speed. Following confirmation in a static tube in which the parameters P and T are easily measurable, some measurements of the three parameters were taken on a supersonic jet by using a gaussian multimode laser and a tunable single mode dye laser.

Author

Laser Induced Fluorescence; Nonintrusive Measurement; Iodine Lasers; Temperature Measurement; Pressure Measurement; Velocity Measurement

19980206026 Cranfield Univ., School of Mechanical Engineering, Bedford, UK

Development of Planar Laser Induced Fluorescence for Fuel: Application to Gas Turbine Combustion

Greenhalgh, D. A., Cranfield Univ., UK; Bryce, D. J., Cranfield Univ., UK; Lockett, R. D., Cranfield Univ., UK; Harding, S. C., Cranfield Univ., UK; May 1998; 18p; In English; Also announced as 19980206002; Original contains color illustrations

Contract(s)/Grant(s): CEC-AER2-CT92-0036; EPSRC-GR/H/78238; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Planar Laser Induced Fluorescence (PLIF) offers advantages over mechanical patternators, gas sampling, and other laser diagnostics in providing high resolution instantaneous two-dimensional images of liquid and vapour fuel concentration in operating gas turbine combustors. The technique has been developed at Cranfield and successfully applied to three different situations. Firstly the power of the method for fundamental mixing studies is illustrated with respect to a simple jet mixing experiment. Secondly the practical application of the method to an atmospheric pressure LPP combustor and a high pressure double annular combustor are presented. Radial and axial imaging of both the liquid and vapour phases has been performed with fuel markers that are capable of distinguishing between different boiling-point fractions. Such data allows investigation of the fuel-air mixing in the combustor, as well as the behaviour of the spray cone angle and patternation with varying fuel rate.
Author
Laser Induced Fluorescence; Imaging Techniques; Combustion; Liquid Phases; Vapor Phases; Fuel Flow; Combustion Chambers

19980206027 Allison Engine Co., Rolls-Royce Aerospace Group, Indianapolis, IN USA
High-Temperature Surface Measurements of Turbine Engine Components Using Thermographic Phosphors
Alaruri, Sami, Allison Engine Co., USA; Brewington, Andy, Allison Engine Co., USA; May 1998; 6p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A laser-based system for single point high-temperature measurements of turbine engine component surfaces coated with thermographic phosphors is described. Decay lifetime calibration measurements obtained for Y203:Eu over the temperature range approx. 530-1000 C are presented. Further, the results obtained from a coupon placed in the outlet gas flow of an atmospheric combustor are described.
Author
Engine Parts; Temperature Measurement; Thermography; Phosphors; Surface Temperature; Coatings; Laser Induced Fluorescence

19980206256 Summus Technologies, Inc., Research Center, Columbia, SC USA
A Laser-Based Surface Reconstruction Device for Oceanographic Measurements, No. 1 ***Progress Report***
Jawerth, B., Summus Technologies, Inc., USA; Zhou, I., Summus Technologies, Inc., USA; Myrick, M. L., Summus Technologies, Inc., USA; Sinzinger, E., Summus Technologies, Inc., USA; Storm, H., Summus Technologies, Inc., USA; May 27, 1998; 7p; In English
Contract(s)/Grant(s): N00014-98-C-0143
Report No.(s): AD-A345687; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The water surface is formed by larger gravitational waves as well as smaller capillary waves superimposed on the gravitational waves. The primary goal of this project is to design, build and field test a device suitable for obtaining the shape, and in particular, the slopes of the larger waves. The target application for this device is an LIDAR-based system, mounted on a helicopter, used for detecting underwater targets. by using the slopes provided by the device, it will be possible to correct for the refraction distortions due to the gravitational waves and obtain a more accurate location estimation of the target.
DTIC
Ocean Surface; Laser Applications; Oceanography; Gravitational Waves; Pulsed Lasers

19980206278 Los Alamos National Lab., NM USA
Multi-kiloampere, electron-beam generation from bare aluminum photo-cathodes driven by an ArF laser
Carlson, R. L., Los Alamos National Lab., USA; Ridlon, R. N., Los Alamos National Lab., USA; Seitz, G. J., Los Alamos National Lab., USA; Hughes, T. P., Mission Research Corp., USA; [1997]; 4p; In English; IEEE Particle Accelerator Conference, 12 - 16 May 1997, Vancouver, Canada
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1664; CONF-970503-222; DE97-008182; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

An electron-beam-pumped laser operating at ArF (193 nm) producing up to 5.0 joules in a 150-ns pulse has been used to illuminate micro-machined aluminum cathodes. The cathode was pulsed from 2.25-2.95-MV across a 20-cm-AK gap producing fields up to 145 kV/cm using REX (a 4-MeV, 5-kA, 100-ns pulsed diode). Extracted current versus laser power gives a quantum efficiency increasing with power density from 0.07 to 0.11%. The present work is significant in that the cathode operates in the presence of out-gassing materials with a background vacuum pressure in the mid 10(exp -6) torr region and 100-ns-long electron beams of up to 3 kA have been produced. Both emission limited (current follows laser pulse) and space-charge-limited (current follows pulsed power) regimes have been studied up to approximately 50 A/sq cm by varying the cathode diameter. The beam

temperature has been measured to be <5eVanddirectlycomparedinte same experimental setup to velvet based cathodes that measure approximately 100 eV.
DOE
Electron Beams; Laser Outputs; Rare Gas-Halide Lasers; Photocathodes; Pulsed Lasers

19980206332 Sandia National Labs., Albuquerque, NM USA
Multi-staged, InAsSb mid-infrared lasers and light-emitting diodes, grown by MOCVD
Kurtz, S. R., Sandia National Labs., USA; Allerman, A. A., Sandia National Labs., USA; Biefeld, R. M., Sandia National Labs., USA; Baucom, K. C., Sandia National Labs., USA; 1997; 7p; In English; 24th; Compound Semiconductors, 11 Aug. 1997, San Diego, CA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2237C; CONF-970887; DE97-009385; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Due to lower nonradiative rates, mid-infrared (2-6 micron) lasers with strained, narrow bandgap, Sb-based active regions have the potential to operate at lower current density and higher temperature than competing devices. Superior performance may be achieved through the 'band structure engineered' reduction of Auger recombination and the implementation of multi-stage (or 'cascaded') active regions. We describe the first lasers and LEDs utilizing strained InAsSb, multi-stage active regions. An (n)InAs / (p)GaAsSb semimetal layer is incorporated into each stage as an internal electron-hole source. to date, 2-stage LEDs and 2-stage lasers have been demonstrated. Our multi-stage devices were grown by MOCVD.
DOE
Current Density; Holes (Electron Deficiencies); Metalorganic Chemical Vapor Deposition; Light Emitting Diodes

37
MECHANICAL ENGINEERING

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

19980203276 Chicago Univ., Chicago, IL USA
Nonlinear Dynamics of Tracked Vehicles ***Final Report, 16 May 1994 - 31 Dec. 1997***
Shabana, Ahmed A., Chicago Univ., USA; Jan. 02, 1997; 10p; In English
Contract(s)/Grant(s): DAAH04-94-G-0207
Report No.(s): AD-A344299; ARO-32023.12-EG; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of this research project to develop nonlinear multibody computer methodologies that take into account the effect of the three dimensional interaction between the track chains and other vehicle components such as the sprockets, idlers, and the rollers as well as the effect of the dynamic coupling between the rigid body displacements and the elastic deformation of the vehicle components. In the methods developed in this research project, the kinematic degrees of freedom of the track chains are taken into consideration when the dynamic equations of the vehicle are formulated. It is demonstrated that significant reduction in the number of degrees of freedom of the track chains can lead to an inaccurate modeling of the vehicle dynamics and also to numerical difficulties in the computer simulation of this type of vehicles. Therefore, in this research project detailed three dimensional tracked vehicle models that take into account the effect of the chain degrees of freedom are developed.
DTIC
Computerized Simulation; Tracked Vehicles; Nonlinear Systems; Dynamical Systems

19980203467 Vanderbilt Univ., Nashville, TN USA
DI Diesel Performance and Emissions Model ***Final Report***
Mellor, A. M., Vanderbilt Univ., USA; Easley, W. L., Vanderbilt Univ., USA; Mello, J. P., Vanderbilt Univ., USA; Psota, M. A., Vanderbilt Univ., USA; Mar. 31, 1998; 40p; In English
Report No.(s): AD-A344633; ARO-32535.6-EG; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Based on findings indicating that both the Zeldovich and N2O mechanisms are important in the formation and decomposition of NO in direct injection (DI) Diesel engines a skeletal mechanism consisting of seven elementary reactions is used to develop a two-zone model for NO(x) emissions from DI Diesel engines. Characteristic chemical kinetic times for NO formation in zone 1 and NO decomposition in zone 2 are formulated from the law of mass action applied separately to each zone and the relative importance of NO decomposition in four DI Diesel engines is examined. Preliminary fluid mechanic mixing times for NO formation are developed by the combination of fluid relations characteristic of each of the many mixing processes occurring in a DI

Diesel engine. These results are empirical, but future fluid mechanic mixing times applicable to all DI Diesel engines may be found. Similarly, a two-zone soot CTM accounting for both soot formation and oxidation is outlined. The NO(x)/soot tradeoff for low loads is also proven using the preliminary models for soot and NO(x) thereby showing that when complete the models will predict the correct trends.
DTIC
Exhaust Emission; Diesel Engines; Combustion; Nitrogen Oxides; Combustion Products; Exhaust Gases

19980203478 Lockheed Martin Corp., Information Systems, Orlando, FL USA
Advanced Distributed Simulation Technology 2 (ADST-2 Hybrid Electric Combat Vehicle *Final Report*
Feb. 02, 1998; 46p; In English
Contract(s)/Grant(s): N61339-96-D-002
Report No.(s): AD-A344727; ADST-II-CDRL-LSE-9800024; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project was originally titled the Hybrid Electric Combat Vehicle (HECV); hence the title on the cover. It was subsequently named the Combat Hybrid Power System (CHPS) project and is so-called hereafter. This paper presents two different analyses of the vehicle performance characteristics of the CHPS. The first used a panel of military subject matter experts to examine the validity of CHPS performance requirements. The second ran virtual exercises using the Modular Semi-Automated Forces (ModSAF) model to gain insight into the relative effectiveness of a CHPS system in conducting Army After Next (AAN) combat missions. Results from the SME Requirements Analysis survey indicate that currently CHPS cross country speeds may be too high for crew safety and command and control reasons. Results of the ModSAF study suggest that the CHPS may prove to be more mobile, survivable, and lethal in an Army After Next battlefield than other candidate systems.
DTIC
Distributed Interactive Simulation; Systems Simulation; Safety Factors; Electric Motor Vehicles; Combat

19980203599 Railway Technical Research Inst., Tokyo, Japan
Possibility of a Superconducting Bulk Magnet for the Maglev Train
Fujimoto, Hiroyuki, Railway Technical Research Inst., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 3-16; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Superconducting magnets which use high critical temperature, T(c), oxide superconductors are promising for industrial applications including the magnetically levitated (Maglev) train. Since the discovery of high T(c) superconductors in 1986, much effort has been devoted to developing materials with a high critical current density, J(c). Recent development shows that rare-earth REBa2Cu3O(7-x) and light rare-earth LREBa2Cu3O(7-x) superconductors prepared by melt processes have a high J(c) at 77 K in high magnetic fields. A wide variety of applications of (RE)-Ba-Cu-O superconductors have been proposed. Further, (LRE)-Ba-Cu-O bulk superconductors melt-processed in a reduced oxygen atmosphere, named oxygen-controlled-melt-growth (OCMG) processes are very promising for high field applications as a superconducting permanent magnet with liquid nitrogen refrigeration. Compared to a good quality melt-grown REBCO bulk, LREBCO bulks exhibit larger J(c) in high magnetic fields and much improved irreversibility field, H(irr) at 77 K, implying that more effective flux pinning can be realized in a commercially feasible way. In this paper, we discuss the possibility of a superconducting bulk magnet for the Maglev train in the aspect of a preliminary design of the bulk magnet and also melt processing for REBCO and LREBCO bulk superconductors and their characteristic superconducting properties.
Author
Superconducting Magnets; Melts (Crystal Growth); Rare Earth Elements; High Temperature Superconductors; Metal Oxides; Magnetic Levitation Vehicles; Crystal Growth

19980203600 HSST Development Corp., Tokyo, Japan
The HSST Maglev Train: Development, Technology, and Prospect
Iwaya, Mituru, HSST Development Corp., Japan; Tanaka, Masao, Chubu HSST Development Corp., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 17-31; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The High Speed Surface Transport (HSST) is a magnetically levitated and linear motor propelled vehicle for mass transit. It has superior environmental adaptability over traditional wheeled vehicles. It was first developed by Japan Air Lines in 1975 as the HSST-01 and the following development efforts have resulted in the latest version of HSST-100L. The Ministry of Transport

in Japan made an announcement in 1993 that the HSST poses no technical problems concerning its commercial use. It is now awaiting practical operation.
Author
Magnetic Levitation Vehicles; Magnetic Suspension; Suspension Systems (Vehicles); Systems Engineering; Design Analysis

19980203604 Thompson (Marc T.), Watertown, MA USA
Modeling of HTSC-Based Iron Core Flux-Canceling Electrodynamic Suspension for Maglev
Thompson, Marc T., Thompson (Marc T.), USA; Thornton, Richard D., Massachusetts Inst. of Tech., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 81-95; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The design and analysis of a new iron core ”flux-canceling” magnetic suspension suitable for high-temperature superconductors (HTSC) is described. A 1/5-scale model of this suspension has been designed and tested with a high-speed rotating wheel test facility. A new low-cost multiple-loop guideway has been tested and lift, drag, and guidance forces have been measured at operating speeds approaching that of a full-scale train. These results are compared to predictions based on simple circuit models, with good results. A vertical control system has been designed and tested to improve ride quality through differential control of the magnet currents. The test fixture has also been used to validate the concept of lift generation at zero train velocity by AC excitation of the main magnet coils. Scaling laws have been applied to the results and predictions made for a full-scale HTSC suspension operating at 40K. Further work in this area may help overcome one of the fundamental limitations of electrodynamic (EDS) Maglev --- the fact that there is zero levitation force at zero train velocity and a low speed suspension is needed.
Author
High Temperature Superconductors; Iron Compounds; Scale Models; Scaling Laws; Design Analysis; Magnetic Suspension; Magnetic Cores; Electrodynamics; Suspension Systems (Vehicles)

19980203606 Mohawk Innovative Technology, Inc., Albany, NY USA
Design of a Stator-Controlled Magnet Bearing
Chen, H. Ming, Mohawk Innovative Technology, Inc., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 101-109; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The subject bearing has a laterally movable stator which consists of a permanent magnetic ring axially polarized and two disks made of magnetic material. The radial magnetic flux at the air gaps between the stator and rotor form an unstable bearing. to make it stable, the stator is mounted on mechanical springs and motion-controlled by feeding back the rotor displacement. The motion control actuators are likely of the stationary electromagnetic type. A design methodology for the new bearing concept is presented herein with emphasis on sizing the system parameters for stability. The bearing is best suited for supporting vertical rotors, such as those of energy or momentum storage flywheels. It has a simple rotor structure, minimal eddy-current loss, and electronically maneuverable stiffness and damping.
Author
Magnetic Bearings; Stators; Control Systems Design; Design Analysis; Stabilization

19980203607 Sulzer Electronics A.G., Winterthur, Switzerland
Radial Active Magnetic Bearing for Operation With a 3-Phase Power Converter
Schoeb, Reto, Sulzer Electronics A.G., Switzerland; Redemann, Christian, Eidgenoessische Technische Hochschule, Switzerland; Gempp, Thomas, Eidgenoessische Technische Hochschule, Switzerland; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 111-123; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In order to reduce costs, radial active magnetic bearings have been proposed which are formed by only three electromagnets. Unfortunately it is not possible to operate the three coils with a 3-phase power converter, since the sum of the coil currents does not equal zero. Three independent amplifier channels are needed for the control of this arrangement. In this paper, a radial magnetic bearing is proposed which can be operated by commercial 3-phase power amplifiers. by the use of an arrangement of bias coils, it is possible to make the sum of the three currents become zero. Some problems related to this bearing arrangement as well as their solutions are discussed and shown using the example of two prototype bearings.
Author
Magnetic Bearings; Power Converters; Power Amplifiers; Cost Reduction; Magnetic Coils

19980203611 Kyushu Univ., Dept. of Electrical and Electronic Systems Engineering, Fukuoka, Japan

Magnet Wheel Using Permanent Magnets for Repulsive Magnetic Levitation and Induction Type Thrust

Fujii, Nobuo, Kyushu Univ., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 165-177; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A revolving permanent magnet type magnetic wheel called the ”magnet wheel” is shown, which has both functions of inductive repulsive-type magnetic levitation and thrust. The characteristics of two types of the ”tilt type magnet wheel” and the ”partial overlap magnet wheel” are studied respectively by using a test facility and three-dimensional numerical analysis. The lift force, the thrust and the lateral force characteristics at standstill are shown versus revolving speed, the mechanical clearance, the conductivity of conducting plate, the arrangement of magnets, the volume of magnets, the tilt angle for the tilt type and the overlap factor for the partial overlap type.

Author

Wheels; Permanent Magnets; Thrust; Levitation

19980203612 National Research Inst. for Metals, Tsukuba, Japan

XHV Integrated Process With Magnetic Levitation Transports

Tosa, Masahiro, National Research Inst. for Metals, Japan; Kasahara, Akira, National Research Inst. for Metals, Japan; Yoshihara, Kazuhiro, National Research Inst. for Metals, Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 179-185; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Extreme high vacuum (XHV), below 10(exp -10) Pa, can result in no surface contamination by adsorption of gases and offer an ideal ultraclean environment which lasts long enough to artificially synthesize advanced materials with atomic manipulation. An XHV integrated process with magnetic levitation transports has been developed in order to transfer substrates long distances from one instrumented vacuum chamber to another without any contamination on the ultraclean substrate surface. The process consists of vacuum chambers, pumps, gauges, gate valves, transports for the main line and sidetrack line and so on. The integrated process has five main line chambers and six sidetrack line chambers with connections to six chambers with instruments. A main line has a connection-chamber to join a main line chamber and a sidetrack line chamber which can attach chambers with such instruments as surface analyzers, film preparation and so on. Magnetic levitation transports are installed into the line chambers because they have no sliding parts to generate dust particles and outgassing which may extensively damage ultraclean substrate surfaces and environments. One transport for the main line electromagnetically levitates a carrier and transfers it by linear motor drive. The other transport for the sidetrack line levitates a carrier by YBa2CuO7-x superconducting magnet discs and mechanically transfers it by means of pinning effect. The levitation transports can transfer a substrate from one connected chamber to another with a pressure change of less than 10(exp -10) Pa.

Author

Magnetic Suspension; High Vacuum; Levitation

19980203614 Knolle Magnetrans, San Francisco, CA USA

Maglev Pipeline to Improve Grain Shipments From America to Asia

Knolle, Ernst G., Knolle Magnetrans, USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 199-209; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Magnetic levitation (Maglev) technology has been advanced to a level where several versions, and combinations thereof, can be considered ’proven technology’. For instance, in Disneyland, an amusement park owned by Walt Disney World Inc. in California, U.S.A., a system, called the PeopleMover, has been in operation since 1975. While the PeopleMover’s linear induction motors (LIMs) operate at low speed, faster LIMs were designed, built and successfully tested in the late 1970s at the Transportation Test Center near Pueblo, Colorado, U.S.A. This technology has now also been adapted for use to levitate and propel grain containers over long distances, such as from grain producing areas of the U.S.A. to the West Coast, at high speed and low cost, for subsequent shipment by large bulk grain carriers to Asia. Capacity requirements, logistics and financial feasibility of such a project was analyzed.

Author

Magnetic Suspension; Technology Transfer; Transportation; Levitation

19980203616 Kyushu Inst. of Design, Dept. of Engineering Design, Fukuoka, Japan

Characteristics of Active Magnetic Bearings Biased With Permanent Magnets on the Rotor

Fukata, Satoru, Kyushu Inst. of Design, Japan; Yutani, Kazuyuki, Kyushu Univ., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 221-235; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

An active magnetic radial bearing is constructed by a combination of permanent magnets for biasing and electromagnets for control. A ring-shaped permanent magnet with axial magnetization is arranged between two rotor cores on a shaft and shares all the pole legs with the electromagnets. The stator is composed of two rings having four pole legs in their inner side and four connecting segments giving the permanent-magnetic flux path. This composition is similar to that of a case where permanent magnets are arranged in the stator. In the non-rotating state, frequency responses of the rotor positioning control system are measured and the transient rotor-motion for impulsive force is tested. The frequency responses are compared with numerical results based on a simple model. In the rotating state, the decay of rotation due to magnetic braking with air friction is examined together with the whirling of the rotor.
Author
Magnetic Bearings; Product Development; Shafts (Machine Elements); Magnetic Flux; Braking; Rotation; Decay

19980203617 Technische Univ., Inst. of Mechatronics, Darmstadt, Germany
A New Model Based Method for the Accurate Measurement of Magnetic Bearing Forces
Matros, Michael, Technische Univ., Germany; Sobotzik, Joachim, Technische Univ., Germany; Nordmann, Rainer, Technische Univ., Germany; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 239-248; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Active magnetic bearings (AMB) are typical mechatronic systems. Their employment in rotating machinery offers the possibility for active control of the dynamics of the shaft as well as use as a diagnosis tool. The use of an AMB can make turbomachinery safer and more efficient. In many cases an accurate knowledge of the bearing forces is demanded. A specific example where this topic is relevant is briefly described in this paper. It is a test-rig which was designed for the identification of physical parameters such as stiffness, damping and inertia coefficients of journal bearings, annular seals and others. The AMB's are used as exciters in order to apply an artificial and controlled motion on a test shaft. For the identification of the unknown coefficients, it is necessary to measure time dependent displacements and forces, which are acting on the moving shaft, with sufficient accuracy. The measurement of the shaft movement, e.g. by eddy current sensors, with very low errors is state of the art whereas the determination of the bearing forces with high accuracy takes much more effort. A very simple and cheap possibility is based on the measurement of bearing coil currents and the air gap between rotor and magnet (i-s-method). The main advantage of this approach is that no additional sensor devices other than the ones which are required for the control system of the AMB, are necessary. But this method has the disadvantage of neglecting eddy current losses as well as hysteresis and saturation effects of the core material. Hence the measured force is polluted by an error of amplitude and phase with unknown quantities. Due to lamination of the magnets and the magnetized parts of the shaft in combination with comparatively low rotational speeds and excitation frequencies, eddy current losses are of less importance and the error is dominated by the hysteresis. The characteristic of the force error by using the i-s-method is shown by theory and with experimental help. In addition to that, the paper presents a new method that allows a prediction and, hence, correction of errors due to hysteresis and saturation effects. It is based on a model by which the hysteresis of the core material can be simulated. The results of the model are verified by measurements. In a specific test, it is shown that the error of the force measurement can be reduced from 9% down to 1.5% in amplitude. The phase shift due to hysteresis losses is shown to be less than 2 deg for the core material used in the test-rig. Hence the capability of the method is proven, which allows a much more accurate identification of rotordynamic coefficients with the test rig. In addition to that, it offers the possibility of precise, simple and cheap force measurement in any machinery where AMB's are used for shaft support.
Author
Magnetic Measurement; Magnetic Bearings; Active Control; Dynamic Control; Diagnosis

19980203618 Saitama Univ., Dept. of Mechanical Engineering, Urawa, Japan
Application of Self-Sensing Magnetic Suspension to a Linear Carrier System
Mizuno, Takeshi, Saitama Univ., Japan; Kitahara, Eiichi, Nissan Motor Co. Ltd., Japan; Araki, Kenji, Saitama Univ., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 249-258; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A magnetically suspended linear carrier system is developed which has electromagnets for suspension on the stator. The electromagnets are used not only for force generation but also for gap sensing so that sensors to be placed along the tracks can be omitted. Permanent magnets for power saving are built in the carrier so that the number of permanent magnets are reduced, compared to systems with permanent magnets in the stator. The virtually zero power suspension is automatically accomplished by applying the observer-based self-sensing suspension method. This paper describes the basic configurations of the developed magnetically suspended carrier system, and demonstrates experimental results on the self-sensing suspension.
Author
Magnetic Suspension; Linear Systems; Fabrication

19980203619 Kanazawa Univ., Dept. of Electrical and Computer Engineering, Japan

Mu-Analysis and Synthesis of a Magnetic Suspension System Considering Structured Uncertainties

Namerikawa, Toru, Kanazawa Univ., Japan; Fujita, Masayuki, Japan Advanced Inst. of Science and Technology Hokuriku, Japan; Matsumura, Fumio, Kanazawa Univ., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 259-271; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper deals with modeling, structured uncertainties, mu-analysis and synthesis of a magnetic suspension system. First we derive a nominal model of the plant and consider its structured uncertainties, e.g., linearization error, parametric uncertainties, and neglected dynamics. Then we set the interconnection structure which includes the above structurally represented uncertainties. Next we design a robust mu controller which achieves robust performance conditions using the structured singular value mu. Finally, we evaluate the proposed interconnection structure and verify robustness and performance of the designed mu controller by experiments.

Author

Magnetic Suspension; Mathematical Models; Errors; Evaluation; Suspension Systems (Vehicles)

19980203621 Thompson (Marc T.), Watertown, MA USA

Test Results From a Large Scale, High Speed EDS Maglev Wheel Test Facility

Thompson, Marc T., Thompson (Marc T.), USA; Kondoleon, Anthony, Draper (Charles Stark) Lab., Inc., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 287-301; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Laboratory for Electromagnetic and Electronic Systems at the Massachusetts Institute of Technology and the Charles Stark Draper Laboratory, for the past few years, have been testing an innovative Electrodynamic Suspension (EDS) system for Maglev applications on their large scale, high speed wheel test facility. Magnetically-levitated high-speed ground transportation technology is a potential solution to increasing highway and air corridor congestion. The Intermodal Surface Transportation Efficiency Act of 1992 (ISTEA) mandated the development of a prototype Maglev demonstration system. In 1993, a team of MIT, Draper, Bechtel, Hughes Electronics, and General Motors completed one of four System Concept Definition studies of Maglev systems in the National Maglev Initiative (NMI). This team concept was based on Electrodynamic Levitation and Guidance (EDS) using superconducting magnets and a special arrangement of electrical conductors on the guideway. The magnetic suspension system was the most important, but least understood part of proposed EDS Maglev systems. Thorough understanding of such systems, with verified analytical design techniques, were essential to formulating improved designs for successful full scale systems. Since the original NMI study, a new ”flux-canceling” Maglev geometry has been developed, and the test fixture described in this paper experimentally confirms the predictions and models derived in the course of this study. New design and analytic techniques for Maglev guideway structures have been developed. The test wheel has been successfully run at speeds simulating that of a full-scale Maglev system and resultant data has been taken at speeds significantly higher than the Maglev drag peak.

Author

Superconducting Magnets; Wheels; Magnetic Suspension; Electrodynamics; Electric Fields; Energy Storage

19980203622 Massachusetts Inst. of Tech., Cambridge, MA USA

Magnetically Based Ride Quality Control for an Electrodynamic Maglev Suspension

Thornton, Richard D., Massachusetts Inst. of Tech., USA; Thompson, Marc T., Thompson (Marc T.), USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 303-312; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

ElectroDynamic Suspensions are highly undamped and require some form of active control or a secondary suspension to achieve adequate ride quality. This paper reports on efforts to develop a version of EDS that uses controllable magnetic forces to eliminate the need for any secondary suspension. The magnetic forces act directly on the guideway and avoid the need to have unsprung weight and a secondary suspension. It is shown that the energy required to effect this control can be less than 1% of the energy stored in the suspension magnets, so a modest size controller can be used. The same controller can also provide lift at very low speeds and thereby eliminate the need for a separate low speed suspension system.

Author

Magnetic Suspension; Levitation; Electrodynamics; Electromechanical Devices; Electric Fields; Energy Storage

19980203624 Kanazawa Univ., Dept. of Electrical and Computer Engineering, Japan

Elimination of Unbalance Vibration in Variable Speed Magnetic Bearings Using Discrete-Time Q-Parameterization Control

Lee, Jun-Ho, Kanazawa Univ., Japan; Mohamed, Abdelfatah M., Assiut Univ., Egypt; Matsumura, Fumio, Kanazawa Univ.,

Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 327-338; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper we propose a controller design methodology using the discrete-time Q-parameterization control for variable speed magnetic bearings in order to achieve elimination of unbalance vibrations. Rotor unbalance usually generates sinusoidal disturbance forces, with frequency equal to the rotational speed. So, in order to achieve asymptotic rejection of these disturbance forces, the Q-parameterization controller free parameter Q is chosen such that the controller has poles on the unit circle at z = exp(sup jP(sub k)T(sub s)) for the different speeds of rotation P(sub k),(T(sub s) is the sampling period). First, we give a mathematical model for the magnetic bearing in state space form. Second, we explain the proposed discrete-time Q-parameterization controller design methodology. The controller free parameter Q is assumed to be a proper stable transfer function whose order equals twice the number of operating speeds. Third, we show that the controller free parameter which satisfies the design objectives can be obtained by simply solving a set of linear equations rather than solving a complicated optimization problem. We also show that the controller order equals: Number of degrees of freedom x (order of Q +3). Finally, several simulation and experimental results were obtained to evaluate the proposed controller. The results obtained showed the effectiveness of the proposed controller in eliminating the unbalance vibrations at the different speeds of rotation.

Author

Magnetic Bearings; Vibration; Transfer Functions; Parameterization; Degrees of Freedom

19980203625 Ibaraki Univ., Dept. of Mechanical Engineering, Hitachi, Japan

Angular Coordinate Repetitive Control of Magnetic Bearings

Okada, Yohji, Ibaraki Univ., Japan; Nagai, Bunshu, Ibaraki Univ., Japan; Karino, Katsuhiko, Ibaraki Univ., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 339-349; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

New repetitive control is applied to active magnetic bearings. It is intended for rotor magnetic bearing systems to reduce unbalanced response automatically. Repetitive control is a kind of servo control which is expected to follow periodic command. The follow-up property is based on internal model principles, that is, the controller includes a repetitive-type transfer function. The system also has noise rejection properties from the repetitive disturbance produced by the rotor imbalance. A simple experiment is performed to confirm the proposed technique. The results show good disturbance rejection properties and robustness.

Author

Magnetic Bearings; Servomechanisms; Rotors; Transfer Functions; Automatic Control; Servocontrol

19980203628 National Aerospace Lab., Tokyo, Japan

2-Axis Actively Controlled Magnetic Bearings

Nakajima, Atsushi, National Aerospace Lab., Japan; Kakuta, Naoki, Hosei Univ., Japan; Soeda, Tomohiro, Hosei Univ., Japan; Shibata, Gen, Mitsubishi Precision Co. Ltd., Japan; Sekine, Tomoyuki, Mitsubishi Precision Co. Ltd., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 385-392; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Microsatellites are characterized as better, faster, cheaper spacecraft and their effective utilization is actively studied by universities, national institutes and private companies. Owing to technology innovations, small and lightweight on-board components are fabricated with high mission performances. For example, 3-axis attitude control is required for 50 kg-class microsatellites. In order to satisfy such demands, weight, mass and power consumption of each sensor and actuator are strictly limited. The National Aerospace Laboratory (NAL) has been developing magnetic bearings for attitude control actuators such as reaction and momentum wheels. Several types of magnetic bearings have been manufactured and evaluated and resulted in the advantage of 2-axis magnetic bearings with a potential miniaturization. In this paper, the development histories of 2-axis magnetic bearings in NAL and recent small magnetic bearing reaction wheels for microsatellite attitude control actuators are described. The design goal is a small size magnetic bearing reaction wheel, which has the characteristics of approximately 1.5 kg weight, 100 mm diameter and 0.2 Nms angular momentum at 6,000 rpm.

Author

Magnetic Bearings; Active Control; Miniaturization; Attitude Control; Onboard Equipment; Actuators

19980203629 Kanazawa Univ., Lab. of Magnetic Field Control and Applications, Japan

Comparative Studies of Levitation and Control Performances of Two Types of Single-Axis Controlled Repulsive Type Magnetic Bearing

Mukhopadhyay, S. C., Kanazawa Univ., Japan; Ohji, T., Kanazawa Univ., Japan; Kuwahara, T., Kanazawa Univ., Japan; Iwahara, M., Kanazawa Univ., Japan; Yamada, S., Kanazawa Univ., Japan; Matsumura, F., Kanazawa Univ., Japan; Fourth International

Symposium on Magnetic Suspension Technology; May 1998, pp. 393-405; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Single-axis controlled repulsive type magnetic bearings have the advantages of simplified control schemes and less numerous electromagnets. The bearing system employed can be one of two types of machine configurations: (1) Vertical-shaft machines, (2) Horizontal-shaft machines. Prototype models of each type have been developed and experiments have been conducted in our laboratory. This paper discusses different aspects such as the design of bearing systems and configuration, levitation, control, vibration and disturbance attenuation characteristics etc. of two types of schemes of repulsive type magnetic bearings. The controllers of both systems have been configured around digital signal processors.

Author

Magnetic Bearings; Levitation; Configuration Management; Magnetic Control; Active Control; Control Simulation; Dynamic Models; Systems Simulation

19980203632 Nizhni Novgorod Univ., Research Inst. for Applied Mathematics and Cybernetics, Nizhni Novgorod, Russia

Nonlinear Robust Control and its Application to Magnetic Suspension Technology

Voronkov, Victor S., Nizhni Novgorod Univ., Russia; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 441-449; In English; Also announced as 19980203598

Contract(s)/Grant(s): RBRF-97-01-00669; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Nonlinear robust control is a development of the modern robust approach to the stability of linear control systems. For nonlinear systems, this approach was used in the theory of absolute stability. The absolute stability methods are bounded as a rule by the class of stable SISO-objects. However, magnetic suspension technology deals with unstable and MIMO-objects in the general case. Design of stabilizing systems for magnetic suspension may effectively be carried out on the basis of a proposed approach to nonlinear robust control synthesis. The proposed approach is based on the criterion of the Maximum Region of Attraction for stabilizing equilibrium in the phase space of a closed loop system. Actually the same criterion is used in absolute stability theory whose methods allow relation of the topological identity, the phase space structure of the system with the nonlinear control, to the phase space structure of the linear system. The analytical solution of the synthesis problem in a form of a nonlinear robust control law allows the determination of the dependence of the optimal regulator's structure and parameters from the objects. The theoretical background of using regulators has been added to the base of the proposed synthesizing approach and new nonlinear robust control laws for stabilizing magnetic suspension systems have been found. One of the new control laws is the control of angular motion of a shaft in magnetic bearings with gyroscopic effects. Finding this law required the development of the suggested approach from unstable to stable objects having conservative stability.

Author

Magnetic Suspension; Feedback Control; Control Theory; Nonlinear Systems; Robustness (Mathematics); Magnetic Bearings; Shafts (Machine Elements); Angular Velocity; Mathematical Models; Gyroscopic Stability

19980203633 Natal Univ., Durban, South Africa

Efficient Method of Force Calculation for Biased Magnetic Bearings

Hippner, Maciej, Natal Univ., South Africa; Piech, Zbigniew, United Technologies Research Center, USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 451-457; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The magnetic field in biased radial magnetic bearings is three dimensional in nature. This means that if a high accuracy is required, design, analysis and performance calculations of such a bearing would call for a three dimensional (3-D) finite element analysis. Unfortunately, 3-D finite element analysis is both time consuming and requires significant computer resources. For force (load) calculation purposes, this 3-D problem can be reduced to a two dimensional one. Such a move significantly reduces both time required to design a finite element model as well as the solution time. It also opens new opportunities e.g. makes parametric analysis and optimization of the bearing much more viable. The proposed method was verified on a prototype high speed (35,000 rpm, 125 lb) homopolar radial magnetic bearing with a permanent magnet bias. Force acting on the rotor of the bearing was calculated using both 3-D and 2-D finite element models of the magnetic bearing. The values obtained from the FE analysis were compared with the force measured on the prototype bearing. The agreement between the calculated and measured values was very good.

Author

Magnetic Bearings; Two Dimensional Models; Mathematical Models; Finite Element Method; Loads (Forces); Permanent Magnets

19980203689 Sandia National Labs., Albuquerque, NM USA

Nonlinear model reduction

Segalman, D., Sandia National Labs., USA; Heinstein, M., Sandia National Labs., USA; Sep. 1997; 41p; In English

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

Report No.(s): SAND-97-2088; DE97-009149; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The very general problem of model reduction of nonlinear systems was made tractable by focusing on the very large subclass consisting of linear subsystems connected by nonlinear interfaces. Such problems constitute a large part of the nonlinear structural problems encountered in addressing the Sandia missions. A synthesis approach to this class of problems was developed consisting of the following: detailed modeling of the interface mechanics; collapsing the interface simulation results into simple nonlinear interface models; constructing system models by assembling model approximations of the linear subsystems and the nonlinear interface models. These system models, though nonlinear, would have very few degrees of freedom. A paradigm problem, that of machine tool vibration, was selected for application of the reduction approach outlined above. Research results achieved along the way as well as the overall modeling of a specific machine tool have been very encouraging. In order to confirm the interface models resulting from simulation, it was necessary to develop techniques to deduce interface mechanics from experimental data collected from the overall nonlinear structure. A program to develop such techniques was also pursued with good success.

DOE

Nonlinear Systems; Machine Tools; Mathematical Models

19980204707 National Inst. of Standards and Technology, Materials Reliability Div., Boulder, CO USA

International Conference on Computer Technology in Welding

Siewert, T., National Inst. of Standards and Technology, USA; Nov. 1997; 602p; In English; 7th, 8-11 Jul. 1997, San Francisco, CA, USA

Report No.(s): PB98-149008; NIST/SP-923; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This is the report of the seventh conference, held July 8-12, 1997 in San Francisco, California, and was presented in conjunction with the American Welding Society, The Welding Institute and the National Institute of Standards and Technology. Attendees were able to observe how computers can be used for more than just databases. In addition to tutorials, the following were covered: case studies, controls and controllers, sensing, process automation, modeling heat and fluid flow, modeling thermomechanical effects, and modeling residual stress or mechanical effects. Also covered were the Internet and networked systems in the welding industry.

NTIS

Welding; Conferences; Computer Systems Design; Computers; Data Bases

19980205616 Allied-Signal Aerospace Co., Kansas City, MO USA

Development of motion control method for laser soldering process

Yerganian, S. S., Allied-Signal Aerospace Co., USA; May 1997; 63p; In English

Contract(s)/Grant(s): DE-AC04-76DP-00613

Report No.(s): KCP-613-5940; DE97-053278; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Development of a method to generate the motion control data for sealing an electronic housing using laser soldering is described. The motion required to move the housing under the laser is a nonstandard application and was performed with a four-axis system using the timed data streaming mode capabilities of a Compumotor AT6400 indexer. A Microsoft Excel 5.0 spreadsheet (named Israuto.xls) was created to calculate the movement of the part under the laser, and macros were written into the spreadsheet to allow the user to easily create this data. A data verification method was developed for simulating the motion data. The geometry of the assembly was generated using Parametric Technology Corporation Pro/E version 15. This geometry was then converted using Pro/DADS version 3.1 from Computer Aided Design Software Inc. (CADSI), and the simulation was carried out using DADS version 8.0 from CADSI.

DOE

Procedures; Soldering; Computer Graphics; Computer Aided Manufacturing; Heating; Laser Beams

19980205799 Sandia National Labs., Albuquerque, NM USA

SmartWeld working session for the GTS4

Kleban, S., Sandia National Labs., USA; Hicken, K., Sandia National Labs., USA; Ng, R., Sandia National Labs., USA; Fricke, B., Allied-Signal Aerospace Co., USA; Aug. 1997; 35p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2094; DE97-009322; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Results from SmartWeld's first working session involving in-progress designs is presented. The Welding Advisor component of SmartWeld was thoroughly exercised, evaluated all eleven welds of the selected part. The Welding Advisor is an expert system implemented with object-oriented techniques for knowledge representation. With two welding engineers in attendance, the recommendations of the Welding Advisor were thoroughly examined and critiqued for accuracy and for areas of improvement throughout the working session. The Weld Schedule Database component of SmartWeld was also exercised. It is a historical archive of proven, successful weld schedules that can be intelligently searched using the current context of SmartWeld's problem solving state. On all eleven welds, the experts agreed that Welding Advisor recommended the most risk free options. As a result of the Advisor's recommendation, six welds agreed completely with the experts, two welds had their joint geometry modified for production, and three welds were not modified but extra care was exercised during welding.
DOE
Evaluation; Technology Assessment; Welded Joints; Welding; Plasma Arc Welding; Laser Welding; Arc Welding

19980206007 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Antriebstechnik, Cologne, Germany
Investigation of the Spray Dynamics of Aeroengine Fuel Injectors Under Atmospheric and Simulated Pressure Conditions
Behrendt, T., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Hassa, C., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 14p; In English; Also announced as 19980206002
Contract(s)/Grant(s): BWB-E/L41A/V0077/P5131; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The two phase flow in the nearfield of an airblast atomizer in a cylindrical confinement was investigated with a three component (3D) dual mode Phase Doppler Anemometer (PDA). An algorithm for the calculation of the mass flux in a strongly swirling spray was derived. The algorithm makes use of all three velocity components. The improved performance relative to a 2D-algorithm is shown for an atmospheric spray. The error of the integrated mass flux is about +/- 15% at a distance of more than 10 mm behind the nozzle exit. The investigations were made in an attempt to get first information on the two phase flow under real pressure condition where the dense spray starts to modify the flow pattern and hence the fuel distribution. Similarity rules were derived for scaling the combustor idle condition with respect to the particle number concentration in the spray. The measurements were made under atmospheric and simulated pressure condition. The measured spray properties agreed well with the expected results calculated from the similarity rules. Several effects of the spray on the gas phase were identified under simulated pressure. A reduced turbulence of the gasphase, a decreased dispersion of the spray and a degradation of the effective swirl number were identified as dense spray effects. These phenomena are likely to occur under real pressure as well. Other effects identified were results of the particle inertia. For the correct interpretation of the results it was necessary to estimate the degree to which the particle behaviour is influenced by its inertia under simulated and real pressure. Together with this evaluation the simulation of real engine condition with respect to the particle number concentration was successful within certain limits.
Author
Fuel Injection; Two Phase Flow; Spraying; Atomizers; Anemometers; Flow Measurement; Velocity Measurement; Algorithms; Atmospheric Pressure; Pressure Ratio

19980206011 Defence Research Agency, Propulsion Dept., Farnborough, UK
DIAL Measurements on a Gas Turbine Exhaust
Brundish, K. D., Defence Research Agency, UK; Wilson, C. W., Defence Research Agency, UK; Moncrieff, J. T. M., Spectrasyne Ltd., UK; May 1998; 8p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper summarises work undertaken by Defence Evaluation and Research Agency (DERA) and SPECTRASYNE, and examines the technique of DIAL as a measurement of gas turbine engine emissions. The work was jointly funded by the UK MOD and UK DTI. The DIAL technique is based on LIDAR, which is a laser based range finding system, similar to RADAR. With the use of a tuneable laser it can be adapted for spectroscopic measurements of mass flux. This technique was used to measure NO(x) and unburnt hydrocarbon mass fluxes from the vertical engine detuner, for two engines at three running conditions. The NO(x) measurements were converted to vppm values at the engine exit plane to allow comparison with intrusive probe measurements. The DIAL measurements of NO(x) at idle and max. continuous were within 25% of the probe measurements. The DIAL measurements are performed at a plane downstream of the detuner exit, and rely on the wind to move the plume through this plane. Low wind speeds which are usually associated with variable wind directions, can result in increased uncertainty. However, minimum reheat values were considerably different, and cannot be explained by these uncertainties. This anomaly is as yet unresolved, although a possible solution may be from continued reactions in the detuner. The unburnt hydrocarbon (UHC) measurements from

both DIAL and the probe exhibited the same trends, although a direct comparison was not possible due to the unknown composition of the hydrocarbons exiting the engine. This made it impossible to calculate concentration from the mass flux measurements. Further work on gas turbine engines should be performed under less arduous conditions for DIAL measurements than the reported tests. Measurements in open areas directly behind the engine with a horizontal plume, offers the best conditions.
Author
Exhaust Emission; Optical Radar; Measuring Instruments; Nitrogen Oxides; Exhaust Gases; Gas Turbine Engines; Mass Flow Rate

19980206012 Sverdrup Technology, Inc., Arnold Engineering Development Center Group, Arnold AFS, TN USA
UV Absorption Measurements of Nitric Oxide Compared to Probe Sampling Data for Measurements in a Turbine Engine Exhaust at Simulated Altitude Conditions
Howard, R. P., Sverdrup Technology, Inc., USA; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Nitric oxide measurements were conducted in the exhaust of a turbofan engine at simulated altitude conditions in a ground-level test cell using both optical nonintrusive and conventional gas sampling techniques. NO-UV absorption measurements, using both resonance and continuum lamps, were made through several chords of the exhaust flow near the nozzle exit plane as a part of a larger effort to characterize aircraft exhaust constituents over a wide range of steady-state engine operating conditions. This paper describes the NO-UV absorption measurements and compares radial profiles of NO concentrations and emission indices with measurements obtained using conventional gas sampling and tunable diode laser infrared absorption.
Author
Ultraviolet Absorption; Absorption Spectroscopy; Nitric Oxide; Turbofan Engines; Laser Spectroscopy; Exhaust Emission; Flow Measurement

19980206014 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Antriebstechnik, Cologne, Germany
Application of 3D-Laser Two Focus Velocimetry in Turbomachine Investigations
Beversdorff, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Matziol, L., Technische Univ., Germany; Blaha, C., Technische Hochschule, Germany; May 1998; 8p; In English; Also announced as 19980206002
Contract(s)/Grant(s): BMBF-BEO/310326801D; BMBF-BEO/310326801X; BMBF-20T9402; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The further development of turbomachines is driven by the improved understanding of the three dimensional, secondary flow processes. Therefore experimental data are needed to analyse the 3D flow in this machines and to provide data for computer code validation. In this context a 3D-L2F velocimeter was developed which enables 3D flow vector measurements under the difficult conditions of turbomachines were the optical access is restricted. The new design of the 3D-L2F velocimeter includes also a special multi-colour set-up with selectable beam separation that helps to reduce measurement time especially in turbulent flow regions, where conventional L2F systems are working rather time consuming. A special seeding probe which can be placed very close to the turbomachine inlet without generating flow distortions provides an increase of the particle concentration in the seeded streamline that passes the L2F probe volume, thus contributing also to a further measuring time reduction. Flow investigations in a transonic compressor are described and selected results of the secondary flow field obtained are presented.
Author
Laser Doppler Velocimeters; Secondary Flow; Velocity Measurement; Flow Measurement; Turbulent Flow; Nonintrusive Measurement; Turbomachinery

19980206015 Deutsche Gesellschaft fuer Luft- und Raumfahrt, Inst. fuer Physikalische Chemie der Verbrennung, Stuttgart, Germany
Characterization of Gas Turbine Combustion Chambers with Single Pulse CARS Thermometry
Lueckerath, R., Deutsche Gesellschaft fuer Luft- und Raumfahrt, Germany; Bergmann, V., Deutsche Gesellschaft fuer Luft- und Raumfahrt, Germany; Stricker, W., Deutsche Gesellschaft fuer Luft- und Raumfahrt, Germany; May 1998; 8p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Temperature results of three measuring campaigns with the mobile CARS system of the DLR Stuttgart are presented. The experiments were performed on different combustion chambers: a thrust nozzle test facility, a RQL combustor, and a ramjet combustor. Single pulse CARS N2 thermometry was used to characterize the homogeneity of the flame at the exit plane of the combustion chamber, to address the quality of mixing of fuel-rich burnt gas of the primary zone with secondary air, to find an improved

design for the H2 injection into a high speed air flow, and to measure the temperature and pressure variations in the shock controlled free jet flame. In the last case both the temperature and the pressure could be determined from the CARS spectrum.
Author
Combustion Chambers; Temperature Measurement; Gas Turbine Engines; Measuring Instruments; Nonintrusive Measurement; Combustion

19980206016 Rolls-Royce Ltd., Applied Science Lab., Derby, UK
CARS Diagnostics on Model Gas Turbine Combustor Rigs
Black, John D., Rolls-Royce Ltd., UK; Wiseall, Stephen S., Rolls-Royce Ltd., UK; May 1998; 12p; In English; Also announced as 19980206002
Contract(s)/Grant(s): CEC-AERO-CT92-0036; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Rolls-Royce Applied Science Laboratory has been active in CARS (Coherent Anti-Stokes Raman Spectroscopy) thermometry in aero gas turbine related combustion rigs for over ten years. This paper describes the mobile CARS system currently used for temperature measurements on research rigs, the current limitations of the technique, and future plans for improvements and implementation.
Author
Temperature Measurement; Gas Turbine Engines; Raman Spectroscopy; Nonintrusive Measurement; Exhaust Gases; Combustion; Combustion Chambers

19980206032 Rolls-Royce Ltd., Civil Aero Engines, Derby, UK
Turbomachinery Blade Tip Measurement Techniques
Heath, S., Rolls-Royce Ltd., UK; Slater, T., Rolls-Royce Ltd., UK; Mansfield, L., Rolls-Royce Ltd., UK; Loftus, P., Rolls-Royce Ltd., UK; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The efficiency of axial flow compressors and turbines is critically dependent on the size of the tip to casing gaps (tip clearance) as is the surge margin of compressors. Optimisation of tip clearance control schemes requires measurements of tip clearances throughout the operating envelope of the engine. The dynamic design of rotor blading to avoid damaging integral order and self excited resonance's is complex and still defies routine right-first time design. This necessitates monitoring of blade vibration during testing which is time consuming and costly with conventional strain-gauging techniques. Both of the above requirements may be addressed by easily mounted tip probes, the design and operation of which are discussed in this paper. Until recently the market for such devices has provided insufficient incentive for instrumentation suppliers to invest in the development of such devices leaving engine manufacturers to develop their own solutions to these unique problems. The Rolls-Royce experience is described.
Author
Blade Tips; Clearances; Measuring Instruments; Structural Vibration; Vibration Measurement; Stress Measurement; Nonintrusive Measurement

19980206154 Arkansas Univ., Dept. of Mechanical Engineering, Fayetteville, AR USA
Process Model for Friction Stir Welding
Adams, Glynn, Arkansas Univ., USA; Research Reports: 1996 NASA/ASEE Summer Faculty Fellowship Program; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Friction stir welding (FSW) is a relatively new process being applied for joining of metal alloys. The process was initially developed by The Welding Institute (TWI) in Cambridge, UK. The FSW process is being investigated at NASA/MSEC as a repair/initial weld procedure for fabrication of the super-light-weight aluminum-lithium shuttle external tank. The FSW investigations at MSFC were conducted on a horizontal mill to produce butt welds of flat plate material. The weldment plates are butted together and fixed to a backing plate on the mill bed. A pin tool is placed into the tool holder of the mill spindle and rotated at approximately 400 rpm. The pin tool is then plunged into the plates such that the center of the probe lies at, one end of the line of contact, between the plates and the shoulder of the pin tool penetrates the top surface of the weldment. The weld is produced by traversing the tool along the line of contact between the plates. A lead angle allows the leading edge of the shoulder to remain above the top surface of the plate. The work presented here is the first attempt at modeling a complex phenomenon. The mechanical aspects of conducting the weld process are easily defined and the process itself is controlled by relatively few input parameters. However, in the region of the weld, plasticizing and forging of the parent material occurs. These are difficult processes to model. The model presented here addresses only variations in the radial dimension outward from the pin tool axis. Examinations of the grain structure of the weld reveal that a considerable amount of material deformation also occurs in the direction parallel to the pin tool axis of rotation, through the material thickness. In addition, measurements of the axial load on the pin tool demonstrate that the forging

affect of the pin tool shoulder is an important process phenomenon. Therefore, the model needs to be expanded to account for the deformations through the material thickness and the forging affect of the shoulder. The energy balance at the boundary of the plastic region with the environment required that energy flow away from the boundary in both radial directions. One resolution to this problem may be to introduce a time dependency into the process model, allowing the energy flow to oscillate across this boundary. Finally, experimental measurements are needed to verify the concepts used here and to aid in improving the model. Derived from text

Friction Welding; Welded Joints; Alloys; Plastic Deformation; Mathematical Models; Weld Tests

19980206161 Alabama Univ., Dept. of Aerospace Engineering and Mechanics, Tuscaloosa, AL USA

An Assessment of Molten Metal Detachment Hazards During Electron Beam Welding in the Space Shuttle Bay at LEO for the International Space Welding Experiment

Fragomeni, James M., Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In 1997, the USA [NASA] and the Paton Electric Welding Institute are scheduled to cooperate in a flight demonstration on the U.S. Space Shuttle to demonstrate the feasibility of welding in space for a possible repair option for the International Space Station Alpha. This endeavor, known as the International Space Welding Experiment (ISWE), will involve astronauts performing various welding exercises such as brazing, cutting, welding, and coating using an electron beam space welding system that was developed by the E.O. Paton Electric Welding Institute (PWI), Kiev Ukraine. This electron beam welding system known as the ”Universal Weld System” consists of hand tools capable of brazing, cutting, autogeneous welding, and coating using an 8 kV (8000 volts) electron beam. The electron beam hand tools have also been developed by the Paton Welding Institute with greater capabilities than the original hand tool, including filler wire feeding, to be used with the Universal Weld System on the U.S. Space Shuttle Bay as part of ISWE. The hand tool(s) known as the Ukrainian Universal Hand [Electron Beam Welding] Tool (UHT) will be utilized for the ISWE Space Shuttle flight welding exercises to perform welding on various metal alloy samples. A total of 61 metal alloy samples, which include 304 stainless steel, Ti-6AI-4V, 2219 aluminum, and 5456 aluminum alloys, have been provided by NASA for the ISWE electron beam welding exercises using the UHT. These samples were chosen to replicate both the U.S. and Russian module materials. The ISWE requires extravehicular activity (EVA) of two astronauts to perform the space shuttle electron beam welding operations of the 61 alloy samples. This study was undertaken to determine if a hazard could exist with ISWE during the electron beam welding exercises in the Space Shuttle Bay using the Ukrainian Universal Weld System with the UHT. The safety issue has been raised with regard to molten metal detachments as a result of several possible causes such as welder procedural error, externally applied impulsive forces(s), filler wire entrainment and snap-out, cutting expulsion, and puddle expulsion. Molten metal detachment from either the weld/cut substrate or weld wire could present harm to a astronaut in the space environment it the detachment was ti burn through the fabric of the astronaut Extravehicular Mobility Unit (EMC). In this paper an experimental test was performed in a 4 ft. x 4 ft. vacuum chamber at MSFC enabling protective garment to be exposed to the molten metal drop detachments to over 12 inches. The chamber was evacuated to vacuum levels of at least 1 x 10(exp -5) torr (50 micro-torr) during operation of the 1.0 kW Universal Hand Tool (UHT). The UHT was manually operated at the power mode appropriate for each material and thickness. The space suit protective welding garment, made of Teflon fabric (10 oz. per yard) with a plain weave, was placed on the floor of the vacuum chamber to catch the molten metal drop detachments. A pendulum release mechanism consisting of four hammers, each weighing approximately 3.65 lbs, was used to apply an impact forces to the weld sample/plate during both the electron beam welding and cutting exercises. Measurements were made of the horizontal fling distances of the detached molten metal drops. The volume of a molten metal drop can also be estimated from the size of the cut. Utilizing equations, calculations were made to determine chande in surafec area (Delat a(surface)) for 304 stainless steel for cutting based on measurements of metal drop sizes at the cut edges. For the cut sample of 304 stainless steel based on measurement of the drop size at the edge, Delta-a(surface) was determined to be 0.0054 2 in . Calculations have indicated only a small amount of energy is required to detach a liquid metal drop. For example, approximately only 0.000005 ft-lb of energy is necessary to detach a liquid metal steel drop based on the above theoretical analysis. However, some of the energy will be absorbed by the plate before it reaches the metal drop. Based on the theoretical calculations, it was determined that during a weld cutting exercise, the titanium alloy would be the most difficult to detach molten metal droplets followed by stainless steel and then by aluminum. The results of the experimental effort have shown that molten metal will detach if large enough of a hammer blow is applied to the weld sample plate during the full penetration welding and cutting exercises. However, no molten metal detachments occurred as a result of the filler wire snap-out tests from the weld puddle since it was too difficult to cause the metal to flick-out from the pool. Molten metal detachments, though not large in size, did result from the direct application of the electron beam on the end of the filler weld wire. Derived from text

Electron Beam Welding; Liquid Metals; Space Suits; Alloys; Microgravity; Low Earth Orbits; Orbital Servicing; Detachment; Drops (Liquids)

19980206185 California Inst. of Tech., Div. of Physics, Math and Astronomy, Pasadena, CA USA

Virtual Reality Simulation of the International Space Welding Experiment

Phillips, James A., California Inst. of Tech., USA; Oct. 1996; 6p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Virtual Reality (VR) is a set of breakthrough technologies that allow a human being to enter and fully experience a 3-dimensional, computer simulated environment. A true virtual reality experience meets three criteria: (1) It involves 3-dimensional computer graphics; (2) It includes real-time feedback and response to user actions; and (3) It must provide a sense of immersion. Good examples of a virtual reality simulator are the flight simulators used by all branches of the military to train pilots for combat in high performance jet fighters. The fidelity of such simulators is extremely high -- but so is the price tag, typically millions of dollars. Virtual reality teaching and training methods are manifestly effective, and we have therefore implemented a VR trainer for the International Space Welding Experiment. My role in the development of the ISWE trainer consisted of the following: (1) created texture-mapped models of the ISWE's rotating sample drum, technology block, tool stowage assembly, sliding foot restraint, and control panel; (2) developed C code for control panel button selection and rotation of the sample drum; (3) In collaboration with Tim Clark (Antares Virtual Reality Systems), developed a serial interface box for the PC and the SGI Indigo so that external control devices, similar to ones actually used on the ISWE, could be used to control virtual objects in the ISWE simulation; (4) In collaboration with Peter Wang (SFFP) and Mark Blasingame (Boeing), established the interference characteristics of the VIM 1000 head-mounted-display and tested software filters to correct the problem; (5) In collaboration with Peter Wang and Mark Blasingame, established software and procedures for interfacing the VPL DataGlove and the Polhemus 6DOF position sensors to the SGI Indigo serial ports. The majority of the ISWE modeling effort was conducted on a PC-based VR Workstation, described below.

Author

Virtual Reality; Training Devices; Welding; Real Time Operation; Software Engineering; Computerized Simulation; Applications Programs (Computers); Training Simulators

19980206188 Alabama A & M Univ., Dept. of Engineering Technology, Huntsville, AL USA

Investigation of Machine Design for Friction Stir Welding

Romine, Peter L., Alabama A & M Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The process of joining two pieces of metal together has not significantly changed over the last few decades. The basic idea used is to bring the pieces together and apply enough heat to melt the metal at the interface. The molten metal mixes and after cooling forms a strong joint. This process is called the fusion process. The most significant difference between the many fusion processes is how the heat is generated and applied. The Welding Institute (TWI), in Great Britain, has recently patented an innovative application of mechanical friction. TWI designed a tool and process called Friction Stir Welding (FSW) that uses friction to heat the metal to within a few hundred degrees Fahrenheit of melting, just to the point of being plastic-like. The tool then stirs the plasticized metal together forming a joint that has been shown to be as good or better than an equivalent fusion joint. The FSW process is well suited for the joining of the aluminum alloys used in the aerospace industry. The relatively low melting point of aluminum eliminates the requirements for exotic materials for pin tool design. The FSW process has been successfully used to join alloys such as 7075 which were before considered "unweldable", and aluminum-lithium 2195 which exhibits many problems when fusion welded. The objective this summer was to investigate the design of a FSW system that could take this process from the laboratory to the manufacturing floor. In particular, it was the goal of my NASA colleague to develop a concept for applying the FSW process to the manufacturing of aluminum cryogenic oxygen and hydrogen tanks, of the sort used to make the Shuttle External Tank.

Derived from text

Friction Welding; External Tanks; Aluminum Alloys; Liquid-Solid Interfaces

19980206192 Florida Univ., Dept. of Mechanical Engineering, Gainesville, FL USA

Analysis and Modeling of a Two-Phase Jet Pump of a Flow Boiling Test Facility for Aerospace Applications

Sherif, S. A., Florida Univ., USA; Steadham, Justin M., Florida Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Jet pumps are devices capable of pumping fluids to a higher pressure employing a nozzle/diffuser/mixing chamber combination. A primary fluid is usually allowed to pass through a converging-diverging nozzle where it can accelerate to supersonic speeds at the nozzle exit. The relatively high kinetic energy that the primary fluid possesses at the nozzle exit is accompanied by a low pressure region in order to satisfy Bernoulli's equation. The low pressure region downstream of the nozzle exit permits a secondary fluid to be entrained into and mixed with the primary fluid in a mixing chamber located downstream of the nozzle. Several com-

binations may exist in terms of the nature of the primary and secondary fluids in so far as whether they are single or two-phase fluids. Depending on this, the jet pump may be classified as gas/gas, gas/liquid, liquid/liquid, two-phase/liquid, or similar combinations. The mixing chamber serves to create a homogeneous single-phase or two-phase mixture which enters a diffuser where the high kinetic energy of the fluid is converted into pressure energy. If the fluid mixture entering the diffuser is in the supersonic flow regime, a normal shock wave usually develops inside the diffuser. If the fluid mixture is one that can easily change phase, a condensation shock would normally develop. Because of the overall rise in pressure in the diffuser as well as the additional rise in pressure across the shock layer, condensation becomes more likely. Associated with the pressure rise across the shock is a velocity reduction from the supersonic to the subsonic range. If the two-phase flow entering the diffuser is predominantly gaseous with liquid droplets suspended in it, it will transform into a predominantly liquid flow containing gaseous bubbles (bubbly flow) somewhere in the diffuser. While past researchers have been able to model the two-phase flow jet pump using the one-dimensional assumption with no shock waves and no phase change, there is no research known to the authors apart from that of Anand (1992) which accounted for condensation shocks. One of the objectives of this research effort is to develop a comprehensive model in which the effects of phase slip and inter-phase heat transfer as well as the wall friction and shock waves are accounted for. While this modeling effort is predominantly analytical in nature and is primarily intended to provide a parametric understanding of the jet pump performance under different operating scenarios, another parallel effort employing a commercial CFD code is also implemented. The latter effort is primarily intended to model an axisymmetric counterpart of the problem in question. The viability of using the CFD code to model a two-phase flow jet pump will be assessed by attempting to recreate some of the existing performance data of similar jet pumps. The code will eventually be used to generate the jet pump performance characteristics of several scenarios involving jet pump geometries as well as flow regimes in order to be able to determine an optimum design which would be suitable for a two-phase flow boiling test facility at NASA-Marshall. Because of the extensive nature of the analytical model developed, the following section will only provide very brief highlights of it, while leaving the details to a more complete report submitted to the NASA colleague. This report will also contain some of the simulation results obtained using the CFD code.
Derived from text
Two Phase Flow; Jet Pumps; Mathematical Models; Supersonic Flow; Jet Mixing Flow

19980206200 Alabama A & M Univ., Dept. of Computer Information Science, Huntsville, AL USA
The Infrastructure of an Integrated Virtual Reality Environment for International Space Welding Experiment
Wang, Peter Hor-Ching, Alabama A & M Univ., USA; Oct. 1996; 6p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This study is a continuation of the summer research of 1995 NASA/ASEE Summer Faculty Fellowship Program. This effort is to provide the infrastructure of an integrated Virtual Reality (VR) environment for the International Space Welding Experiment (ISWE) Analytical Tool and Trainer and the Microgravity Science Glovebox (MSG) Analytical Tool study. Due to the unavailability of the MSG CAD files and the 3D-CAD converter, little was done to the MSG study. However, the infrastructure of the integrated VR environment for ISWE is capable of performing the MSG study when the CAD files become available. Two primary goals are established for this research. First, the essential peripheral devices for an integrated VR environment will be studied and developed for the ISWE and MSG studies. Secondly, the training of the flight crew (astronaut) in general orientation, procedures, and location, orientation, and sequencing of the welding samples and tools are built into the VR system for studying the welding process and training the astronaut.
Author
Virtual Reality; Welding; Systems Integration; Astronaut Training; Training Simulators

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QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19980203723 Oak Ridge Y-12 Plant, TN USA
Development of XRMF Techniques for Measurement of Multi-Layer Film Thicknesses on Semiconductors for VLSI and ULSI Integrated Circuits *Final Report*
Carpenter, D. A., Lockheed Martin Energy Systems, Inc., USA; Golijanin, D. L., Kevex, Inc., USA; Wherry, D., Kevex, Inc., USA; Feb. 03, 1997; 7p; In English
Contract(s)/Grant(s): DE-AC05-84OS-21400
Report No.(s): Y/AMT-454; DE97-008830; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A CRADA with Kevex Instruments was carried out to develop improved XRMF instrumentation for the nondestructive analysis of electronic components during manufacture. Experiments conducted at Y-12 proved the feasibility of a new Kevex x-ray tube design. Tests also show that the current commercial supply of straight glass capillaries is unreliable; however, other vendors of tapered single and multiple glass capillaries were identified. The stability of the Y-12 x-ray microprobe was significantly enhanced as a result of this CRADA.
DOE
Film Thickness; Very Large Scale Integration; X Ray Fluorescence; Microanalysis; Integrated Circuits

19980205672 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
End-to-End Reliable Multicast Protocol Using Polling for Scaleability
Barcellos, M. P., Newcastle-upon-Tyne Univ., UK; Ezhilchelvan, P. D., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 36p; In English
Report No.(s): PB98-147846; TRS-609; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
Reliable sender-based one-to-many protocols do not scale well due mainly implosion caused by excessive rate of feedback packets arriving from receivers. We show that this problem can be circumvented by making the sender poll the receivers at carefully planned timing instants, so that the arrival rate of feedback packets is not large enough to cause implosion
NTIS
Casting; Implosions; Reliability Analysis; Protocol (Computers); Fault Tolerance

19980206187 Alabama Univ., Industrial Engineering Dept., Tuscaloosa, AL USA
An Independent Evaluation of the FMEA/CIL Hazard Analysis Alternative Study
Ray, Paul S., Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche
The present instruments of safety and reliability risk control for a majority of the National Aeronautics and Space Administration (NASA) programs/projects consist of Failure Mode and Effects Analysis (FMEA), Hazard Analysis (HA), Critical Items List (CIL), and Hazard Report (HR). This extensive analytical approach was introduced in the early 1970's and was implemented for the Space Shuttle Program by NHB 5300.4 (1D-2. Since the Challenger accident in 1986, the process has been expanded considerably and resulted in introduction of similar and/or duplicated activities in the safety/reliability risk analysis. A study initiated in 1995, to search for an alternative to the current FMEA/CIL Hazard Analysis methodology generated a proposed method on April 30, 1996. The objective of this Summer Faculty Study was to participate in and conduct an independent evaluation of the proposed alternative to simplify the present safety and reliability risk control procedure.
Author
Hazards; Risk; Safety; NASA Programs; Failure Analysis; Reliability Analysis; Failure Modes; Assessments

19980206260 Missouri Univ., Dept.of Physics and Astronomy, Columbia, MO USA
Mathematical Studies of Wavelet Inverse Reconstructions for Nondestructive Evaluation, Novel Dielectrics, and the Dispersion from Chaotic Motions in Water ***Final Report, 1 Nov. 1994 - 30 Apr. 1998***
DeFacio, Brian, Missouri Univ., USA; May 06, 1998; 17p; In English
Contract(s)/Grant(s): F49620-95-1-0060
Report No.(s): AD-A345581; AFRL-SR-BL-TR-98-0466; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Wavelet inverse methods for non-destructive evaluation of high technology materials using transient pulses of ultrasound have been developed using the Kullback-Liehler information. This selects scales with small energy wavelet coefficients which have large information content. Wavelet aliasing by all compactly supported orthonormal wavelet families has been proven, and pathological multiresolutions were ruled out by choosing the correct group for the films; SU(2). The PBGS, photonic band gap structures, have been studied for electromagnetic and elastic waves. These periodic, two-component dielectrics have been studied with loss-tangent (dissipation) dispersion and lattice-disorder. Localized defects have been studied. An elastic wave filter and a gap opened by the high contrast of waver at microwave frequencies were found.
DTIC
Signal Processing; Nondestructive Tests; Wavelet Analysis; Numerical Analysis

19980206282 Los Alamos National Lab., NM USA
Vibration-based health monitoring and model refinement of civil engineering structures
Frrar, C. R., Los Alamos National Lab., USA; Doebling, S. W., Los Alamos National Lab., USA; [1997]; 15p; In English; Assuring the Performance of Buildings and Infrastructures, 14 - 15 May 1997, Albuquerque, NM, USA

Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-UR-97-1919; CONF-9705144-4; DE97-008147; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Damage or fault detection, as determined by changes in the dynamic properties of structures, is a subject that has received considerable attention in the technical literature beginning approximately 30 years ago. The basic idea is that changes in the structure's properties, primarily stiffness, will alter the dynamic properties of the structure such as resonant frequencies and mode shapes, and properties derived from these quantities such as modal-based flexibility. Recently, this technology has been investigated for applications to health monitoring of large civil engineering structures. This presentation will discuss such a study undertaken by engineers from New Mexico State University, Sandia National Laboratory and Los Alamos National Laboratory. Experimental modal analyses were performed in an undamaged interstate highway bridge and immediately after four successively more severe damage cases were inflicted in the main girder of the structure. Results of these tests provide insight into the abilities of modal-based damage ID methods to identify damage and the current limitations of this technology. Closely related topics that will be discussed are the use of modal properties to validate computer models of the structure, the use of these computer models in the damage detection process, and the general lack of experimental investigation of large civil engineering structures.
DOE
Structural Vibration; Mathematical Models; Highways; Fault Detection; Systems Health Monitoring

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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.

19980203432 Oak Ridge National Lab., TN USA
The dislocation free zone model of fracture by symbolic programming
Chang, Shih-Jung, Oak Ridge National Lab., USA; 1997; 5p; In English; 5th; Fundamentals of Fracture, 17-21 Aug. 1997, Gaithersburg, MD, USA
Contract(s)/Grant(s): DE-AC05-84OR-21400
Report No.(s): CONF-970877-1; DE97-008471; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The dislocation free zone (DFZ) model of fracture was developed by Chang and Ohr after a series of experimental observations on the crack tip dislocation structures that invariably showed the existence of the dislocation free region. The DFZ model is a modified BCS crack model that is supplemented with the Rice-Thomson crack tip dislocation emission mechanism. This dislocation emission mechanism imposes a finite energy barrier to the crack tip for emitting dislocations into the plastic zone, in contrast to a zero energy barrier for the BCS model. This finite energy barrier results in the formation of the DFZ and a stress-singular crack tip region. This resistance was expressed in terms of a dislocation emission toughness K(sub e) as a material constant. Because of the emission toughness K(sub e) the crack tip has the choice either to emit dislocation or to fracture in brittle mode. The model, therefore, was first used to explain the fundamental phenomenon of brittle versus ductile fracture. Brittle fracture occurs if K(sub Ic) less than K(sub e), that is, the crack tip breaks before the dislocation can be emitted. Ductile fracture is possible if K(sub Ic) greater than K(sub e) so that dislocation will be generated before brittle fracture toughness K(sub Ic) is reached. The distribution function for the dislocations was solved from the dislocation pile-up equation. It was expressed in terms of the complete elliptic integrals. Although the analytical nature of the model is clear and precise, the numerical values of the model may not always be obtained readily. Attempts have been made to simplify and approximate the model by elementary mathematical functions. In this paper the distribution function is written in terms of a symbolic programming language MAPLE. The analytical and numerical manipulations can be made easily. An improvement of the program that accounts for the technique of calculating the elliptic integral of the third kind in different regions of the model is presented here.
DOE
Brittleness; Ductility; Cracks; Fracture Strength; Fracturing

19980203539 Aalborg Univ., Aalborg, Denmark
Detection of Fatigue Damage in a Steel member
Rytter, A., Ramboell A/S, Denmark; Brinker, R., Aalborg Univ., Denmark; PilegaardHansen, L., Aalborg Univ., Denmark; [1997]; 7p; In English
Contract(s)/Grant(s): ENS-1313/89-0014

Report No.(s): NEI-DK-2690; DE97-769010; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In this paper the possibilities of detection of crack extension in a steel beam by observation of changes in the dynamical response are investigated. System changes are observed by frequency domain and time domain techniques. The position and the size of the crack by finite element calculations. The estimated values are compared to the real values observed in the experiment. DOE

Crack Propagation; Fatigue (Materials); Finite Element Method; Steels; Cracks; Beams (Supports); Detection

19980203541 Max-Planck-Inst. fuer Metallforschung, Stuttgart, Germany

Crack Initiation and Crack Growth in High Temperature Materials Under Cyclic Thermal Stresses ***Rissinitiierung und Risswachstum in Hochtemperaturwerkstoffen unter Zyklisch Thermischer Beanspruchung***

Gruen, C., Max-Planck-Inst. fuer Metallforschung, Germany; Dec. 1996; 172p; In German

Report No.(s): DE97-762235; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The high temperatures of use in drive units, such as the combustion chamber or the hot gas turbine, for example, usually cause high temperature changes. Great temperature differences occur for short periods in the components, and thermal shock is produced. In this work, theoretical and experimental investigations are introduced on crack initiation and crack growth in high temperature materials under cyclic thermal stresses. The experiments were carried out with the inter-metallic phase Ni3Al, the nickel-based alloy Nimonic 80A, and the iron-based alloy PM 2000 strengthened by oxide dispersion (ODS). A characteristic crack appearance picture was found for each material, which was examined more closely. The stresses occurring in the sample during one cycle were calculated with the aid of the finite element program ABAQUS, knowing the specific material parameters. Based on the linear-elastic fracture mechanics, stress intensity factors were calculated on the superimposition principle. Using the material data from isothermal crack propagation experiments, the prediction of fatigue crack spread with cyclic thermal stresses is compared with the experimental findings.
DOE

Intermetallics; Crack Initiation; Crack Propagation; High Temperature Environments; Thermal Stresses; Cracks; Refractory Materials; Fracture Mechanics; Finite Element Method; Thermal Cycling Tests

19980203687 Oak Ridge National Lab., TN USA

Analysis of cracking of co-extruded recovery boiler floor tubes

Keiser, J. R., Oak Ridge National Lab., USA; Taljat, B., Oak Ridge National Lab., USA; Wang, X. L., Oak Ridge National Lab., USA; 1997; 17p; In English, 5 Oct. 1997, Nashville, TN, USA

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

Report No.(s): CONF-971060-1; DE97-007761; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Cracking of the stainless steel layer in co-extruded 304L/SA210 tubing used in black liquor recovery boilers is being found in an ever-increasing number of North American pulp and paper mills. Because of the possibility of a tube failure, this is a significant safety issue, and, because of the extra time required for tube inspection and repair, this can become an economic issue as well. In a project funded by the U.S. Department of Energy and given wide support among paper companies, boiler manufacturers, and tube fabricators, studies are being conducted to determine the cause of the cracking and to identify alternate materials and/or operating procedures to prevent tube cracking. Examination of cracked tubes has permitted characterization of crack features, and transmission electron microscopy is providing information about the thermal history, particularly cyclic thermal exposures, that tubes have experienced. Neutron and x-ray diffraction techniques are being used to determine the residual stresses in as-fabricated tube panels and exposed tubes, and finite element modeling is providing information about the stresses the tubes experience during operation. Laboratory studies are being conducted to determine the susceptibility of the co-extruded 304L/SA210 tubes to stress corrosion cracking, thermal fatigue, and corrosion in molten smelt. This paper presents the current status of these studies. On the basis of all of these studies, recommendations for means to prevent tube cracking will be offered.
DOE

Cracks; Boilers; Stress Corrosion Cracking; Thermal Fatigue; Stainless Steels; Pipes (Tubes); Failure; Fabrication; Crack Propagation; Stress Corrosion

19980203771 Naval Postgraduate School, Monterey, CA USA

Model for Estimation of Thermal History Produced by a Single Pass Underwater Wet Weld

Dill, Jay F., Naval Postgraduate School, USA; Dec. 1997; 63p; In English

Report No.(s): AD-A343358; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Thermal history calculations for single pass underwater wet weldments were made by solving the appropriate beat transfer equations using the three-dimensional Crank-Nicholson finite difference method. The Adams approach, which defines the fusion line temperature as a boundary condition, was adopted. Tsai and Masubuchi's semi-empirical correlation, defining the surface heat transfer coefficient of underwater weldments, was used to determine the heat loss through the surface of the welded plate. As expected, the calculated cooling rates in Heat Affected Zones (HAZs) of underwater wet welded ferritic steels were found to be somewhat faster than equivalent cooling rates calculated for the same weldments generated in air. However, the effect of water temperature on cooling times in the HAZ between 8000 and 5000 C (the parameter conventionally used to measure the cooling rate in the HAZ) was found to be minimal. These calculations suggest that HAZ microstructure of underwater wet welded ferritic steels should be independent of water temperature. This prediction was confirmed by microstructural studies of samples of ASTM A516 grade 70 steel which were underwater wet welded at water temperatures of 31, 10 and 30 C respectively and for which suggest that HAZ microstructures were obtained in each case.

DTIC

Finite Difference Theory; Mathematical Models; Temperature Effects; Heat Transfer Coefficients; Heat Affected Zone; Underwater Structures

19980203856 Oak Ridge National Lab., TN USA

Elastic modulus calculations from load/displacement curves using spherical and pointed indenters

Riester, L., Oak Ridge National Lab., USA; Ferber, M. K., Oak Ridge National Lab., USA; Breder, K., Oak Ridge National Lab., USA; Bridge, R. J., Connecticut Univ., USA; [1997]; 10p; In English; 99th; Annual Meeting of the American Ceramic Society, 4 - 7 May 1997, Cincinnati, OH, USA; Sponsored by American Ceramic Society, USA

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

Report No.(s): CONF-970568-10; DE97-008457; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Hard materials with known mechanical properties were probed with spherical and Berkovich indenters using a Nanoindenter(trademark). A simple analysis of the loading portion of the indentation experiment was found to give reasonable estimates of the elastic modulus for a variety of brittle materials.

DOE

Indentation; Modulus of Elasticity; Brittle Materials; Mechanical Properties

19980205000 Southampton Univ., Inst. of Sound and Vibration Research, UK

IUTAM Symposium on Statistical Energy Analysis: Programme

Gladwell, G. M., Editor, Southampton Univ., UK; Fahy, Frank, Editor, Southampton Univ., UK; Jan. 1997; 366p; In English; Statistical Energy Analysis, 8-11 Jul. 1997, Southampton, UK

Contract(s)/Grant(s): N00014-97-1-0571

Report No.(s): AD-A344218; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This was the first international scientific gathering devoted specifically to Statistical Energy Analysis which was first introduced nearly forty years ago. Abstracts were invited from 33 persons suggested by the Scientific and Organizing Committee of which 30 were agreed by the committees to be converted to full papers. All the discussion sessions were tape recorded for subsequent transcription: it is hoped to include a synopsis in the edited proceedings. The papers fell into three categories: theoretical developments; developments of experimental technique; and practical applications. The first category included papers on the newly introduced smoothed energy flow and asymptotic wave propagation approaches to high frequency structural vibration analysis. The second category included papers on two new experimental techniques, namely input power modulation and energy impulse response measurement. The third category included a number of illustrations of the growing sophistication and utilization of commercial SEA software, of which four versions were on display throughout the Symposium. The very lively discussion periods provided and excellent opportunity for individual scientists and engineers to air fundamental questions, to exchange views and experiences and to indicated their personal priorities for future research.

DTIC

Statistical Analysis; Structural Vibration; Continuum Mechanics; Dynamic Structural Analysis; Conferences; Energy Transfer

19980205004 Cambridge Univ., Dept. of Applied Mathematics and Theoretical Physics, Cambridge, UK

IUTAM Symposium on Nonlinear Analysis of Fracture

Willis, J. R., Editor, Cambridge Univ., UK; Jan. 1997; 399p; In English; Nonlinear Analysis of Fracture, 3-7 Sep. 1995, Cambridge, UK

Contract(s)/Grant(s): N00014-95-1-9015
Report No.(s): AD-A344251; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

The symposium remained focussed on issues of practical significance for fracture phenomena, with concentration on aspects that are still imperfectly understood. The most significant unifying issue in this regard is that of scale: this theme was addressed from several perspectives. One important aspect is the problem of passing information on one scale up or down, as an input for analysis at another scale. Although this is not always the case, it may be that the microscopic process of fracture is understood in some particular class of materials. The problem then becomes one of constructing an appropriate model at the macroscopic scale, that retains the essential features of the microscopic process but avoids unmanageable complexity. Dually, considering the problem from the macroscopic end, it is important to assess which particular aspects of the macroscopic stress field interact directly with the fracture process. In the simplest cases, the process is driven by the crack tip singularity in the macroscopic field; then, at least some problems relating to scale disappear. The focus of interest of course is in the regime where this 'singularity dominance' is not realised.

DTIC

Fracturing; Conferences; Crack Tips; Nonlinearity

19980205056 New Hampshire Univ., Dept. of Mechanical Engineering, Durham, NH USA

Stress-Intensity Factors for Elliptical Cracks Emanating from Countersunk Rivet Holes ***Final Report***

Gosz, M., New Hampshire Univ., USA; Moran, B., New Hampshire Univ., USA; Apr. 1998; 38p; In English
Report No.(s): PB98-146186; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Small cracks developing from rivet holes in lap joints of fuselage structure have been an issue of concern over the past decade. Stress-industry factor solutions required to assess the structural integrity of such configurations are lacking. to address this need, the domain integral method was used in their research to obtain the mode I, normalized stress-intensity factor distributions for cracks emanating from a centrally located countersunk rivet hole in a square plate subjected to remote tension.

NTIS

Cracks; Riveted Joints; Fuselages; Stress Concentration; Holes (Mechanics)

19980205078 Minnesota Univ., Center for Transportation Studies, Minneapolis, MN USA

Thermal and Mechanical Fatigue Effects on GFRP Rebar-Concrete Bond ***Final Report***

French, C., Minnesota Univ., USA; Shield, C., Minnesota Univ., USA; Retika, A. C., Minnesota Univ., USA; Apr. 1997; 150p; In English
Report No.(s): PB98-149040; CTS-97-10; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report summarizes an experimental program conducted to investigate the thermal and mechanical fatigue effects on the bond between Glass Fiber-Reinforced Plastic (GFRP) rebars and concrete. Variables included in the study were rebar diameter (No. 6 and No. 4 GFRP, No. 6 steel), material (steel and GFRP) and manufacturer (two different manufactures for the GFRP rebar). For comparison, specimens were also fabricated using steel rebar as a control. The embedment lengths were chosen so that a splitting failure was assured in all spacimens. A total of 30 inverted half-beam specimens were cast in 15 beams. Six specimens were mechanically tension-tension cycled, twelve specimens were thermally cycled and twelve were used as control specimens (no thermal or mechanical fatigue). During thermal fatigue, the rebars were also subjected to a constant tensile load to simulate dead load. During the bond tests, specimens were loaded continuously until failure while monitoring load, free-end slip, and loaded end slip. The results were evaluated to compare the bond performance of GFRP rebar to steel rebar, and to determine the effects of thermal and mechanical fatigue on bond. It was found that mechanical fatigue has more detrimental effect on steel than on GFRP specimens while thermal fatigue has more effect on GFRP than on steel specimens. The effect of thermal fatigue was more in GFRP M2 than in M1 specimens. The difference in bond performance between No. 6 and No. 4 GFRP M1 cannot be determined form this study due to inferior product quality of the No. 4 M1 bars.

NTIS

Bonding; Thermal Fatigue; Concretes; Glass Fibers; Glass Fiber Reinforced Plastics

19980205595 Texas Univ., Inst. for Advanced Technology, Austin, TX USA

Investigation of Oblique Penetration, 1, The Effects of Penetrator Leading End Shapes on Unyawed an Yawed Impacts

Hawkins, J. A., Texas Univ., USA; Bless, S. J., Texas Univ., USA; Normandia, M., Texas Univ., USA; Mar. 1998; 17p; In English
Contract(s)/Grant(s): DAAA21-93-C-0101
Report No.(s): AD-A344522; IAT.R-0144; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report investigates the effects of nose shapes on simple oblique and yawed oblique impacts. For simple oblique penetration there is a significant amount of rod tip erosion. Novel shaped noses can be designed which minimize the amount of mass lost

in erosion and which create efficient craters sufficient to allow passage of the upstream portion of the rod. Gains brought about by novel rod tip designs are not as evident in the yawed oblique impact case as in the simple oblique impact case. The gains made in the axial direction are obscured somewhat by the additional loading due to slot formation. However, nose shapes seem to affect the degree and nature of this load and may provide a means of reducing the damage caused by slot formation.
DTIC
Yaw; Craters; Penetration; Erosion

19980205797 Sandia National Labs., Albuquerque, NM USA
Ultra-high-speed studies of shock phenomena in a miniaturized system: A preliminary evaluation
Trott, W. M., Sandia National Labs., USA; Erickson, K. L., Sandia National Labs., USA; Sep. 1997; 32p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2214; DE97-009351; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A laboratory-scale experimental test system for small-scale of shock phenomena has been assembled. This system uses a variety of miniature test platforms in which shock loading is provided by laser-driven flyer impact. Acceptor materials include thin-film explosives and high-density metal foils. Optical access is provided for high-speed optical diagnostics such as optically recording velocity interferometry and single-pulse Raman spectroscopy. The experimental assembly for Raman studies features a common laser source for both flyer generation and excitation of Raman scattering (to achieve high timing precision) and a detection scheme that uses the coupling fiber for the excitation source to collect with high efficiency backscattered Raman light. Preliminary system evaluation experiments indicate that detailed particle velocity studies of the dynamic material properties of high-density metals under short-pulse, high-strain-rate loading can be performed in a miniaturized test configuration. Single-pulse Raman studies on shock compressed thin film explosives also appear feasible if the thickness and grain structure of these films can be tailored to enhance the Raman scattering signal sufficiently. Possible improvements in the experimental design and a number of likely applications of these techniques are also discussed.
DOE
High Speed; Shock Tests; Evaluation; Experiment Design; Diagnosis; Laboratory Equipment

19980206135 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Fatigue Analysis of Prestressed Concrete Pavement
Al-Khaleefi, A. L. M., Kuwait Univ., Kuwait; Harmon, Thomas G., Washington Univ., USA; Lin, San-Shyan, National Taiwan Ocean Univ., Taiwan, Province of China; Yang, Chung-CHia, National Taiwan Ocean Univ., Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 151-158; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A theoretical model to predict the fatigue life along with the punching shear failure of prestressed concrete pavements loaded with a stationary load, is proposed. A layered shell element considering shear failure is used in the analysis. An octahedral constitutive relation is used to model concrete in compression. In tension, the concrete is linearly elastic with cracking occurring at points of maximum tension when the fatigue life is used up. A smeared crack model is used with a shear retention factor for concrete cracking. A multi-linear curve was used for prestressing steel model. The comparison between predicted and experimental results appears to be very satisfactory.
Author
Concretes; Pavements; Structural Failure; Cracking (Fracturing); Mathematical Models; Stress Analysis; Shear Stress; Static Loads; Fatigue Tests

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GEOSCIENCES (GENERAL)

19980203286 Rutherford Appleton Lab., Chilton, UK
Twenty Third European Geophysical Society General Assembly: Annales Geophysicae, Volume 16, Hydrology, Oceans and Atmosphere
Jan. 1998; 404p; In English; 23rd; Annales Geophysicae, 20-24 Apr. 1998, Nice, France
Report No.(s): AD-A344328; RL-1546-Vol-16-Pt-2-Suppl-2; EOARD-CSP-98-1044-Vol-16-Pt-2-Suppl-2; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

The Final Proceedings for European Geophysical Society XXIII General Assembly, 20 April 1998 - 24 April 1998. This is an interdisciplinary conference. Topics include meteorology, ionospheric physics, space physics, oceanography, geophysics and geodesy.
DTIC
Conferences; Geophysics; Meteorology

19980203287 Rutherford Appleton Lab., Chilton, UK
Twenty Third European Geophysical Society General Assembly: Annales Geophysicae, Volume 16, Society Symposia, Solid Earth Geophysics and Geodesy
Jan. 1998; 420p; In English; 23rd; Annales Geophysicae, 20-24 Apr. 1998, Nice, France; Original contains color plates
Report No.(s): AD-A344329; EOARD-CSP-98-1044-Vol-16-Pt-1-Suppl-1; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

The Final Proceedings for European Geophysical Society XXIII General Assembly. 20 April i998 - 24 April 1998 This is an interdisciplinary conference. Topics include meteorology, ionospheric physics, space physics, oceanography, geophysics and geodesy.
DTIC
Conferences; Geodesy; Geophysics; Meteorology

19980203288 Rutherford Appleton Lab., Chilton, UK
Twenty Third European Geophysical Society General Assembly: Annales Geophysicae, Volume 16, Nonlinear Geophysics and Natural Hazards
Jan. 1998; 180p; In English; 23rd; Annales Geophysicae, 20-24 Apr. 1998, Nice, France
Report No.(s): AD-A344330; EOARD-CSP-98-1044-Vol-16-Pt-4-Suppl-4; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The Final Proceedings for European Geophysical Society XXIII General Assembly, 20 April 1998 - 24 April 1998. This is an interdisciplinary conference. Topics include meteorology, ionospheric physics, space physics, oceanography, geophysics and geodesy.
DTIC
Geophysics; Conferences; Meteorology; Geodesy

19980203289 Rutherford Appleton Lab., Chilton, UK
Twenty Third European Geophysical Society General Assembly, Annales Geophysicae, Volume 16, Space and Planetary Sciences
Jan. 1998; 244p; In English; 23rd; Annales Geophysicae, 20-24 Apr. 1998, Nice, France
Report No.(s): AD-A344331; EOARD-CSP-98-1044-Vol-16-Pt-3-Suppl-3; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The Final Proceedings for European Geophysical Society XXIII General Assembly, 20 April 1998 - 24 April 1998. This is an interdisciplinary conference. Topics include: meteorology, ionospheric physics, space physics, oceanography, geophysics and geodesy.
DTIC
Conferences; Geodesy; Geophysics; Oceanography

19980205531 Fleet Numerical Meteorology and Oceanography Center, Monterey, CA USA
Navy Weather and Oceanography in the Next Century: A New Challenge in Numerical Modeling
Pollack, Kenneth D., Fleet Numerical Meteorology and Oceanography Center, USA; Mauck, C. J., Fleet Numerical Meteorology and Oceanography Center, USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 103-114; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Fleet Numerical Meteorology and Oceanography Center (FNMOC) in Monterey currently runs a suite of meteorological and oceanographic (METOC) analysis and forecast models on Cray C90 and J90 mainframes. These models, which provide METOC support throughout the Department of Defense, are becoming obsolete as their resolutions and physics packages are limited by current operational computer hardware architecture. The Navy also faces the challenge of implementing more skillful models. Fortunately for the Navy, the science and technology of numerical modeling has kept pace with computer hardware. The chief impediment to instituting improved models is acquiring a larger computational capability in which to run them. FNMOC is now

formalizing plans to replace its aging vector processing architecture with a scaleable system. This new system will provide an affordable, phased approach to meet FNMOC's new computational requirements. Next generation models executing on this replacement system will provide FNMOC's customers with more skillful and longer range METOC forecasts. Improvements will be the result of better physics, higher grid resolutions, and full coupling of air, ocean, wave, and ice models.
Author
Numerical Weather Forecasting; Ocean Surface; Ocean Models; Meteorology; Computerized Simulation; Ocean Dynamics; Oceanography

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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.

19980203497 Washington Univ., Dept. of Atmospheric Sciences, Seattle, WA USA
Microwave Emission from Polar Surfaces ***Final Report, 1 Oct. 1995 - 30 Sep. 1997***
Grenfell, Thomas C., Washington Univ., USA; Apr. 01, 1998; 12p; In English
Contract(s)/Grant(s): N00014-96-1-0324
Report No.(s): AD-A343249; Rept-61-6612; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Based on the work described in this report, our observations and modeling work have revealed several considerations which are central to understanding the physical basis for the application and interpretation of thin ice algorithms for passive microwave imagery. We have shown that passive microwave measurements provide one of the most robust remote sensing techniques for distinguishing among sea ice types including the thin ice types that are pivotal for regional energy considerations. We have found that current theories applicable at microwave frequencies (multi layer SFT wave theory, for example) and in the visible and infrared (radiative transfer theory) can reproduce the radiation signatures of FY ice types quite well incorporating the actual physical structure of the ice. As a result of the cooperative work carried out during the electromagnetics ARI, the determination of the wavelength regions and physical situations appropriate for the application of various radiation models has been improved considerably, and our results, both theoretical and observational, have demonstrate the levels of accuracy of the models. It is clear that our understanding of the microwave emissivities of sea ice and their relation to other types of remote sensing signatures has increased significantly in the course of this grant.
DTIC
Microwaves; Emissivity; Polar Regions; Algorithms; Microwave Imagery; Infrared Radiation

19980203548 Colorado Univ., Boulder, CO USA
An Efficient Strategy for the Inversion of Bidirectional Reflectance Models with Satellite Remote Sensing Data
Privette, J. L., Colorado Univ., USA; 1994; 205p; In English
Contract(s)/Grant(s): DE-AC05-76OR-00033
Report No.(s): DOE/OR/00033-T710; DE97-053337; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The angular distribution of radiation scattered by the earth surface contains information on the structural and optical properties of the surface. Potentially, this information may be retrieved through the inversion of surface bidirectional reflectance distribution function (BRDF) models. This report details the limitations and efficient application of BRDF model inversions using data from ground- and satellite-based sensors. A turbid medium BRDF model, based on the discrete ordinates solution to the transport equation, was used to quantify the sensitivity of top-of-canopy reflectance to vegetation and soil parameters. Results were used to define parameter sets for inversions. Using synthetic reflectance values, the invertibility of the model was investigated for different optimization algorithms, surface, and sampling conditions. Inversions were also conducted with field data from a ground-based radiometer. First, a soil BRDF model was inverted for different soil and sampling conditions. A condition-invariant solution was determined and used as the lower boundary condition in canopy model inversions. Finally, a scheme was developed to improve the speed and accuracy of inversions.
DOE
Bidirectional Reflectance; Distribution Functions; Earth Surface; Spectral Reflectance; Satellite Imagery; Remote Sensing; Optical Properties

19980203777 Rome Univ., Rome, Italy

Multi-sunsynchronous constellations for continuous surveillance in tropical regions

Castronuovo, Marco M., Rome Univ., Italy; Ulivieri, Carlo, Rome Univ., Italy; Laneve, Giovanni, Rome Univ., Italy; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 17-28; In English; Also announced as 19980203775

Report No.(s): AAS-98-301; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Uniform Homogeneous Constellations (UHC) of small satellites on multi-sun-synchronous (MSS) orbits, which allow to revisit any given location every m nodal days with an integer number n/m of different illumination geometries repeated every n days, have been considered. These constellations could offer a good means of continuous surveillance for the tropical regions where natural disasters, such as floodings and droughts, are most common. A study has been carried out to ascertain how they allow to obtain efficient revisit coverages and repeat cycles, deploying satellites on one or more orbital planes whose inclination has been chosen equal to tropical latitudes. The dynamical behaviour of a satellite constellation has been simulated, so to analyze the configuration and coverage evolution under the effects of the major perturbations.

Author

Satellite Constellations; Tropical Regions; Surveillance; Stationkeeping

19980203929 Naval Research Lab., Geology/Geophysics Section, Stennis Space Center, MS USA

Demonstration of a Technique for Rapid Inversion of Geo-Acoustic Properties of Littoral Marine Locations ***Final Report***

Lindwall, Dennis A., Naval Research Lab., USA; Apr. 07, 1998; 12p; In English

Contract(s)/Grant(s): Proj. PE62435N

Report No.(s): AD-A343941; NRL/MR/7432-97-8065; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes how to invert seismic data collected with sonobuoys in littoral marine environments to obtain sea floor geo-acoustic properties. The inversion method is an adaptation of simulated annealing (SA) which can rapidly and automatically find the best Earth model for each data set. The established SA algorithm was enhanced with envelope fitting and layer stripping. The first example is a synthetic data set to demonstrate the method for a known Earth model. The second example is at a 750 m water depth site using a watergun source that has a very clean and sharp pulse. The offsets were accurately determined prior to the inversion calculation for this case and a clear subbottom reflector was modeled in only 5323 iterations. The third example was at a site with 250 m water depth using an airgun source. The direct airgun signal saturated the sonobuoys at small offsets causing distortions in the waveforms and amplitudes. Data offsets could not be accurately measured and had to be included in the inversion problem which tripled the number of variables. This more difficult third example was solved with 35,421 iterations. This demonstration is with highly data. The receivers are sparsely and irregularly spaced and have too limited a dynamic range for the source strengths and sea floor reflections encountered. However, by adapting the inversion technique to the challenges presented by the field data, the geoacoustic parameters of the sea floor were measured using rapidly deployed inexpensive and expendable equipment. The geoacoustic properties that I modeled include the sea floor depth, the water sound velocity and the compressional wave velocity of the uppermost 150 m of sediment. In the last case I also inverted for the sonobuoy to airgun offsets.

DTIC

Marine Environments; Acoustic Properties; Acoustic Velocity; Algorithms; Compression Waves

19980205536 NASA Goddard Space Flight Center, Greenbelt, MD USA

Incorporating Parallel Computing into the Goddard Earth Observing System Data Assimilation System (GEOS DAS)

Larson, Jay W., NASA Goddard Space Flight Center, USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 155; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

Atmospheric data assimilation is a method of combining actual observations with model forecasts to produce a more accurate description of the earth system than the observations or forecast alone can provide. The output of data assimilation, sometimes called the analysis, are regular, gridded datasets of observed and unobserved variables. Analysis plays a key role in numerical weather prediction and is becoming increasingly important for climate research. These applications, and the need for timely validation of scientific enhancements to the data assimilation system pose computational demands that are best met by distributed parallel software. The mission of the NASA Data Assimilation Office (DAO) is to provide datasets for climate research and to support NASA satellite and aircraft missions. The system used to create these datasets is the Goddard Earth Observing System Data Assimilation System (GEOS DAS). The core components of the the GEOS DAS are: the GEOS General Circulation Model (GCM), the Physical-space Statistical Analysis System (PSAS), the Observer, the on-line Quality Control (QC) system, the Coupler (which feeds analysis increments back to the GCM), and an I/O package for processing the large amounts of data the system produces (which will be described in another presentation in this session). The discussion will center on the following issues: the

computational complexity for the whole GEOS DAS, assessment of the performance of the individual elements of GEOS DAS, and parallelization strategy for some of the components of the system.
Author
Atmospheric General Circulation Models; Earth Observing System (EOS); Parallel Processing (Computers); Numerical Weather Forecasting

19980205816 Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO USA
Weighted Linear Regression Using D(2)H and D(2) as the Independent Variables
Schreuder, H. T., Rocky Mountain Forest and Range Experiment Station, USA; Williams, M. S., Rocky Mountain Forest and Range Experiment Station, USA; May 1998; 20p; In English
Report No.(s): PB98-149198; RMRS-RP-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several error structures for weighed regression equations used for predicting volume were examined for 2 large data sets of felled and standing loblolly pine trees (Pinus taeda L. The generally accepted model with variance of error proportional to the value of the covariate squared (D2H = diameter squared times height of D2 = diameter squared)) remains the best. Although D2H is a better covariate than D2, the authors found no significant difference between them when testing model accuracy for felled trees, but there were significant differences for standing trees. When the authors predicted the total volume of a population using equations based on felled tree data, assuming known frequencies for diameter classes and using D2H as the covariate, the authors obtained essentially the same estimate as that predicted using D2 (0.1% difference). Using the conventional approach of D2H for all trees (standing and felled) yielded an estimate of volume of 5.6% less than using the equation with D2H for felled trees only. Trees are more accurately measured for volume when felled, and total heights are often not measured accurately on standing trees. Therefore, the authors recommend that volume equations be based on felled tree data only and that when they are intended to be applied to standing trees, D2 be used as the covariate in prediction.
NTIS
Regression Analysis; Trees (Plants); Forest Management; Volume

19980206297 Los Alamos National Lab., NM USA
Iterative retrieval of surface emissivity and temperature for a hyperspectral sensor
Borel, C. C., Los Alamos National Lab., USA; 1997; 7p; In English; Remote Sensing of Land Surface Emissivity, 6-8 May 1997, Pasadena, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3012; CONF-9705196; DE98-001085; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The central problem of temperature-emissivity separation is that we obtain N spectral measurements of radiance and need to find N + 1 unknowns (N emissivities and one temperature). to solve this problem in the presence of the atmosphere we need to find even more unknowns: N spectral transmissions (tau)(sub atmo)((lambda)) up-welling path radiances L(sub path)(up arrow)((lambda)) and N down-welling path radiances L(sub path)(down arrow)((lambda)). Fortunately there are radiative transfer codes such as MODTRAN 3 and FASCODE available to get good estimates of (tau)(sub atmo)((lambda)), L(sub path)(up arrow)((lambda)) and L(sub path)(down arrow)((lambda)) in the order of a few percent. With the growing use of hyperspectral imagers, e.g. AVIRIS in the visible and short-wave infrared there is hope of using such instruments in the mid-wave and thermal IR (TIR) some day. We believe that this will enable us to get around using the present temperature - emissivity separation (TES) algorithms using methods which take advantage of the many channels available in hyperspectral imagers. The first idea we had is to take advantage of the simple fact that a typical surface emissivity spectrum is rather smooth compared to spectral features introduced by the atmosphere. Thus iterative solution techniques can be devised which retrieve emissivity spectra (epsilon) based on spectral smoothness. to make the emissivities realistic, atmospheric parameters are varied using approximations, look-up tables derived from a radiative transfer code and spectral libraries. by varying the surface temperature over a small range a series of emissivity spectra are calculated. The one with the smoothest characteristic is chosen. The algorithm was tested on synthetic data using MODTRAN and the Salisbury emissivity database.
DOE
Airborne Equipment; Emissivity; Infrared Radiation; Infrared Spectrometers; Iterative Solution; Meteorological Parameters; Surface Temperature

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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.

19980203233 Naval Postgraduate School, Monterey, CA USA
Computer Simulation of a Two-Phase Capillary Pumped Loop (CPL) Using SINDA/FLUINT
Ryan, Peter J., Jr, Naval Postgraduate School, USA; Dec. 1997; 135p; In English
Report No.(s): AD-A343672; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The heat transfer performance of a prototype Capillary Pumped Loop (CPL) test bed from the U.S. Air Force Phillips Laboratory is modeled using numerical differencing techniques. A commercial computer code was used to create the model and simulate performance over a wide range of operating conditions. Steady state and transient performance were modeled as part of the initial phase of testing in a program designed to evaluate the effectiveness and reliability of capillary pumped loop technology for use in spacecraft thermal control. The performance baseline developed in this phase of testing will serve as the foundation for continued research and development of this technology.
DTIC
Computerized Simulation; Pumps; Computer Programs; Reliability; Capillary Flow

19980203411 Sandia National Labs., Albuquerque, NM USA
Balance-of-system improvements for photovoltaic applications resulting from the PVMaT phase 4A1 program
Bower, W., Sandia National Labs., USA; Bonn, R., Sandia National Labs., USA; Hund, T., Sandia National Labs., USA; 1997; 4p; 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-97-1195C; CONF-970953-4; DE97-007464; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Photovoltaic Manufacturing Technology Program (PVMaT) program began in 1990 as a cost-shared partnership among the US photovoltaic industry and the US Photovoltaic Program. Balance-of-systems (BOS) components and concepts were included under Phase 4A1 of the program. BOS contracts ranged from newly developed AC PV modules to 100kW inverters for photovoltaic applications. Utility-interactive, stand-alone and hybrid components were also improved, while better manufacturing processes were developed. Specific products developed through Phase 4A1 contracts included AC modules and module integrated inverters, an advanced polymer system to reduce BOS costs, low cost integrated tracking PV systems, improved inverters, new concept inverters, communications links for BOS, and advanced modular PV systems for remote applications. This paper summarizes the research and development work, presents product and applications improvements, and describes manufacturing improvements while analyzing performance and cost benefits.
DOE
Photovoltaic Cells; Manufacturing; Cost Reduction; Alternating Current

19980203415 Buero fuer Technikfolgen-Abschaetzung des Deutschen Bundestages, Bonn, Germany
Monitoring "Renewable fuels": Gasification and pyrolysis of biomass ***Monitoring "Nachwachsende Rohstoffe": Vergasung und Pyrolyse von Biomasse. Zweiter Sachstandsbericht***
Roesch, C., Buero fuer Technikfolgen-Abschaetzung des Deutschen Bundestages, Germany; Wintzer, D., Buero fuer Technikfolgen-Abschaetzung des Deutschen Bundestages, Germany; Apr. 1997; 116p; In German
Report No.(s): ETDE-DE-543; DE98-700972; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The second situation report deals with gasification and pyrolysis as means of improving the energetic utilisation of wood and strawlike biomass and with various possibilities of utilising the gas produced in these processes. It also presents different gasification techniques, measures for gas purification, and ways of utilising gas for electricity generation. Out of the wide range of possible process combinations for producing energy from biomass the report only deals more closely with a few concepts that appear very promising from today's viewpoint. Working from the current state and perspectives of technical development and from prospective operating conditions and potential market chances of pyrolysis and gasification the report deliberates on the future orientation of research, development, and demonstration activities.
DOE
Biomass; Fuels; Gasification; Pyrolysis; Electricity

19980203482 Army Communications-Electronics Command, Fort Monmouth, NJ USA

Evaluation of State of Charge Meters for BA-5800 Lithium Sulfur Dioxide Batteries

Wilkin, Michael, Army Communications-Electronics Command, USA; Esses-Fernandez, Anita, Army Communications-Electronics Command, USA; Olsen, Henry, Army Communications-Electronics Command, USA; Atwater, Terrill, Army Communications-Electronics Command, USA; Zeman, Jonas, Army Communications-Electronics Command, USA; Mar. 1998; 72p; In English

Report No.(s): AD-A343625; CECOM-TR-98-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Product Manager Global Positioning System (PM GPS) sponsored the test and evaluation of BA-5800/U (a military lithium sulfur dioxide battery) State of Charge (SOC) meters made by two manufacturers, Monica Computers and Quality Power Supplies, Limited. This battery is used to power the AN/PSN-11 Precision Lightweight GPS Receiver (PLGR). Over 70,000 PLGR's have been distributed to the Army by PM GPS with a grand total of 78,800 to be distributed by September 1998. Battery operating costs are the major life cycle cost to the PLGR, and there are no SOC testers for this battery in the Army inventory. Based on field data collected from PLGR users at Fort Drum, NY, an economic analysis concluded that the use of the SOC meter saves 43.9% in the cost of batteries, and the use of 228 SOC meters in active Army units would save $4,270,000 over a 5-year period. Through controlled laboratory testing, it was concluded that the SOC meters from both manufacturers provide a reading accurate to within 10% of actual battery capacity at room temperature and above. At the minimum meter operating temperature of zero degrees Celsius, both meters have greater error and conservatively underestimate the capacity of the battery.

DTIC

Evaluation; Electric Batteries; Lithium Sulfur Batteries; Performance Tests; Sulfur Dioxides

19980203547 Risoe National Lab., Test Station for Wind Turbines, Roskilde, Denmark

Nacelle anemometry on a 1MW wind turbine: Comparing the power performance results by use of the nacelle or mast anemometer

Antoniou, I., Risoe National Lab., Denmark; FriisPedersen, T., Risoe National Lab., Denmark; Aug. 1997; 35p; In English

Report No.(s): RISO-R-941(EN); DE98-701662; ISBN-87-550-2323-1; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The report describes measurements carried out on the ELKRAFT 1MW wind turbine in the period from week 46/1994 to week 10/1997. The correlation between the mast and the nacelle anemometer is investigated and the result of the power curve measurements is presented as a function of both the mast and the 'corrected' nacelle anemometer. The scope of this is to gain a better understanding on the merits and limitations of the use of the nacelle anemometer as a alternative to the mast anemometer for the verification of the turbine's power curve and the calculation of the annual energy production. Data collected from three phases of operation and two nacelle anemometer height positions is shown and compared with each other in the present report. During the first phase the turbine blades are set at a pitch angle of +0.5 deg. (nacelle anemometer at 1.2 m height). During the second phase the turbine blades are also set at a pitch angle of +0.5 deg. and a new yaw condition is introduced in order to reduce the turbine's yaw error (nacelle anemometer at 1.2 m height). Finally, during the third phase, the pitch angle of the blades is set to -1.0 deg. and vortex generators are placed in the inner part of the blades (nacelle anemometer at 1.2 m and 3 m height). Following the above analysis conclusions, concerning the limits on the use of the nacelle anemometer as an alternative for the power curve measurements, will be drawn.

DOE

Anemometers; Velocity Measurement; Wind Turbines; Nacelles; Performance Tests; Power Spectra

19980203909 South Carolina Univ., Columbia, SC USA

Workshop on Hydrogen Storage and Generation for Medium-Power and -Energy Applications ***Final Report, Feb. 1998***

Matthews, Michael A., South Carolina Univ., USA; Feb. 1998; 485p; In English; Hydrogen Storage and Generation Technologies for Medium-Power and-Energy Applications, 8-10 Apr. 1997, Orlando, FL, USA

Contract(s)/Grant(s): DAAG55-97-1-0135

Report No.(s): AD-A344786; ARO-36737.1-CH-CF; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

This report summarizes the Workshop on Hydrogen Storage and Generation Technologies for Medium-Power and -Energy Applications which was held on April 8-10, 1997 at the Radisson Hotel Orlando Airport in Orlando, Florida. There were 70 participants, representing private industry, national laboratories, the Department of Defense, and academia. The Workshop was sponsored by the U.S. Army Research Office and by the Office of Research and Development of the Central Intelligence Agency. The objective of this workshop was to review and summarize what is known or under development concerning hydrogen storage and generation technologies that are potentially applicable for use in small-to medium-sized PEM fuel cell systems. The Workshop participants were instructed to consider three specific fuel cell power systems: a 300 watt (W) fuel cell with 10 kWh energy stor-

age, a 100 W person-portable fuel cell with a minimum of 1 kWh energy storage, and a 10 W fuel cell with 90 kWh energy storage. These three power systems were suggested by the Workshop sponsors because of anticipated future military and defense applications. In addition, power supplies of this size may also have significant applications in the commercial sector.
DTIC
Airports; Defense Program; Energy Storage; Military Technology

19980203928 Eltron Research, Inc., Boulder, CO USA
Advanced High Energy Lithium Polymer Electrolyte Battery ***Final Report, 14 Nov. 1997 - 14 May 1998***
Spiegel, E. F., Eltron Research, Inc., USA; Adamic, K. J., Eltron Research, Inc., USA; Sammells, A. F., Eltron Research, Inc., USA; May 14, 1998; 25p; In English
Contract(s)/Grant(s): DAAB07-98-C-G005
Report No.(s): AD-A343879; Rept-113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This program was directed toward synthesis of two closely related classes of new lithium ion conducting polymer electrolytes which are demonstrating both higher ionic conductivity and improved elastomeric properties over current state-of-the-art polymer electrolytes. The strategy exploited the approach that carbonate oxygens, within the single phase carbonate-siloxane polymer matrix, will facilitate extensive ionic dissociation of introduced lithium salts, and that furthermore elastomeric behavior of the matrix under ambient temperature conditions will lead to enhanced mobility of lithium ions. The validity of this approach was verified during this program where preliminary data supports lithium ion conductivities greater than 0001 per Scm at ambient temperature. Furthermore the elastomeric properties of these lithium ion conducting polymers will facilitate small inter-electrode distances to be achieved within portable secondary lithium batteries incorporating these new polymer electrolytes. These polymers were incorporated into lithium cells during this program.
DTIC
Lithium; Electrodes; Ion Currents; Conducting Polymers; Polymers

19980203947 Bundesministerium fuer Bilding, Wissenschaft, Forschung und Technologie, Bonn, Germany
Clearing up the kinetics in high temperature fuel cells SOFC ***Final Report Aufklaerung der Kinetik in Hochtemperatur-Brennstoffzellen SOFC. Abschlussbericht***
Stimming, U., Bundesministerium fuer Bilding, Wissenschaft, Forschung und Technologie, Germany; May 12, 1997; 189p; In German
Contract(s)/Grant(s): Foerderkennzeichen BMBF ET 951
Report No.(s): ETDE-DE-527; DE97-762092; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

In this work, the kinetics of the oxygen reduction of the SOFC cathode are to be detailed, i.e., depending on the parameters of electrode potential, temperature and oxygen partial pressure, they are to be examined with impedance spectroscopy and quasi-stationary current/voltage measurements. From the dependence of the impedances and the current density on the temperature and the oxygen partial pressure, apparent activation energies and pre-exponential factors as well as apparent reaction orders are to be determined, in order to obtain information on possible reaction mechanisms. These investigations should be carried out not only on standard cathode material (La(1-x)SR(x)MnO3, LSM) but also on modified LSM cathodes. This modification should consist either of the addition of noble metal catalysts or in a change of the composition of the cathode material, and should lead to increased catalytic activity of the cathode. In addition, using the example of the standard cathode, different possible reaction mechanisms should be compared by a computer simulation of the current/voltage measurements and impedance spectra.
DOE
Reaction Kinetics; Reduction (Chemistry); Solid Oxide Fuel Cells; Oxygen; Electrochemistry; Catalytic Activity; Chemical Reactions; Catalysts; Cathodes

19980205600 Sandia National Labs., Albuquerque, NM USA
Subsurface steam sampling in Geysers wells
Normann, R., Sandia National Labs., USA; Henfling, J., Sandia National Labs., USA; [1997]; 9p; In English; Geothermal Resources Council (Grc) Annual Meeting, 12 Oct. 1997, San Francisco, CA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-1382C; CONF-971048-6; DE97-006833; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

A new downhole sampling tool has been built for use in steam wells at The Geysers geothermal reservoir. The tool condenses specimens into an initially evacuated vessel that is opened down hole at the direction of an on-board computer. The tool makes

a temperature log of the well as it is deployed, and the pressure and temperature of collected specimens are monitored for diagnostic purposes. Initial tests were encouraging, and the Department of Energy has funded an expanded effort that includes data gathering needed to develop a three-dimensional model of The Geysers geochemical environment. Collected data will be useful for understanding the origins of hydrogen chloride and non-condensable gases in the steam, as well as tracking the effect of injection on the composition of produced steam. Interested parties are invited to observe the work and to join the program.
DOE
Geochemistry; Noncondensable Gases; Wells; Reservoirs; Water Vapor; Sampling; Geysers

19980205801 Los Alamos National Lab., NM USA
Rail-gap switch modifications and test data for the Atlas capacitor bank
Lopez, E. A., Los Alamos National Lab., USA; Bennett, G. A., Los Alamos National Lab., USA; Bartsch, R. R., 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-97-2479; CONF-9706113-23; DE97-009114; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Atlas is a facility being designed at the Los Alamos National Laboratory (LANL) to perform high energy-density experiments in support of weapons-physics and basic-research programs. The capacitor bank design consists of a 36-MJ array of 240-kV Marx modules. The system is designed to deliver a peak current of 45- to 50-MA with a 4- to 5-us risetime. Evaluation, testing and qualification of key components of the Marx module are being conducted. One key element of the Marx module is the low inductance, high-voltage, high-current, high-coulomb transfer spark-gap switch needed for this application, 304 of which will be used in the Atlas capacitor bank. Because of the Marx module configuration, overall system inductance requirements and the need for a triggered switch, the design team initially selected the Maxwell Technologies railgap switch. The switch has been used in other high-voltage, high-current, high-coulomb transfer applications and would meet the Atlas facility requirements with some modifications. Testing of the Maxwell rail-gap switch under expected Atlas conditions is in progress. For the Atlas application, the rail-gap switch required some mechanical design modifications, which are discussed. Maxwell provided to modified switches for testing and evaluation. Results of this testing, before and after modifications, and inherent maintenance improvements to meet overall system reliability will be discussed.
DOE
Capacitors; Research Facilities; Design Analysis; Experimentation; Density (Number/Volume); Switches; Research; Test Facilities; High Energy Electrons

19980205803 Energy Information Administration, Office of the National Energy Information System, Washington, DC USA
Energy information directory 1997
Sep. 1997; 117p; In English
Report No.(s): DOE/EIA-0205(97); DE97-009396; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The National Energy Information Center (NEIC), as part of its mission, provides energy information and referral assistance to Federal, state, and local governments, the academic community, business and industrial organizations, and the general public. The two principal functions related to this task are: (1) operating a general access telephone line, and (2) responding to energy-related correspondence addressed to the Energy Information Administration (EIA). The Energy Information Directory was developed to assist the NEIC staff, as well as other Department of Energy (DOE) staff, in directing inquiries to the proper offices within DOE, other Federal agencies, or energy-related trade associations. The Directory lists some of the Government offices and trade associations that are involved in energy matters. It includes those DOE offices which deal with the public or public information. For the purposes of this publication, each entry has been given a numeric identification symbol. The index found in the back of this publication uses these identification numbers to refer the reader to relevant entries.
DOE
Directories; Commerce; Governments; Organizations; Readers

19980205804 Los Alamos National Lab., NM USA
Atlas chamber, power flow channel, and diagnostic interface design
Wurden, G. A., Los Alamos National Lab., USA; Davis, H. A., Los Alamos National Lab., USA; Taylor, A., Los Alamos National Lab., USA; Bowman, D., Los Alamos National Lab., USA; Ballard, E., Los Alamos National Lab., USA; Ney, S., Los Alamos National Lab., USA; Scudder, D., Los Alamos National Lab., USA; Trainor, J., Los Alamos National Lab., USA; [1997]; 7p; In

English; 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-97-2478; CONF-9706113-24; DE97-009110; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Atlas pulsed-power machine, presently being designed at Los Alamos, will deliver a pulse of approximately 45 MA, in 4--5 micro-sec, with energies of up to 6 MJ (from a bank of 36 MJ maximum) to a load assembly, located in vacuum. Design considerations for the vacuum vessel, power flow channel from the vessel inward, are presented. In contrast to Sandia's PBFA II-Z, where 20 MA currents and 2--2.5 MJ of energy are delivered to (approximately 15 mg) loads in approximately 100 nsec, the Atlas structures will have to be designed for longer timescales and higher energies to drive heavy lines (approximately 70 g). Design issues for the chamber include materials stresses, formation of (and protection from) debris and molten jets, impulse loading, and survivability and ease of replacement of internal structures. For the power flow channel designs, issues are minimizing inductance, preventing movement of conductors during and after firing, damage mitigation, reducing the cost of materials and installation, and electrical insulation. A key issue for damage mitigation is the radius within which total destruction of material objects occurs. Choices of vessel size, insulator materials, cost and ease of manufacturing, and mechanical stability issues are presently in the conceptual design phase. Typical access requirements for diagnostics (including radial and axial X-ray backlighting, flux loops, spectroscopy, interferometry, bolometry, etc.) are provided for in the design.
DOE
Electric Power Supplies; Electrical Insulation; Nuclear Weapons

19980205806 Los Alamos National Lab., NM USA
Controls and data acquisition on Atlas
Scudder, D. W., Los Alamos National Lab., USA; Hosack, K. W., Los Alamos National Lab., USA; Parsons, W. M., Los Alamos National Lab., USA; Reass, W. A., Los Alamos National Lab., USA; Thompson, M. C., Los Alamos National Lab., USA; Wysocki, F. J., Los Alamos National Lab., USA; Creager, J., Allied-Signal Corp., USA; [1997]; 7p; In English; 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-97-2382; CONF-9706113-26; DE97-009106; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The control and data acquisition systems for Atlas will use a large degree of decentralization. by distributing control points close to the systems being controlled, the authors expect to simplify the task of isolating electronic systems from the large expected EMI pulses, allow connection of the various parts of the system by high-level fiber-optic networks, allow a simple configuration of the control and data acquisition screen rooms, and simplify the software efforts through the resulting modularization. The Atlas control system must control capacitor charging, machine and diagnostic timing and triggering, marx module diagnostics, vacuum systems, gas handling for railgaps, safety interlocks, and oil handling. Many of these tasks will be performed by industrial-style programmable logic controllers (PLCs). Each of 38 Marx bank maintenance units will have a control and diagnostic package which will monitor both charging and discharging current and railgap trigger timing. An unusual feature of digitizers to record each Marx module's output waveform, plus nanosecond resolution time interval meters to record the firing time of each railgap. The machine data acquisition system for Atlas will be built around an SQL database, use National Instruments LabVIEW software to control data acquisition instruments and provide links for a variety of experimentalists' data analysis packages. World Wide Web access will provide an interface through which users can monitor experimental data and machine status.
DOE
Data Acquisition; Nuclear Weapons; Capacitors; Energy Storage; Controllers

19980205820 National Renewable Energy Lab., Golden, CO USA
Village Power
Cardinal, J., Editor, National Renewable Energy Lab., USA; Flowers, L., Editor, National Renewable Energy Lab., USA; Taylor, R., Editor, National Renewable Energy Lab., USA; Weingart, J., Editor, National Renewable Energy Lab., USA; 1997; 521p; In English; Conference Proceedings, 14 - 15 Apr. 1997, Arlington, VA, USA
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/CP-440-23409; CONF-9704141; DE97-008397; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

It is estimated that two billion people live without electricity and its services. In addition, there is a sizable number of rural villages that have limited electrical service, with either part-day operation by diesel gen-sets or partial electrification (local school

or community center and several nearby houses). For many villages connected to the grid, power is often sporadically available and of poor quality. The U.S. National Renewable Energy Laboratory (NREL) in Golden, Colorado, has initiated a program to address these potential electricity opportunities in rural villages through the application of renewable energy (RE) technologies. The objective of this program is to develop and implement applications that demonstrate the technical performance, economic competitiveness, operational viability, and environmental benefits of renewable rural electric solutions, compared to the conventional options of line extension and isolated diesel mini-grids. These four attributes foster sustainability; therefore, the program is entitled Renewables for Sustainable Village Power (RSVP). The RSVP program is a multi-disciplinary, multi-technology, multi-application program composed of six key activities, including village application development, computer model development, systems analysis, pilot project development, technical assistance, and an Internet-based village power project database. The current program emphasizes wind, photovoltaics (PV), and their hybrids with diesel gen-sets. NREL's RSVP team is currently involved in rural electricity projects in thirteen countries, with U.S., foreign, and internationally based agencies and institutions. This document contains reports presented at the Proceedings of Village Power, 1997. Individual projects have been processed separately for the USA Department of Energy databases.
DOE
Photovoltaic Conversion; Energy Technology; Energy Consumption; Solar Energy; Electricity

19980206300 Power-One, Inc., Engineering Dept., Camarillo, CA USA
The aerocapacitor: An electrochemical double-layer energy-storage device
Mayer, S. T., Power-One, Inc., USA; Pekala, R. W., Power-One, Inc., USA; Kaschmitter, J. L., Power-One, Inc., USA; [1997]; 31p; In English
Contract(s)/Grant(s): DE-FC07-94ID-13283; W-7405-ENG-48
Report No.(s): DOE/ID/13283-T1-App.C-Pt.3; DE98-000671; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors have applied unique types of carbon foams developed at Lawrence Livermore National Laboratory (LLNL) to make an "aerocapacitor". The aerocapacitor is a high power-density, high energy-density, electrochemical double-layer capacitor which uses carbon aerogels as electrodes. These electrodes possess very high surface area per unit volume and are electrically continuous in both the carbon and electrolyte phase on a 10 nm scale. Aerogel surface areas range from 100 to 700 sq m/cc (as measured by BET analysis), with bulk densities of 0.3 to 1.0 g/cc. This morphology permits stored energy to be released rapidly, resulting in high power densities (7.5 kW/kg). Materials parameterization has been performed, and device capacitances of several tens of Farads per gram and per cu cm of aerogel have been achieved.
DOE
Capacitors; Electrochemical Cells; Electrolytes; Aerogels; Foams; Carbon; Capacitance

19980206301 Power-One, Inc., Engineering Dept., Camarillo, CA USA
Advanced power conversion based on the Aerocapacitor(trademark)
Josephs, L. C., Power-One, Inc., USA; Gregory, D., Power-One, Inc., USA; Roark, D., Power-One, Inc., USA; [1997]; 13p; In English
Contract(s)/Grant(s): DE-FC07-94ID-13283
Report No.(s): DOE/ID/13283-T1-App.C-Pt.2; DE98-000670; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors report here, for the first time, high frequency testing of a new type of electrochemical double layer capacitor (EDLC), based on carbon aerogels: the Aerocapacitor. Carbon aerogels, are a novel type of carbon foam developed by Lawrence Livermore National Laboratory for military applications. The unique properties of carbon aerogels, high surface area (700 sq m/g), high density (1g/cc), well controlled pore diameter and high material conductivity (25 S/cm) made it an ideal EDLC electrode material. Using carbon aerogel as the electrode material, the authors have developed Aerocapacitors. These new EDLC's have a frequency response comparable to that of aluminum electrolytic capacitors and are thus ideally suited to power conversion applications.
DOE
Capacitors; Aerogels; Carbon; Foams; Electrochemical Cells

19980206302 Power-One, Inc., Engineering Dept., Camarillo, CA USA
Hybrid Aerocapacitor(trademark)-battery power sources
Isaacson, M. J., PolyStor Corp., USA; Kraemer, B. J., PolyStor Corp., USA; Laramore, T. J., PolyStor Corp., USA; [1997]; 4p; In English

Contract(s)/Grant(s): DE-FC07-94ID-13283
Report No.(s): DOE/ID/13283-T1-App.C-Pt.1; DE98-000669; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

PolyStor, Power-One, LLNL, and Aerojet are participants in a Technology Reinvestment Program contract supported by the Advanced Research Project Agency for developing carbon aerogel-based Electrolytic Double Layer Capacitors (Aerocapacitors). This paper reports some recent results for organic-electrolyte Aerocapacitors developed under this contract and initial results on their use in electrolytic double layer capacitor (EDLC)-battery power sources. EDLC-battery hybrid power sources offer the potential for increased discharge time, improved low temperature performance and longer cycle life vis-a-vis batteries in pulse discharge applications. The authors previously presented performance results for AA Aerocapacitors but this is the first report of their work on hybrid power sources. Prototype organic-electrolyte Aerocapacitors exhibit low equivalent series resistance (ESR), high capacitance, excellent rate capability at room temperature and low temperatures, and long life. The AA-size devices assembled for testing have ESRs of 20-30 m(Omega) at 1000 Hz and capacitances of about 6 Farads. They are capable of being discharged at very high rates. The capacity at 15 Amps is about 71% of the capacity at 1 Amp. The capacity at 1 Amp and -40 C is 57% of the room-temperature 1 Amp capacity. AA Aerocapacitors have demonstrated 32,000 cycles in cycle life testing. After an initial capacity decrease of about 17% the capacity remained almost constant between cycle 10,000 and cycle 32,000.
DOE
Capacitors; Electric Batteries; Electrolytes; Capacitance; Aerogels; Carbon; Electrolytic Cells

19980206303 Power-One, Inc., Engineering Dept., Camarillo, CA USA
Advanced power conversion based on the Aerocapacitor(trademark) ***Final Report***
Roark, D., Power-One, Inc., USA; Mar. 05, 1997; 46p; In English
Contract(s)/Grant(s): DE-FC07-94ID-13283
Report No.(s): DOE/ID/13283-T1; DE98-000667; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report summarizes work performed under contract No. DE-FC07-94ID13283, "Advanced Power Conversion Based on the Aerocapacitors(TM)." Under this contract high power density, high energy density, organic electrolyte Aerocapacitors(TM) were developed and characterized for power conversion applications. Pilot facilities for manufacturing prototype AA-size Aerocapacitors(TM) were put in place. The low ESR and good frequency response of these devices show that they are ideal components for high discharge rate and low to moderate frequency (less than 10 kHz) applications such as power conversion.
DOE
Capacitors; Carbon; Manufacturing; Electric Power Supplies

19980206309 Los Alamos National Lab., NM USA
Pegasus 2 experiments and plans for the Atlas pulsed power facility
Shlachter, J. S., Los Alamos National Lab., USA; Adams, P. J., Los Alamos National Lab., USA; Atchison, W. L., Los Alamos National Lab., USA; 1997; 7p; In English; 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-97-2467; CONF-9706113; DE97-008964; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Atlas will be a high-energy (36 MJ stored), high-power (approximately 10 TW) pulsed power driver for high energy-density experiments, with an emphasis on hydrodynamics. Scheduled for completion in late 1999, Atlas is designed to produce currents in the 40-50 MA range with a quarter-cycle time of 4-5 micro-s. It will drive implosions of heavy liners (typically 50 g) with implosion velocities exceeding 20 mm/micro-s. Under these conditions very high pressures and magnetic fields are produced. Shock pressures in the 50 Mbar range and pressures exceeding 10 Mbar in an adiabatic compression will be possible. By performing flux compression of a seed field, axial magnetic fields in the 2000 T range may be achieved. A variety of concepts have been identified for the first experimental campaigns on Atlas. These experiments include Rayleigh-Taylor instability studies, convergent (e.g., Bell-Plesset type) instability studies, material strength experiments at very high strain and strain rate, hydrodynamic flows in 3-dimensional geometries, equation of state measurements along the hugoniot and adiabats, transport and shock propagation in dense strongly-coupled plasmas, and atomic and condensed matter studies employing ultra-high magnetic fields. Experimental configurations, associated physics issues, and diagnostic strategies are all under investigation as the design of the Atlas facility proceeds. Near-term proof-of-principle experiments employing the smaller Pegasus II capacitor bank have been identified, and

several of these experiments have not been performed. This paper discusses a number of recent Pegasus II experiments and identifies several areas of research presently planned on Atlas.
DOE
Hydrodynamics; Implosions; Condensed Matter Physics; Strongly Coupled Plasmas; Equations of State; Dense Plasmas

19980206316 Sandia National Labs., Albuquerque, NM USA
Photovoltaic system reliability
Maish, A. B., Sandia National Labs., USA; Atcitty, C., Sandia National Labs., USA; Greenberg, D., Ascension Technology, Inc., 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-97-2450C; CONF-970953; DE98-000402; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper discusses the reliability of several photovoltaic projects including SMUD's PV Pioneer project, various projects monitored by Ascension Technology, and the Colorado Parks project. System times-to-failure range from 1 to 16 years, and maintenance costs range from 1 to 16 cents per kilowatt-hour. Factors contributing to the reliability of these systems are discussed, and practices are recommended that can be applied to future projects. This paper also discusses the methodology used to collect and analyze PV system reliability data.
DOE
Photovoltaic Conversion; Pioneer Project; System Failures

19980206317 Sandia National Labs., Albuquerque, NM USA
Recent progress on the self-aligned, selective-emitter silicon solar cell
Ruby, D. S., Sandia National Labs., USA; Yang, P., Sandia National Labs., USA; Roy, M., Solarex Corp., 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-97-2462C; CONF-970953; DE98-000398; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We developed a self-aligned emitter etchback technique that requires only a single emitter diffusion and no alignments to form self-aligned, patterned-emitter profiles. Standard commercial, screen-printed gridlines mask a plasma-etchback of the emitter. A subsequent PECVD-nitride deposition provides good surface and bulk passivation and an antireflection coating. We succeeded in finding a set of parameters which resulted in good emitter uniformity and improved cell performance. We used full-size multicrystalline silicon (mc-Si) cells processed in a commercial production line and performed a statistically designed, multiparameter experiment to optimize the use of a hydrogenation treatment to increase performance. Our initial results found a statistically significant improvement of half an absolute percentage point in cell efficiency when the self-aligned emitter etchback was combined with a 3-step PECVD-nitride surface passivation and hydrogenation treatment.
DOE
Antireflection Coatings; Solar Cells; Hydrogenation; Emitters

45
ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19980203250 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 1 ***Final Report***
Mar. 1998; 694p; In English
Report No.(s): AD-A341657; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

The purpose of the proposed action is to meet the legal directives of the Defense Base Closure and Realignment Act of 1990 (DBCRA) Public Law No. 101-510 to realign E-2 aircraft and facilities. The proposed action will relocate four E-2 aircraft squadrons and related support personnel, equipment, and functions from MCAS Miramar to one of three alternative naval bases in California. The proposed action includes siting 16 E-2 aircraft, relocating 988 associated personnel and their families, and expanding

or constructing facilities to support aircraft and personnel, and to provide associated training functions. In addition to the increased staffing and equipment levels, there would be an increase in Navy training activities and an increase in flight operations at the receiving installation. The three installations considered for the receiving base are Naval Air Weapons Station (NAWS) Point Mugu (the preferred alternative), Naval Air Station (NAS) Lemoore, and Naval Air Facility (NAF) El Centro. NAS North Island was initially considered as a potential alternative base, but was eliminated due to the need to support Clean Air Act, as amended, 42 USA Code (USC) 7401 et seq., requirements with regard to the BRAC-mandated Marine Corps realignment to MCAS Miramar. This EIS evaluates the potential environmental impacts that may result from constructing and/or operating airfield, training, maintenance and personnel support facilities required to carry on the E-2 mission at the three alternative base locations. This EIS has been prepared in accordance with the National Environmental Policy.
DTIC
E-2 Aircraft; Flight Operations; Environment Effects

19980203386 Corps of Engineers, Washington, DC USA
Evaluation of Environmental Investments Research Program
Nov. 24, 1997; 13p; In English
Report No.(s): AD-A343635; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall objective of the EEIRP was to provide an evaluation framework, techniques, and procedures to assist planners, managers, and regulators in addressing both the site and portfolio issues; i.e., whether the recommended action is the most effective and efficient alternative for a particular location, and how to allocate limited resources among competing recommended actions. A goal of the program was the development of a series of environmental evaluation procedures manuals (”how to” manuals) addressing various steps in the planning, evaluating, and prioritizing processes. This paper provides an annotated bibliography of EEIRP reports, manuals, and other products and includes information for ordering copies.
DTIC
Cost Effectiveness; Efficiency; Effectiveness; Manuals; Procedures; Environment Management

19980203416 Swedish Water and Air Pollution Research Lab., IVL-Aneboda, Lammhult, Sweden
Air pollution in northern Sweden: Deposition, levels, and effects, *Oct. 1995 - Sep. 1996 Luftfoeroreningar i norra Sverige. Nedfall, halter och effekter oktober 1995 - september 1996*
Hallgren-Larsson, E., Swedish Water and Air Pollution Research Lab., Sweden; Westling, O., Swedish Water and Air Pollution Research Lab., Sweden; Jun. 1997; 88p; In Swedish
Report No.(s): IVL-B-1264; DE97-769039; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The purpose of the monitoring programme is to quantify sulphur and nitrogen deposition to forests, and to illustrate possible acidification of the soil. Deposition is investigated by precipitation studies in open field areas and as through fall. SOIl-water chemistry in the forest stands is used as indicator of soil conditions. Most locations were established during 1991. During 1995 and 1996 seven international permanent forest plots were established. This report concern the hydrological year from October 1995 through September 1996 for almost 20 locations in the four most northern counties of Sweden. The results are compared with previous years and other regions in Sweden. Less precipitation was measured in northern Sweden during the hydrological year 1995/1996, compared to averages for 1961-90. The drought was most pronounced during autumn and winter. As averages for 1995/96, temperatures were normal. A gradient with more acidic precipitation with higher concentrations of sulphur at coastal, than at inland, locations was found. Precipitation has been less acid, with lower concentrations of sulphur during 1995/96 compared to 1994/95. Deposition illustrates a gradient with larger loads of sulphur and nitrogen at coastal, than at inland locations. About 70 % of the precipitation reached the ground as through-fall. Sulphur and nitrogen deposition were larger in southern than in northern Sweden. The most acidified soil solutions (pH 4.5-4.6) with highest concentrations of aluminium were found at coastal locations outside Luleaa and Umeaa. One contributing factor might be a natural occurrence of higher sulphur levels in the soil. At most of the other locations pH-values were between 5.2 and 6.5. A significant trend towards diminished amounts of the micro nutrient manganese were found in soil solution from half of the locations. Lowered pH-values and higher concentrations of aluminium were found at many locations, indicating a continuing acidification process.
DOE
Forests; Acidity; Air Pollution; SOIl Pollution; Nitrogen; Sulfur; Environmental Monitoring

19980203417 Swedish Environmental Protection Agency, Stockholm, Sweden
Volatile organic compounds and oxides of nitrogen: Further emission reductions
Froste, H., Compiler, Swedish Environmental Protection Agency, Sweden; 1996; ISSN 0282-7298; 109p; In English

Report No.(s): SNV-4689; DE97-769034; ISBN 91-620-4689-6; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report presents the current status in relation to achievement of the Swedish Environmental target set by Parliament to reduce emission of volatile organic compounds by 50 per cent between 1988 and 2000. It also instructed the Agency to formulate proposed measures to achieve a 50 per cent reduction of emission of nitrogen oxides between 1985 and 2005. The report presents an overall account of emission trends for volatile organic compounds (from all sectors) and nitrogen oxides (from the industry sector) and steps proposed to achieve further emission reductions.

DOE

Organic Compounds; Nitrogen Oxides; Air Pollution; Pollution Control; Emission

19980203427 Technical Univ. of Denmark, Inst. for Energiteknik, Lyngby, Denmark

Data structure for estimating emissions from non-road sources

Sorenson, S. C., Technical Univ. of Denmark, Denmark; Kalivoda, M., Technical Univ. of Denmark, Denmark; Vacarro, R., Technical Univ. of Denmark, Denmark; Trozzi, C., Technical Univ. of Denmark, Denmark; Samaras, Z., Technical Univ. of Denmark, Denmark; Lewis, C. A., Technical Univ. of Denmark, Denmark; Mar. 1997; 73p; In English

Contract(s)/Grant(s): ST-96-SC.204

Report No.(s): DTU-ET-EO-97-02; DE97-769013; ISBN 87-7475-177-8; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The work described in the following is a portion of the MEET project (Methodologies for Estimation Air Pollutant Emissions from Transport). The overall goal of the MEET project is to consolidate and present methodologies which can be used to estimate air pollutant emissions from various types of traffic sources. One of the goals of MEET is to provide methodologies to be used in the COMMUTE project also funded by DG VII. COMMUTE is developing computer software which can be used to provide emissions inventories on the European scale. Although COMMUTE is viewed as a prime user of the information generated in MEET, the MEET results are intended to be used in a broader area, and on both smaller and larger spatial scales. The methodologies and data presented will be useful for planners on a more local scale than a national or continental basis. While most attention in previous years has been concentrated on emissions from road transport, it has become increasingly apparent in later years that the so-called off road transportation contributes significantly to the emission of air pollutants. The three most common off-road traffic modes are Air Traffic, Rail Traffic, and Ship or Marine traffic. In the following, the basic structure of the methods for estimating the emissions from these sectors will be given and of the input and output data associated with these calculations. The structures will of necessity be different for the different types of traffic. The data structures in the following reflect these variations and uncertainties. In some instances alternative approaches to emissions estimation will be suggested. The user must evaluate the amount and reliability of available data for the application at hand, and select the method which would be expected to give the highest accuracy. In any event, a large amount of uncertainty is inherent in the estimation of emissions from the non-road traffic sources, particularly those involving rail and maritime transport.

DOE

Air Pollution; Exhaust Emission; Contaminants; Exhaust Gases; Transportation; Computer Programs; Inventories

19980203440 Greeley-Polhemus Group, Inc., West Chester, PA USA

Risk and Uncertainty Analysis Procedures for the Evaluation of Environmental Outputs

Skaggs, Leigh, Corps of Engineers, USA; Yoe, Charles E., Greeley-Polhemus Group, Inc., USA; Aug. 1997; 138p; In English

Contract(s)/Grant(s): DACW72-95-D-0002

Report No.(s): AD-A343651; IWR-97-R-7; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Ecosystem restoration projects are replete with uncertainties, large and small. A major source of uncertainty in many such projects is the environmental output of the project. to estimate existing and future environmental outputs, many U.S. Army Corps of Engineers' projects rely on habitat evaluation models like the Habitat Evaluation Procedures (REP) developed by the U.S. Department of the Interior's Fish and Wildlife Service (U.S. Fish and Wildlife Service). REP analysis, as this process is called, relies on the estimation of the number of habitat units that exist at a site under certain environmental conditions. Habitat units are the simple product of a number of acres of habitat and a habitat suitability index that indicates the relative suitability of those acres for a particular wildlife species. The habitat suitability index is based on the mathematical manipulation of a set of habitat variables. A case study is used to illustrate the role that habitat variable measurements play in the uncertainty that attends the estimation of project outputs. The lessons learned during the course of the case study investigation can be grouped into three categories: preparation, data collection and analysis. During the preparation of the risk-based analysis several things were learned. First, it is necessary to realize that uncertainty exists, it cannot be eliminated and it is best to address it explicitly. Second, one must understand the nature of uncertainty and how to think about it. Third, the purpose of the risk analysis, to improve decision-making, must be

clear to all. Fourth, the major sources of uncertainty must be identified as soon as possible. Fifth, care must be taken to assure that everyone is using the language consistently. Sixth, preparing ahead of time for the risk-based analysis is important.
DTIC
Environment Effects; Risk; Ecosystems; Habitats

19980203475 Army Construction Engineering Research Lab., Champaign, IL USA
Demonstration of Ozone Treatment for Cooling Towers at Thayer Hall, US Military Academy at West Point, NY ***Final Report***
Hock, Vincent F., Army Construction Engineering Research Lab., USA; Hess, Robert, Army Construction Engineering Research Lab., USA; Mar. 1998; 137p; In English
Report No.(s): AD-A344704; FEAP-TR-98/37; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report covers the evaluation of ozone as a stand-alone treatment in a new cooling tower system that has been in operation for two cooling seasons (summer only) at the US Military Academy, West Point, NY. This report reviews the monitoring of the system as to the performance of ozone, only during the second season of operation, mid-June through mid-October 1993. Data was collected relative to the system water chemistry, particularly the scaling potential, the corrosion potential and the microbiological conditions. The results showed that ozone appeared to have protected the water contacted equipment from mineral scale and excessive microbiological deposits but showed increased, excessive corrosion of both copper and mild steel. The use of ozone treatment for cooling towers appears to be somewhat effective as a biocide. However, the ozone residuals were too low and the fluctuation too great at Thayer Hall for optimum effectiveness. The ozone feed system at Thayer Hall must be improved to provide better, more reliable feed and delivery. The life-cycle cost analyses compared ozone treatment to conventional chemical treatment.
DTIC
Chemical Reactions; Ozone; Microbiology; Cooling Systems; Cooling; Towers; Corrosion

19980203540 Alfred-Wegener-Inst. for Polar Research, Bremerhaven, Germany
Tropospheric Ozone Variations in Polar Regions ***Troposphaerische Ozonvariationen in Polarregionen***
Wessel, S., Alfred-Wegener-Inst. for Polar Research, Germany; 1997; ISSN 0176-5027; 198p; In German
Report No.(s): DE97-762237; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

An extensive analysis for the description of chemical and dynamical processes during tropospheric ozone minima in the Arctic and Antarctic was carried out in this work. One main task was the analysis of the source regions of tropospheric ozone destruction and the following transport of ozone depleted air masses to the measuring site. Furtheron the ozone destruction mechanism itself should be examined as well as the efficiency of heterogeneous reactions for the regeneration of non-reative bromine compounds, which seems to be necessary because bromine may be the key component in the destruction of tropospheric ozone in polar regions.
DOE
Atmospheric Chemistry; Polar Regions; Gas Transport; Ozone Depletion; Troposphere; Ozone; Atmospheric Composition; Environmental Monitoring

19980203543 Illinois Univ., Urbana, IL USA
Vapor Scavenging by Atmospheric Aerosol Particles
Andrews, E., Illinois Univ., USA; May 1996; 183p; In English
Contract(s)/Grant(s): DE-AC05-76OR-00033
Report No.(s): DOE/OR/00033-T711; DE97-053339; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Particle growth due to vapor scavenging was studied using both experimental and computational techniques. Vapor scavenging by particles is an important physical process in the atmosphere because it can result in changes to particle properties (e.g., size, shape, composition, and activity) and, thus, influence atmospheric phenomena in which particles play a role, such as cloud formation and long range transport. The influence of organic vapor on the evolution of a particle mass size distribution was investigated using a modified version of MAEROS (a multicomponent aerosol dynamics code). The modeling study attempted to identify the sources of organic aerosol observed by Novakov and Penner (1993) in a field study in Puerto Rico. Experimentally, vapor scavenging and particle growth were investigated using two techniques. The influence of the presence of organic vapor on the particle's hydroscopicity was investigated using an electrodynamic balance. The charge on a particle was investigated theoretically and

experimentally. A prototype apparatus--the refractive index thermal diffusion chamber (RITDC)--was developed to study multiple particles in the same environment at the same time.
DOE
Aerosols; Air Pollution; Atmospheric Chemistry; Climate Change; Organic Compounds; Particulates; Vapors; Size Distribution

19980203684 Department of Energy, Office of Energy Research, Washington, DC USA
Proceedings of the Sixth Atmospheric Radiation Measurement (ARM) Science Team Meeting
Jun. 1997; 413p; In English; 6th; Atmospheric Radiation Measurement (ARM), 4-7 Mar. 1996, San Antonio, TX, USA
Report No.(s): CONF-9603149; DE97-007973; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This document contains the summaries of papers presented at the 1996 Atmospheric Radiation Measurement (ARM) Science Team meeting held at San Antonio, Texas. The history and status of the ARM program at the time of the meeting helps to put these papers in context. The basic themes have not changed. First, from its beginning, the Program has attempted to respond to the most critical scientific issues facing the US Global Change Research Program. Second, the Program has been strongly coupled to other agency and international programs. More specifically, the Program reflects an unprecedented collaboration among agencies of the federal research community, among the US Department of Energy's (DOE) national laboratories, and between DOE's research program and related international programs, such as Global Energy and Water Experiment (GEWEX) and the Tropical Ocean Global Atmosphere (TOGA) program. Next, ARM has always attempted to make the most judicious use of its resources by collaborating and leveraging existing assets and has managed to maintain an aggressive schedule despite budgets that have been much smaller than planned. Finally, the Program has attracted some of the very best scientific talent in the climate research community and has, as a result, been productive scientifically.
DOE
Conferences; Atmospheric Radiation; Radiation Measurement; Schedules; Laboratories

19980203736 Department of Energy, Washington, DC USA
US Department of Energy strategic plan
Jun. 16, 1997; 39p; In English
Report No.(s): DOE-97008850; DE97-008850; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Clinton Administration was elected with a vision for America: to move away from the Cold War economy, invest in people and technology to strengthen the economy and protect the environment, and reinvent government to become more efficient, serve the American people, and provide more services with fewer resources. This strategic plan integrates the Department's unique scientific and technological assets--30,000 scientists and engineers at laboratories with a capital value of $30 billion--to help achieve this vision.
DOE
Energy Policy; Project Management

19980203948 UFZ Unweltforschungszentrum Leipzig-Halle G.m.b.H., Leipzig, Germany
Relationship between urban structures for using areas and climatic conditions, using the example of the city of Leipzig region *Final Report Beziehungen zwischen urbanen Flaechennutzungsstrukturen und klimatischen Verhaeltnissen am Beispiel der Stadtregion Leipzig. Abschlussbericht*
Mueller, U., UFZ Unweltforschungszentrum Leipzig-Halle G.m.b.H., Germany; 1997; ISSN 0948-9452; 109p; In German
Contract(s)/Grant(s): Foerderkennzeichen BMBF 07SIO0
Report No.(s): ETDE-DE-524; DE97-762093; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

Based on the continuous stationary measurements of climate carried out since the summer of 1992 at various sites in the Leipzig area and for mobile air temperature and humidity measurements carried out for in situ weather in the city area at selected test areas, relationships were carried out between urban structures for using areas and climatic conditions of the air layer near the ground in the city of Leipzig region. The data on the sealing of the functional types of structures obtained in the context of a further part project were used as an important indicator for the use of areas. A basic precondition for these city climate investigations is the preparation of the extensive data obtained in the form of tables and graphs.
DOE
Climatology; Atmospheric Temperature; Cities; Climate

19980204714 Research Triangle Inst., Research Triangle Park, NC USA

Development of a Method for the Speciation of Source Mercury Emissions

Giglio, J. J., Research Triangle Inst., USA; ORourke, J. A., Research Triangle Inst., USA; Grohse, P. M., Research Triangle Inst., USA; Wilshire, F., Research Triangle Inst., USA; Ryan, J., Research Triangle Inst., USA; Apr. 21, 1998; 28p; In English; 17th; International IT3 (Incinceration) Conference, 11-15 May 1998, Salt Lake City, UT, USA; Prepared in cooperation with ARCADIS Geraghty and Miller, Inc.

Report No.(s): PB98-147267; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In a study conducted at the Research Triangle Institute (RTI), funded through an EPA cooperative agreement, RTI and EPA researchers sought to identify a stationary source mercury (Hg) speciation method that is applicable to both fossil fuel and waste combustion processes. Initial research included the bench-scale evaluation of EPA Method 29, as well as the identification of other potential impinger solution reagents and methods capable of selectively capturing and preserving mercury species. A relatively simple speciation/collection approach for Hg emissions from fossil fuel combustion was developed that employed impingers containing deionized water (Draft Method 101B) upstream of the Method 29 peroxide solution. Recent work by RTI and EPA has focused on the evaluation of a dilute sodium hydroxide impinger solution to replace the water used in Draft Method 101B. Results obtained to date from both bench tests and pilot-scale combustion tests indicate that the Alkaline Mercury Speciation method (AMS) is highly effective at speciating elemental and ionic mercury emissions in the presence of Cl2 concentrations up to 20 ppmv and SO2 levels exceeding 1,500 ppmv. Other potential interferences investigated during the study were hydrogen chloride, nitric oxide, carbon dioxide, and moisture.

NTIS

Procedures; Mercury (Metal); Emission; Evaluation; Combustion Chambers; Air Pollution

19980204715 Research Triangle Inst., Research Triangle Park, NC USA

Analytical Techniques for Measuring Hydrocarbon Emissions from the Manufacture of Fiberglass-Reinforced Plastics

Wright, R. S., Research Triangle Inst., USA; Kong, E. J., Research Triangle Inst., USA; Bahner, M. A., Research Triangle Inst., USA; Clayton, C. A., Research Triangle Inst., USA; Nunez, C. M., Research Triangle Inst., USA; 1998; 14p; In English; ISA Analysis Division Symposium, 26-29 Apr. 1998, Research Triangle Park, NC, USA

Report No.(s): PB98-147259; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper discusses several projects to measure hydrocarbon emissions associated with the manufacture of fiberglass-reinforced plastics. The main purpose of the projects was to evaluate pollution prevention techniques to reduce emissions by altering raw materials, application equipment, and operator technique. Analytical techniques were developed to reduce the cost of these emission measurements. Emissions from a small test mold in a Temporary Total Enclosure (TTE) correlated with emissions from full-size production molds in a separate TTE. Gravimetric mass balance measurements inside the TTE generally agreed to within +/- 30% with total hydrocarbon (THC) measurements in the TTE exhaust duct.

NTIS

Pollution Monitoring; Procedures; Chemical Analysis; Hydrocarbons; Air Pollution; Emission; Numerical Analysis

19980204716 Southern Research Inst., Birmingham, AL USA

Indoor Air Quality Large Building Characterization Project Planning

Menetrez, M. Y., Southern Research Inst., USA; Kulp, R. N., Southern Research Inst., USA; Pyle, B., Southern Research Inst., USA; Williamson, A., Southern Research Inst., USA; McDonough, S., Southern Research Inst., USA; 1998; 10p; In English

Report No.(s): PB98-147184; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Three buildings were characterized in this project by examining radon concentrations and Indoor Air Quality (IAQ) levels as affected by building ventilation dynamics. IAQ data collection stations (IAQDS) for monitoring and data logging, remote switches (pressure and sail switches), and a weather station were installed. Measurements of indoor radon carbon dioxide (CO2), particle concentrations, temperature, humidity, pressure differentials, ambient and sub-slab radon concentrations, and outdoor air (OA) intake flow rates were collected. The OA intake was adjusted when possible, and fan cycles were controlled while tracer gas measurements were taken in all zones and IAQDS data were collected. Ventilation, infiltration, mixing rates, radon entry, pressure/temperature convective driving forces, CO2 generation/decay rates, and IAQ levels were established for baseline and OA-adjusted conditions.

NTIS

Buildings; Radon; Air Flow; Indoor Air Pollution; Carbon Dioxide Concentration; Ecology; Air Quality; Data Acquisition

19980204717 Minnesota Univ., Dept. of Mechanical Engineering, Minneapolis, MN USA
Effects of Fan Cycling on the Particle Shedding of Particulate Air Filters Used for IAQ Control
Kuehn, T. H., Minnesota Univ., USA; Yang, C. H., Minnesota Univ., USA; Kulp, R. N., Minnesota Univ., USA; 1998; 8p; In English; Indoor Air 1996, 21-26 Jul. 1996, Nagoya, Japan
Report No.(s): PB98-147150; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of the present study is to investigate the effect of fan cycling on two types of bag filters. Total particle concentrations and viable bioaerosol concentrations were measured upstream and downstream of the filters.

NTIS
Particulates; Microorganisms; Air Filters; Indoor Air Pollution

19980204719 Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Future of the National Performance Audit Program (NPAP)
Elkins, J. B., Environmental Protection Agency, USA; Hunike, E. T., Environmental Protection Agency, USA; 1998; 16p; In English
Report No.(s): PB98-147051; EPA/600/A-98/052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The National Performance Audit Program (NPAP) is one of the major components in the quality assurance of the nation's air monitoring program. The nation's ambient air monitoring program contains approximately 5000 monitors collecting data for the six pollutants for which National Ambient Air Quality Standards (NAAQS) have been designated. On January 1, 1998 EPA's ORD transferred the NPAP to the Office of Air Quality Planning and Standards (OAQPS). The future of this important performance evaluation program is discussed.

NTIS
Pollution Monitoring; Environmental Monitoring; Air Pollution; Project Management; Air Quality; Q Factors

19980204723 Environmental Protection Agency, Air Pollution Prevention and Control Div., Research Triangle Park, NC USA
Dioxin Formation Mechanisms: Implications for Combustion Technologies
Gullett, B. K., Environmental Protection Agency, USA; 1998; 12p; In English
Report No.(s): PB98-145584; EPA/600/A-98/066; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper discusses current mechanistic theories relating to the formation of polychlorinated dibenzodioxin and polychlorinated dibenzofuran (PCDD/F) and how these theories relate to coal combustion, diesel vehicles, and open burning practices that may be of interest for the Asia-Pacific region. Co-firing coal with waste combustion has been shown to significantly decrease PCDD/F formation, likley by affecting the catalytic activity of the fly ash. On-road sampling results for diesel trucks have shown that modern, electronically controlled vehicles are likely a minor source of PCDD/F, although older vehicles remain a virtually uncharacterized and potentially significant source. Recent results from open burning of municipal waste have shown that PCDD/F emission factors are at least 14 orders of magnitude higher than modern waste combustors.

NTIS
Combustion Chambers; Combustion Products; Catalytic Activity; Coal; Fly Ash

19980204724 Research Triangle Inst., Research Triangle Park, NC USA
Verification Testing of Air Pollution Control Technology
Farmer, J. R., Research Triangle Inst., USA; VanOsdell, D. W., Research Triangle Inst., USA; Brna, T. G., Research Triangle Inst., USA; 1998; 12p; In English
Report No.(s): PB98-145576; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper describes EPA's Air Pollution Control Technology (APCT) program, 1 of 12 pilot programs for EPA's Environmental Technology Verification (ETV) program, to verify the performance of innovative technical solutions to problems that threaten human health or the environment. EPA created the ETV program to accelerate the entrance of new or improved environmental technologies into the domestic and international marketplace. The Research Triangle Institute (RTI) is EPA's cooperating partner, or Verification Organization (VO), for the APCT pilot and is responsible for organizing and developing the pilot for verification testing of APCTs. The pilot verifies the performance of commercial-ready technologies used to control air pollutant emissions. The primary emphasis of the pilot is in technologies for controlling particulate matter, volatile organic compounds, nitrogen oxides, and hazardous air pollutants.

NTIS
Air Pollution; Pollution Control; Nitrogen Oxides; Exhaust Emission; Contaminants

19980205539 NASA Goddard Space Flight Center, Greenbelt, MD USA

Implementation of a Parallel Kalman Filter for Stratospheric Chemical Tracer Assimilation

Chang, Lang-Ping, General Sciences Corp., USA; Lyster, Peter M., Maryland Univ., USA; Menard, R., Maryland Univ. Baltimore County, USA; Cohn, S. E., NASA Goddard Space Flight Center, USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 165-181; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

A Kalman filter for the assimilation of long-lived atmospheric chemical constituents has been developed for two-dimensional transport models on isentropic surfaces over the globe. An important attribute of the Kalman filter is that it calculates error covariances of the constituent fields using the tracer dynamics. Consequently, the current Kalman-filter assimilation is a five-dimensional problem (coordinates of two points and time), and it can only be handled on computers with large memory and high floating point speed. In this paper, an implementation of the Kalman filter for distributed-memory, message-passing parallel computers is discussed. Two approaches were studied: an operator decomposition and a covariance decomposition. The latter was found to be more scalable than the former, and it possesses the property that the dynamical model does not need to be parallelized, which is of considerable practical advantage. This code is currently used to assimilate constituent data retrieved by limb sounders on the Upper Atmosphere Research Satellite. Tests of the code examined the variance transport and observability properties. Aspects of the parallel implementation, some timing results, and a brief discussion of the physical results will be presented.
Author

Kalman Filters; Atmospheric Composition; Chemical Composition; Assimilation; Atmospheric Sounding

19980205546 Los Alamos National Lab., Theoretical Div., NM USA

The Los Alamos Coupled Climate Model

Jones, Philip W., Los Alamos National Lab., USA; Malone, Robert C., Los Alamos National Lab., USA; Lai, C. Aaron, Los Alamos National Lab., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 239-247; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A climate model which couples ocean, sea ice, atmosphere and land components is described. The component models are run as autonomous processes coupled to a flux coupler through a flexible communications library. Performance considerations of the model are examined, particularly for running the model on distributed-shared-memory machine architectures.
Author

Air Sea Ice Interactions; Distributed Memory; Memory (Computers); Massively Parallel Processors

19980205547 National Center for Atmospheric Research, Boulder, CO USA

Portability and Performance of a Parallel Coupled Climate Model

James, Rodney, National Center for Atmospheric Research, USA; Bettge, T., National Center for Atmospheric Research, USA; Hammond, S., National Center for Atmospheric Research, USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 249; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

The Parallel Climate Model (PCM) is a coupled climate system model being developed in a collaborative effort at NCAR with support from the DOE Climate Change Prediction Program (which includes scientists and software engineers from the Los Alamos National Laboratory and the Naval Postgraduate School). PCM has four components: ocean, atmosphere/land, and ice models, and a flux coupler, all combined into a single portable program which can be run on several parallel platforms. The ocean, atmosphere/land, and ice component models are configured on different grids with different time steps. Component model interactions, both temporal and spatial, are coordinated through the flux coupler. In this paper, we discuss the details of the coupled model software architecture and the strategies used for maintaining both code portability and performance portability across platforms. We present details of the computational and communication efficiency for the complete coupled model as well as the individual components on different systems from different vendors. Finally, we compare and contrast PCM performance and scaling results on several different parallel machines for four processors up to hundreds of processors.
Author

Parallel Processing (Computers); Climate Models; Applications Programs (Computers); Ocean Models; Machine-Independent Programs

19980205548 California Univ., Dept. of Atmospheric Sciences, Los Angeles, CA USA

An Atmospheric General Circulation Model with Chemistry for the CRAY T3E: Design, Performance Optimization and Coupling to an Ocean Model

Farrara, John D., California Univ., USA; Drummond, Leroy A., California Univ., USA; Mechoso, Carlos R., California Univ., USA; Spahr, Joseph A., California Univ., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 251-264; In English; Also announced as 19980205520

Contract(s)/Grant(s): CAN-21425/041; DE-F039-1-ER-1214; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The design, implementation and performance optimization on the CRAY T3E of an atmospheric general circulation model (AGCM) which includes the transport of, and chemical reactions among, an arbitrary number of constituents is reviewed. The parallel implementation is based on a two-dimensional (longitude and latitude) data domain decomposition. Initial optimization efforts centered on minimizing the impact of substantial static and weakly-dynamic load imbalances among processors through load redistribution schemes. Recent optimization efforts have centered on single-node optimization. Strategies employed include loop unrolling, both manually and through the compiler, the use of an optimized assembler-code library for special function calls, and restructuring of parts of the code to improve data locality. Data exchanges and synchronizations involved in coupling different data-distributed models can account for a significant fraction of the running time. Therefore, the required scattering and gathering of data must be optimized. In systems such as the T3E, there is much more aggregate bandwidth in the total system than in any particular processor. This suggests a distributed design. The design and implementation of a such distributed 'Data Broker' as a means to efficiently couple the components of our climate system model is described.

Author

Cray Computers; Climate Models; Ocean Models; Atmospheric General Circulation Models

19980205624 Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

SLAMS/NAMS/PAMS Network Review Guidance ***Final Report***

Mar. 27, 1998; 94p; In English

Report No.(s): PB98-147226; EPA/454/R-98/003-Rev; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The annual network review is used to determine how well the network is achieving its required air monitoring objectives, how well it is meeting data users needs, and how it should be modified (e.g., through termination of existing stations, relocation of stations, or establishment of new stations) to continue to meet its monitoring objectives and data needs. The main purpose of the review is to improve the network to ensure that it provides adequate, representative, and useful air quality data. Section 2.0 of this guidance contains a summary of the regulatory requirements contained in Appendices D and E as well as a description of other ambient air monitoring data needs that should be considered during the network review. Section 3.0 provides an overview of network review procedures to determine conformance with Appendix D and E requirements. Section 4.0 contains an example checklist for conditioning a network review. Section 5.0 includes a list of references.

NTIS

Networks; Environmental Monitoring; Monitors; Air Quality

19980205625 Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

New Source Performance Standards, Subpart Db: Technical Support for Proposed Revisions to NOx Standard

Jun. 1997; 254p; In English

Report No.(s): PB98-147218; EPA/453/R-95/012; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This report characterizes nitrogen oxide (NOx) emissions from industrial steam generating units having capacities greater than 100 million Btu hour heat input and assesses the performance and costs associated with controlling NOx emissions. Available data on NOx emissions. Available data on NOx emissions from industrial and utility steam generating units are summarized. Various control technologies for reducing NOx emissions, both combustion modifications and add-on controls, are reviewed. Performance data and operational experience for NOx controls which have been applied to industrial steam generating units are presented.

NTIS

Nitrogen Oxides; Boilers; Emission; Air Pollution

19980205629 University of South Florida, Center for Urban Transportation Research, Tampa, FL USA

Neural Network Application for Predicting the Impact of Trip Reduction Strategies

Winters, P. L., University of South Florida, USA; Perez, R., University of South Florida, USA; Pietrzyk, M., University of South Florida, USA; Cleland, F., University of South Florida, USA; Burris, M., University of South Florida, USA; Feb. 1998; 36p; In English

Report No.(s): PB98-141591; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project executive summary describes neural network models, highlights the efforts to build a model to predict changes in average vehicle ridership (AVR), summarizes the development of the application, compares the neural network model performance with other analytical approaches, and summarizes the results of the field test. The reader should review the four technical memoranda prepared as part of this project for more information.

NTIS

Neural Nets; Predictions; Vehicles

19980205681 Michigan Univ., Dept. of Atmospheric, Oceanic and Space Sciences, Ann Arbor, MI USA

Evaluating the Relation between Ozone, NOx and Hydrocarbons: The Method of Photochemical Indicators

Sillman, S., Michigan Univ., USA; 1998; 132p; In English

Contract(s)/Grant(s): EPA CR822083-01

Report No.(s): PB98-142052; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The use of the photochemical indicator method to investigate the sensitivity of ozone (O3) to nitrogen oxides (NOx) and reactive organic gases (ROG) is described. The method is based on identifying measurable species or species ratios that are closely associated with O3-NOx-ROG predictions in photochemical simulation models.

NTIS

Ozone; Nitrogen Oxides; Hydrocarbons; Air Pollution; Photochemical Reactions; Sensitivity

19980205800 Los Alamos National Lab., NM USA

The ozonizer discharge as a gas-phase advanced oxidation process

Rosocha, L. A., Los Alamos National Lab., USA; [1997]; 7p; In English; Ozone World Congress, 26 - 31 Oct. 1997, Kyoto, Japan

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

Report No.(s): LA-UR-97-2381; CONF-971008-1; DE97-009122; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In the past several years, there has been increased interest in gas-phase pollution control arising from a larger body of environmental regulations and a greater respect for the environment. One promising class of pollution-control technologies is that called advanced oxidation processes (AOPs). Ozonizers have been used for over a century in water treatment and for about two decades in advanced oxidation. Ozonizers are fundamentally based on non-thermal plasmas, which are useful for generating reactive species (free radicals) in gas streams. Because radical-attack reaction rate constants are very large for many chemical species, entrained pollutants are readily decomposed by these radicals. Non-thermal plasmas can generate both oxidative and reductive radicals; therefore, they show promise for treating a wide variety of pollutants. However, this application is only about a decade old, so more work is needed for optimizing and commercializing the process. This paper is intended to serve as an introduction to the subject of pollutant decomposition with the nonthermal plasmas generated by ozonizer discharges. Basic plasma and decomposition chemistry, laboratory experiments, and example applications are discussed.

DOE

Ozone Depletion; Pollution Control; Waste Disposal; Data Acquisition; Exhaust Gases; Technology Assessment

19980205815 Environmental Protection Agency, National Risk Management Research Lab., Ada, OK USA

Emplacement Verification and Long-Term Performance Monitoring for Permeable Reactive Barrier at the USCG Support Center, Elizabeth City, North Carolina

Puls, R. W., Environmental Protection Agency, USA; Blowes, D. W., Environmental Protection Agency, USA; Gillham, R. W., Environmental Protection Agency, USA; 1998; 20p; In English; Groundwater Quality, 1998, Tubingen, Germany

Report No.(s): PB98-151285; EPA/600/A-98/085; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A continuous hanging iron wall was installed in June, 1996, at the US Coast Guard (USCG) Support center near Elizabeth City, North Carolina, United States, to treat overlapping plumes of chromate and chlorinated solvent compounds.

NTIS

Pollution Control; Permeability; Ground Water; Proving; Performance Prediction; Life (Durability); Monitors; Water Pollution

19980205822 Environmental Protection Agency, Air Pollution Prevention and Control Div., Research Triangle Park, NC USA

Experiments on Evaporative Emissions in Ventilated Rooms

Topp, C., Aalborg Univ., Denmark; Nielsen, P. V., Aalborg Univ., Denmark; Heiselberg, P., Aalborg Univ., Denmark; Sparks, L. E., Environmental Protection Agency, USA; Howard, E. M., Environmental Protection Agency, USA; 1998; 12p; In English, 14-17 Jun. 1998, Stockholm, Sweden

Report No.(s): PB98-145618; EPA/600/A-98/063; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper discusses experiments at different velocity levels performed in a full-scale ventilated chamber to investigate the influence of local airflow on the evaporative emissions from a surface. The experiments included velocity measurements in the flow over the surface and measurements of chamber air concentrations.

NTIS

Velocity Measurement; Air Flow; Flow Velocity; Ventilation; Indoor Air Pollution; Emission; Evaporation

19980205823 Research Triangle Inst., Research Triangle Park, NC USA

Evaluation of Low-Emitting Products for Use in the Indoor Environment

Leovic, K. W., Environmental Protection Agency, USA; Whitaker, D., Research Triangle Inst., USA; Brockmann, C., Research Triangle Inst., USA; Bayer, C. W., Georgia Tech Research Inst., USA; Sojka, P. E., Purdue Univ., USA; 1998; 20p; In English, 14-18 Jun. 1998, San Diego, CA, USA

Report No.(s): PB98-145592; EPA-600/A-98/065; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper gives an overview of recently completed research on the application of pollution prevention techniques to reduce indoor air emissions from aerosol consumer products.

NTIS

Aerosols; Pollution Control; Indoor Air Pollution; Emission

19980206094 Cramer (H.E.) Co., Inc., Salt Lake City, UT USA

Open Burn/Open Detonation Dispersion Model (OBODM) User's Guide, Volume 2, Technical Description

Bjorklund, Jay R., Cramer (H.E.) Co., Inc., USA; Bowers, James F., Dugway Proving Ground, USA; Dodd, Gregory C., Cramer (H.E.) Co., Inc., USA; White, John M., Cramer (H.E.) Co., Inc., USA; Apr. 1998; 55p; In English

Contract(s)/Grant(s): DAAD09-91-D-0002

Report No.(s): AD-A345376; DPG-TR-96-008B; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Open Burn/Open Detonation Dispersion Model (OBODM) is intended for use in evaluating the potential air quality impacts of the open-air burning and detonation (OB/OD) of obsolete munitions and solid propellants. OBODM uses cloud/plume rise, dispersion, and deposition algorithms taken from existing models for instantaneous and quasi-continuous sources to predict the downwind transport and dispersion of pollutants released by OB/OD operations. The model can be used to calculate peak concentration, time-mean concentration, dosage (time-integrated concentration) , and particulate ravitational- deposition for emissions from multiple OB/OD sources for either a single event or up to a year of sequential hourly source and meteorological inputs. The program is designed for use on IBM-compatible PCs using the MS-DOS (Version 2.1 or higher) operating system with keyboard and optional mouse control. It will also run under most WINDOWS environments. The OBODM computer program requires 505 kilobytes of conventional memory, a math coprocessor, and a minimum of 3 megabytes of hard disk storage. Volume I of this user1 5 guide contains instructions for installing and running the model and example problems. Volume II discusses the model's mathematical algorithms and default meteorological inputs.

DTIC

Evaluation; Air Quality; User Manuals (Computer Programs); Environment Management; Detonation; Computer Programs; Algorithms

19980206290 Commerce Dept., Asheville, NC USA

Comprehensive Aerological Reference Data Set (CARDS)

Eskridge, R. E., National Oceanic and Atmospheric Administration, USA; Polansky, A. C., National Oceanic and Atmospheric Administration, USA; Alduchov, O. A., National Oceanic and Atmospheric Administration, USA; [1997]; 62p; In English

Contract(s)/Grant(s): DE-AI05-90ER-61011

Report No.(s): DOE/ER/61011-T5; DE98-001238; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The possibility of anthropogenic climate change has reached the attention of Government officials and researchers. However, one cannot study climate change without climate data. The CARDS project will produce high-quality upper-air data for the research community and for policy-makers. The authors intend to produce a dataset which is: easy to use, as complete as possible, as free of random errors as possible. They will also attempt to identify biases and remove them whenever possible. In this report, they relate progress toward their goal. They created a robust new format for archiving upper-air data, and designed a relational database structure to hold them. The authors have converted 13 datasets to the new format and have archived over 10,000,000 individual soundings from 10 separate data sources. They produce and archive a metadata summary of each sounding they load. They have researched station histories, and have built a preliminary upper-air station history database. They have converted sta-

tion-sorted data from their primary database into synoptic-sorted data in a parallel database. They have tested and will soon implement an advanced quality-control procedure, capable of detecting and often repairing errors in geopotential height, temperature, humidity, and wind. This unique quality-control method uses simultaneous vertical, horizontal, and temporal checks of several meteorological variables. It can detect errors other methods cannot.
DOE
Meteorological Parameters; Atmospheric Temperature; Aerology; Climate Change

46
GEOPHYSICS

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

19980203216 Communications Research Lab., Tokyo, Japan
Development of INTERMAGNET/Hiraiso GIN System
Ishibashi, Hiromitsu, Communications Research Lab., Japan; Nozaki, Kenrou, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 291-299; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

The INTERMAGNET objective is to establish a global network of cooperating digital geomagnetic observatories, adopting modern standard specifications for measuring and recording equipment, in order to establish data exchange and the production of indices in close to real time using existing meteorological satellites (including GOES East, GOES West, GMS, INSTAT, and METEOSAT). From the viewpoint of space weather forecasting, the real-time monitoring of a global geomagnetic field is necessary for predicting geomagnetic disturbances. Thus we as one of Geomagnetic Information Nodes (GINs) of the INTERMAGNET, that is Hiraiso GIN, have been responsible for collecting and distributing the geomagnetic field data. Our task is to take care of the area covered by GMS. This paper describes the Hiraiso GIN system in detail.
Author
Magnetic Disturbances; Data Acquisition; Aerospace Environments; Information Flow; Data Bases; Data Base Management Systems; Magnetic Fields

19980203247 Maxwell Technologies, Inc., San Diego, CA USA
Seismic Discrimination with Regional Phase Spectral Ratios: Investigation of Transportability ***Final Report, 31 Jul. 1995 - 31 Jul 1997***
Bennett, Theron J., Maxwell Technologies, Inc., USA; Cook, Ronald W., Maxwell Technologies, Inc., USA; Carter, Jerry A., Maxwell Technologies, Inc., USA; Oct. 1997; 78p; In English
Contract(s)/Grant(s): F19628-95-C-0108; AF Proj. 5101
Report No.(s): AD-A341313; MSD-FR-97-15919; PL-TR-97-2140; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Comprehensive Test Ban Treaty (CTBT) requires the location and identification of seismic events which might be associated with small potential underground nuclear explosion tests. For monitoring the CTBT at low magnitude thresholds, reliance must be placed on regional seismic measurements. Various regional discrimination techniques have been shown to be effective for identifying events in some areas, but the transportability of such methods into uncalibrated source areas remains a problem. This research developed procedures which could be useful for transporting regional phase spectral ratio discriminant measures by accounting for propagation path effects using prior knowledge of attenuation. We have found that by correcting for attenuation the scatter in Lg spectral ratio observations between stations could be reduced. However, these measurements still show considerable overlap between different source types which weakens the reliability of the discriminant. It might be possible to improve the reliability of regional phase spectral ratios by limiting effects of noise on the measurements by focusing on nearer stations, limiting the frequency band over which the ratios are formed.
DTIC
Discrimination; Earthquakes; Identifying; Noise Measurement; Seismology; Signal Detection

19980203325 Indiana Univ., Dept. of Geological Sciences, Bloomington, IN USA

Broadband Signal Enhancement of Seismic Array Data: Application to Long-Period Surface Waves and High-Frequency Wavefields ***Final Report, 1 Nov. 1993 - 30 Jun. 1997***

Pavlis, Gary L., Indiana Univ., USA; Jan. 27, 1998; 6p; In English

Contract(s)/Grant(s): F49620-94-1-0039

Report No.(s): AD-A341009; AFRL-SR-BL-TR-98-0297; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The original main goals of this project were twofold: (1) development of new techniques for enhancement of low signal to noise surface wave signals recorded by broadband arrays, and (2) research on fundamental properties of high-frequency wavefields. Two peer reviewed papers and two annual symposium reports present our results on the first task. For the second we have two published peer reviewed papers, one of our annual symposium reports, a completed M.S. thesis, and two submitted papers in various in the review process. Reprints of published papers and reports and preprints of papers not yet published are supplied with this report.

DTIC

Data Acquisition; Arrays; High Frequencies; Procedures; Signal to Noise Ratios; Seismograms

19980203387 Scripps Institution of Oceanography, Inst. of Geophysics and Planetary Physics, La Jolla, CA USA

Broadband Signal Enhancement of Seismic Array Data: Application to Long-Period Surface Waves and High Frequency Wavefields ***Final Report, 1 Nov. 1993 - 31 Oct. 1997***

Vernon, Frank L., Scripps Institution of Oceanography, USA; Mellors, Robert J., Scripps Institution of Oceanography, USA; Thomson, David J., Scripps Institution of Oceanography, USA; Apr. 28, 1998; 32p; In English

Contract(s)/Grant(s): F49620-94-1-0037

Report No.(s): AD-A343629; AFRL-SR-BL-TR-98-0433; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We demonstrate the use of ”dual-frequency” coherence in detecting and characterizing seismic surface waves. Using a multitaper method, we calculate the coherence between different frequencies of one or multiple signals. We test the algorithm both on a variety of synthetic signals and on broad-band seismic data. Dispersive waves such as seismic surface waves are easily identified and we show that the method is robust in the presence of noise. Phase relationships between different frequencies can be extracted, allowing reconstruction of the original phase function. ”Dual-frequency” coherence is useful in identifying overtones and frequency shifts between signals, features which are undetectable by standard coherence measures. We construct a filter to extract only the coherent frequencies from a waveform and show that it significantly increases the signal-noise-ratio for dispersive waveforms.

DTIC

Surface Waves; Arrays; Signal Detection; Data Acquisition; High Frequencies; Waveforms

19980203418 Energia Nucleare e Delle Energie Alternative, Dipt. Innovazione, Bologna, Italy

The Premar Code for the Monte Carlo Simulation of Radiation Transport in the Atmosphere ***Il codice PREMAR per la simulazione Montecarlo del trasporto della radiazione dell'atmosfera***

Cupini, E., Energia Nucleare e Delle Energie Alternative, Italy; Borgia, M. G., Energia Nucleare e Delle Energie Alternative, Italy; Premuda, M., Consiglio Nazionale delle Ricerche, Italy; Mar. 1997; ISSN 1120-5571; 43p; In Italian

Report No.(s): ENEA-RT-INN-97-05; RT/INN-97-5; DE97-765455; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The Monte carlo code PREMAR is described, which allows the user to simulate the radiation transport in the atmosphere, in the ultraviolet-infrared frequency interval. A plan multilayer geometry is at present foreseen by the code, witch albedo possibility at the lower boundary surface. For a given monochromatic point source, the main quantities computed by the code are the absorption spatial distributions of aerosol and molecules, together with the related atmospheric transmittances. Moreover, simulation of of Lidar experiments are foreseen by the code, the source and telescope fields of view being assigned. to build-up the appropriate probability distributions, an input data library is assumed to be read by the code. For this purpose the radiance-transmittance LOWTRAN-7 code has been conveniently adapted as a source of the library so as to exploit the richness of information of the code for a large variety of atmospheric simulations. Results of applications of the PREMAR code are finally presented, with special reference to simulations of Lidar system and radiometer experiments carried out at the Brasimone ENEA Centre by the Environment Department.

DOE

Monte Carlo Method; Radiation Transport; Aerosols; Atmospheric Chemistry; Electromagnetic Radiation; Molecules

19980203441 Advanced Power Technologies, Inc., Washington, DC USA

HAARP Imaging Riometer Diagnostic ***Final Report, 17 Sep. 1991 - 31 Dec. 1997***

Rosenberg, Ted J., Advanced Power Technologies, Inc., USA; Jul. 16, 1997; 20p; In English

Contract(s)/Grant(s): F19628-91-C-0158; AF Proj. 4029

Report No.(s): AD-A343679; PL-TR-97-2101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the prototype 16-beam, 38.6 MHz riometer system developed by APTI and the University of Maryland for the HAARP program. The prototype system is the forerunner for a full-scale imaging riometer diagnostic instrument for characterizing the ionospheric volume perturbed by controlled RF heating experiments. The prototype system, installed at the HAARP site near Gakona, AK, consists of a 1 x 16 antenna array phased in one dimension (beam width of 6.7 deg) and oriented approximately along the magnetic meridian. The system responds sensitively to natural variations or auroral absorption, such as those caused by magnetospheric substorms, and provides clear evidence of its capability to discern spatial structure and motion. A newly observed feature seen near dusk are intense, short-duration absorption spikes accompanied by only weak magnetic signatures. The proximity of the prototype system to the HAARP RF heater can result in significant interference to the riometer signal, making the data unusable at times. Detailed data comparisons have not yet been made with operations of the heater. However, the full scale imaging capability of the proposed instrument, and a remote location, may be required to detect small scale modifications of the ionosphere caused by the RF heater.

DTIC

Riometers; Magnetospheric Instability; Magnetic Signatures; Auroral Absorption; Heating; Magnetic Storms

19980203549 Washington Univ., Seattle, WA USA

Extent, Timing, and Climatic Significance of Latest Pleistocene and Holocene Glaciation in the Sierra Nevada, California

Clark, D. H., Washington Univ., USA; 1995; 218p; In English

Contract(s)/Grant(s): DE-AC05-76OR-00033

Report No.(s): DOE/OR/00033-T709; DE97-053336; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Despite more than a century of study, scant attention has been paid to the glacial record in the northern end of the Sierra Nevada, and to the smaller moraines deposited after the retreat of the Tioga (last glacial maximum) glaciers. Equilibrium-line altitude (ELA) estimates of the ice fields indicate that the Tioga ELA gradients there are consistent with similar estimates for the southern half of the range, and with an intensification of the modern temperature/precipitation pattern in the region. The Recess Peak advance has traditionally been considered to be mid-Neoglacial age, about 2--3,000 yr B.P., on the basis of relative weathering estimates. Sediment cores of lakes dammed behind moraines correlative with Recess Peak in four widely spaced sites yields a series of high-resolution AMS radiocarbon dates which demonstrate that Recess Peak glaciers retreated before (approximately) 13,100 cal yr B.P.. This minimum limiting age indicates that the advance predates the North Atlantic Younger Dryas cooling. It also implies that there have been no advances larger than the Matthes in the roughly 12,000 year interval between it and the Recess Peak advance. This finding casts doubt on several recent studies that claim Younger Dryas glacier advances in western North America. The 13,100 cal yr B.P. date is also a minimum age for deglaciation of the sample sites used to calibrate the in situ production rates of cosmogenic Be-10 and Al-26. The discrepancy between this age and the 11,000 cal yr B.P. exposure age assumed in the original calibration introduces a large (greater than 19%) potential error in late-Pleistocene exposure ages calculated using these production rates.

DOE

Glaciers; Isotope Ratios; Glaciology; Paleoclimatology

19980203586 Finnish Geodetic Inst., Kirkkonummi, Finland

Geoid and Crustal Structure in Fennoscandia, No. 126

Wang, Zhitong, Finnish Geodetic Inst., Finland; 1998; ISSN 0085-6932; 124p; In English; ISBN 951-711-219-X; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Land uplift, according to the theory of isostasy, is a process through which the crust and upper mantle deform in order to sustain an isostatic state, i.e., towards equilibrium. In other words, the land would continue to uplift until an equilibrium state is reached. This theory enabled the determination of the remaining uplift by studying the deviation of the Earth from equilibrium, which in turn, could be inferred from the gravity field of the Earth. As an equipotential surface of the Earth's gravity field, the geoid is a good candidate for this purpose. It has been found in previous studies that a geoidal depression of about 8-10 m is present in the central part of the Fennoscandian Shield (located in the northwestern corner of the Eurasian Continent). It could not, however, be completely associated to the remaining uplift, since variations in the structure of the crust in Fennoscandia play a significant role in the characteristics of the local geoid. In this thesis a 3-D structural model of the crust in Fennoscandia was constructed

via a collection of more than 40 seismic profiles in the area. The effects of the crust on the geoid have been estimated according to the model. The density-velocity relations that relate the seismic velocities with the mass densities were explored and the usage of spherical harmonic expansions in modelling the geoid was investigated. The modelling showed that the structure of the crust exerts significant effects on the geoid in the Fennoscandian Shield. Anomalous masses may exist in all parts of the crust and their effects on the geoid compensated by each other to some extent but not completely. Their effects on the geoidal depression are surprisingly large, being about two times the observed geoidal depression, which clearly indicates the existence of very dense subcrustal materials. This is in agreement with the thinking that the root of the deep lithosphere in Fennoscandia is formed from a crystallization of the asthenospheric materials. The asthenospheric materials may have become crystallized into semisolid or solid form due to the cooling during the long history of the shield.
Author
Geoids; Earth Crust; Gravity Anomalies; Earth Mantle; Geological Faults; Earth Gravitation; Gravitational Fields; Earth Movements; Three Dimensional Models; Structural Properties (Geology); Geodesy

19980203648 Institute for Petroleum Research and Geophysics, Holon, Israel
Discrimination of Seismic Sources Using Israel Seismic Network ***Final Report, Jun. 1995 - Oct. 1997***
Shapira, Avi, Institute for Petroleum Research and Geophysics, Israel; Pinsky, Vladimir, Institute for Petroleum Research and Geophysics, Israel; Gitterman, Yefim, Institute for Petroleum Research and Geophysics, Israel; Nov. 1997; 90p; In English
Contract(s)/Grant(s): F19628-95-K-0006; AF Proj. DENN
Report No.(s): AD-A343432; Rept-55/53/96(10); AFRL-VS-HA-TR-98-0015; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

We addressed the problem of automated event discrimination in both the local and teleseismic ranges using the Israel Seismic Network, as an example of a dense regional seismic network. A new high resolution technique was developed, based on multistation representation of the seismic signal: spectral semblance, measuring coherency of spectral shapes, and velogram, characterizing kinematic features. Semblance and energy spectral ratio statistics, applied to a wide variety of local and teleseismic events, showed, for specific spectral bands, almost total separation of explosions and earthquakes. Efficient automated classifiers based on combinations of different physical features of the events have been designed. The discrimination results for the teleseismic data were compared for the ISN and NORESS, showing almost equivalent performance. Noise recordings and teleseismic signals were used to evaluate the ISN detectability by array technique, including adaptive beamforming, optimal detectors, maximum likelihood estimators and phase correlation analysis, applied to the ISN subnetworks with promising results. Experimental relationships between charge weight and magnitude for local single quarry shots and underwater Dead Sea explosions with outstanding high coupling were developed, providing a basis for the execution of effective calibration explosions currently lacking in the region.
DTIC
Procedures; Maximum Likelihood Estimates; Statistical Analysis; Spectral Methods; Spectral Bands; Seismic Waves

19980203832 Los Alamos National Lab., NM USA
Experimental studies of auroral arc generators
Suszcynsky, D. M., Los Alamos National Lab., USA; Borovsky, J. E., Los Alamos National Lab., USA; Thomsen, M. F., Los Alamos National Lab., USA; [1997]; 14p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2320; DE97-008696; 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). An all-sky video camera system was deployed in Eagle, Alaska at the foot of the magnetic field line that threads geosynchronous satellite 1989-046 as part of a campaign to study correlations of ground-based auroral activity with satellite-based plasma and energetic particle measurements. The overall intent of the project was to study magnetosphere-ionosphere coupling as it relates to the aurora, and, in particular, to look for signatures that may help to identify various auroral generator mechanism(s). During this study, our efforts were primarily directed towards identifying the generator mechanism(s) for pulsating aurora. Our data, though not conclusive, are found to support theories that propose a cyclotron resonance mechanism for the generation of auroral pulsations.
DOE
Auroral Arcs; Auroras; Arc Generators; Energetic Particles; Cyclotron Resonance; Television Cameras

19980203851 Los Alamos National Lab., NM USA

Plasmasphere refilling: New numerical and observational tools

Winske, D., Los Alamos National Lab., USA; Gary, S. P., Los Alamos National Lab., USA; Thomsen, M. F., Los Alamos National Lab., USA; Miller, R. H., Michigan Univ., USA; [1997]; 12p; In English

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

Report No.(s): LA-UR-97-2176; DE97-008575; 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 outflow of plasma from the ionosphere and its interactions in the outer magnetosphere remain important problems in space physics. While outflow is a continuous process, it becomes even more important after geomagnetic substorms when magnetic field lines that have been vented of plasma are reconnected. The purpose of this project was to develop new computational, theoretical, and observational tools to study plasma dynamics and heating associated with the outflow and refilling processes. In particular, we have developed new numerical methods to model the transition from collisional plasma flow at low altitudes to collisionless behavior at high altitudes and incorporated them in a multi-species kinetic simulation model to model the outflow process. We have also investigated electromagnetic instabilities in the outer magnetosphere to understand their contribution to the heating of upflowing protons and minority ions. In addition, new observational techniques have been used to analyze geosynchronous plasma data and to assess the effect of the spacecraft potential on the observations.

DOE

Collisional Plasmas; Plasmasphere; Magnetohydrodynamic Flow; Magnetohydrodynamic Stability; Plasma Dynamics; Transition Flow; Atmospheric Physics; Plasma Heating; Mathematical Models

19980203895 Norwegian Seismic Array, Kjeller, Norway

[Activities of the Norwegian Regional Seismic Array (NORESS)] ***Semiannual Report, 1 Apr. - 30 Sep. 1997***

Nov. 1997; 148p; In English

Contract(s)/Grant(s): F08650-96-C-0001

Report No.(s): AD-A344249; NORSAR-SCIENTIFIC-1-97/98; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This Semiannual Technical Summary describes the operation, maintenance and research activities at the Norwegian Seismic Array (NORSAR) , the Norwegian Regional Seismic Array (NORESS), the Arctic Regional Seismic Array (ARCESS) and the Spitsbergen Regional Array for the period 1 April - 30 September 1997. Statistics are also presented for additional seismic stations, which through cooperative agreements with institutions in the host countries provide continuous data to the NORSAR Data processing Center (NDPC). These stations comprise the Finnish Regional Seismic Array (FINESS), the German Regional Seismic Array (GERESS), the Hagfors array in Sweden and the regional seismic array in Apatity, Russia. The NORSAR Detection Processing system has been operated throughout the period with an average uptime of 99.99%. A total of 2005 seismic events have been reported in the NORSAR monthly seismic bulletin for April through September 1997. The performance of the continuous alarm system and the automatic bulletin transfer to AFTAC has been satisfactory. Processing of requests for full NORSAR and regional array data on magnetic tapes has progressed according to established schedules. This Semiannual Report also presents statistics from operation of the Regional Monitoring System (RMS). The RMS has been operated in a limited capacity, with continuous automatic detection and location and with analyst review of selected events of interest for GSETT-3. Data sources for the RMS have comprised all the regional arrays processed at NORSAR. The Generalized Beamforming (GBF) program is now used as a pre-processor to RMS. Online detection processing and data recording at the NORSAR Data Processing Center (NDPC) of NORESS, ARCESS, FINESS and GERESS data have been conducted throughout the period.

DTIC

Seismology; Data Processing; Detection; Earthquakes

19980203906 Colorado Univ., Boulder, CO USA

Analysis of Coherent Lidar Data ***Final Report***

Frehlich, Rod, Colorado Univ., USA; Mar. 07, 1998; 5p; In English

Contract(s)/Grant(s): DAAH04-94-6-0041

Report No.(s): AD-A344516; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The performance of the best velocity estimators was determined using a new technique that does not require in situ measurements to estimate the statistical performance of velocity estimates. A new theoretical prediction of the effects of the pulse averaging of the wind field on estimates of the spatial structure function and the variance of the velocity field has excellent agreement with simulations and the measurements from data. The conditions under which corrections for the effects of pulse averaging can be performed were determined. This permits accurate estimates of the velocity variance, the velocity structure function, and the

energy dissipation rate when Kolmogorov scaling is valid or when a valid model exists for the spatial statistics. The performance of coherent Doppler lidar in the weak signal regime was determined by computer simulations and from data. Profiles of atmospheric statistics (mean velocity, velocity variance and energy dissipation rate for various lidar beam angles) were produced with corrections for the spatial averaging by the lidar pulse. Estimation algorithms for Doppler lidar data from cloudy regions were developed to handle high velocity shear and large gradients in backscatter. High resolution in situ measurements of atmospheric turbulence using an instrumented kite platform were produced.
DTIC
Doppler Radar; Velocity; Velocity Distribution; Atmospheric Turbulence; Variance (Statistics)

19980204838 Space and Naval Warfare Systems Command, San Diego, CA USA
Proceedings of the 1997 Battlespace Atmospherics Conference
Anderson, K. D., Space and Naval Warfare Systems Command, USA; Richter, J. H., Space and Naval Warfare Systems Command, USA; Mar. 1998; 687p; In English; Battlespace Atmospherics, 2-4 Dec. 1997, White Sands, NM, USA
Report No.(s): AD-A344056; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

Until 1995, Battlefield Atmospherics Conferences were hosted annually by the Army's Atmospheric Sciences Laboratory (ASL) at White Sands, NM. These conferences, while primarily addressing Army concerns, had Navy, Air Force, and international participation. With the incorporation and move of ASL into the Army Research Laboratory, the Army could not host this widely recognized conference in 1996. DDR&E recommended that it become a tri-service event to be hosted by each of the three U.S. services in succession, whereby each service would be responsible for the conference 2 years in a row. The Navy was selected for 1996 and 1997, with the Space and Naval Warfare Systems Center, San Diego (SSC San Diego, formerly NRaD) as host. The conference name was changed to Battlespace Atmospherics Conference to reflect the broader concerns of all service branches. The 1996 Battlespace Atmospherics Conference (BAC '96) was held from 3-5 December 1996. BAC
DTIC
Atmospherics; Conferences; Atmospheric Physics; Meteorology; Warfare

19980204843 Maxwell Technologies, Inc., San Diego, CA USA
The Physical Basis for the Lg/P Discriminant: General Properties and Preliminary Modeling
Bennett, Theron J., Maxwell Technologies, Inc., USA; McLaughlin, Keith L., Maxwell Technologies, Inc., USA; Marshall, Margaret E., Maxwell Technologies, Inc., USA; Stevens, Jeffry L., Maxwell Technologies, Inc., USA; Mar. 1997; 56p; In English
Contract(s)/Grant(s): F19628-95-C-0107; AF Proj. 5101
Report No.(s): AD-A344175; MFD-FR-97-15727; PL-TR-97-2044; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A critical problem for reliable implementation of regional discrimination is incomplete understanding of how regional seismic signals depend on physical characteristics of the source and propagation path to the recording station. This research is directed at improving understanding of effects of these characteristics on an important regional discriminant, the Lg/P ratio. An empirical element in this research program has aimed at describing behavior of Lg/P ratios and their dependence on frequency for nuclear explosions, earthquakes, rockbursts, and other sources in various tectonic environments. Observations indicate differences between event types which appear to be enhanced at higher frequencies, but sources of scatter in the observations need further study. The theoretical element of this project seeks to explain the main features of the Lg/P observations in terms of source mechanisms and propagation models for the regional signals. Initial focus of the theoretical studies has been on effectiveness of mechanisms for generation of Lg by explosive sources. The studies indicate that, even though Rg-to-Lg scattering might explain observed frequency dependence and other features of explosion Lg/P ratios, it probably provides only a minor contribution to explosion Lg signals compared to other mechanisms.
DTIC
Mathematical Models; Seismograms; Seismographs; Explosions; Earthquakes

19980205534 National Center for Atmospheric Research, Boulder, CO USA
Simulations of Gravity Wave Induced Turbulence Using 512 PE Cray T3E
Prusa, Joseph M., Iowa State Univ. of Science and Technology, USA; Smolarkiewicz, Piotr K., National Center for Atmospheric Research, USA; Wyszogrodzki, Andrzej A., Warsaw Univ., Poland; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 139-151; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

A 3D nonhydrostatic, time-dependent Eulerian/semi-Lagrangian Navier-Stokes solver has been employed to simulate gravity wave induced turbulence at mesopause altitudes. The solver is suitable for modeling a wide range of natural atmospheric flows

(broadly documented in the literature). In the present study, the semi-Lagrangian option of the message-passing implementation of the solver was used. This work extends our earlier 2D study reported in the literature to three spatial dimensions while maintaining fine resolution required to capture essential physics of the wave breaking. Present calculations, which would be difficult on standard vector supercomputers, have been performed on the 512 processor Cray T3E machine at the National Energy Research Scientific Computing Center (NERSC) in Berkeley. The physical results of this study are spectacular and clearly demonstrate advantages of highly parallel technologies. In this paper, we briefly outline the physical outcome of the study, while focusing on selected computational aspects of the project. In particular, we compare the relative model performance across several machines (Crays T3E and T3D, Hewlett-Packard Exemplar SPP2000 and Cray PVP systems) using both MPI and Shmem communication software (where applicable).
Author
Computerized Simulation; Gravity Waves; Navier-Stokes Equation; Supercomputers; Mesopause; Cray Computers

19980205617 Pacific Northwest National Lab., Richland, WA USA
Hanford Seismic Network
Reidel, S. P., Pacific Northwest National Lab., USA; Hartshorn, D. C., Pacific Northwest National Lab., USA; May 1997; 15p; In English
Contract(s)/Grant(s): DE-AC06-76RL-01830
Report No.(s): PNNL-11535; DE97-053274; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report describes the Hanford Seismic Network. The network consists of two instrument arrays: seismometers and strong motion accelerometers. The seismometers determine the location and magnitude of earthquakes, and the strong motion accelerometers determine ground motion. Together these instruments arrays comply with the intent of DOE Order 5480.20, Natural Phenomena Hazards Mitigation.
DOE
Networks; Seismographs; Accelerometers; Earthquakes

19980205690 Lawrence Livermore National Lab., Livermore, CA USA
Late miocene/pliocene origin of the inverted metamorphism of the Central Himalaya
Harrison, T. M., Lawrence Livermore National Lab., USA; Ryerson, F. J., Lawrence Livermore National Lab., USA; LeFort, P., Lawrence Livermore National Lab., USA; Yin, A., Lawrence Livermore National Lab., USA; Lovera, O. M., Lawrence Livermore National Lab., USA; Jan. 01, 1997; 14p; In English; Earth Systems Summit, 28 - 31 Oct. 1996, Denver, CO, USA; Sponsored by Geological Society of America, USA
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-126613; CONF-9610113-1; DE97-053182; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The spatial association of intracontinental thrusting and inverted metamorphism, recognized in the Himalaya more than a century ago, has inspired continuing efforts to identify their causal relationship. Perhaps the best known sequence of inverted metamorphism is that found immediately beneath the Himalayan Main Central Thrust (MCT), generally thought to have been active during the Early Miocene. It has been widely assumed that the pattern of inverted metamorphism also developed at that time. Using a new approach, in situ Th-Pb dating of monazite included in garnet, we have discovered that the peak metamorphic recrystallization recorded in the footwall of the MCT fault occurred at ca. 5 Ma. The apparent inverted metamorphism resulted from activation of a broad shear zone beneath the MCT zone which juxtaposed two right-way-up metamorphic sequences. Recognition of this remarkably youthful phase of metamorphism resolves outstanding problems in Himalayan tectonics, such as why the MCT (and not the more recently initiated thrusts) marks the break in slope of the present day mountain range, and transcends others, such as the need for exceptional conditions to explain Himalayan anatexis.
DOE
Chronology; Time Measurement; Metamorphism (Geology); Isotope Ratios

19980206202 Alabama Univ., Dept. of Physics, Huntsville, AL USA
Visualization of High Latitude Ion Upflow in Support of the Image Mission
Wilson, Gordon R., Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The study of the magnetosphere is a 400 year old science that began with the publication by Gilbert, in 1600, of his hypotheses that the Earth was a giant magnet. Since then we have learned many things about the magnetosphere, particularly in the last 40

years of the space age, but we still have many unanswered questions. In spite of the many thousands of observations of this system we still lack a global understanding of how it works. This is due to its large size and tenuous nature that mean that any measurement made of the fields or particles involved only give one a knowledge of the local conditions at a given time. to gain a global perspective through such observations would require the simultaneous operation of thousands of satellites spread throughout the magnetospheric system in addition to observations made on the ground. Such a program would be impractical at least from financial considerations. What is needed for the advancement of magnetospheric physics is to develop the same capabilities that astrophysicists, solar physicists and meteorologists have been using for years --- the ability to stand back from the object under study and see it in its entirety. The challenge for doing this for the magnetosphere is that the particle densities are very low and the material is, for the most part, not luminous. In the last 25 years several ideas have been proposed that would allow at least the imaging of certain portions of the magnetosphere. These include imaging of the plasmasphere through the resonant scattering of solar 304 A from He+ ions, imaging of various hot plasma populations (i.e. the ring current, plasmasheet, upflowing ionospheric ions, etc.) from the neutral atoms that result when ions of these populations charge exchange with the hydrogen geocorona, and imaging the aurora at various wavelengths in the far ultraviolet. In addition, a novel technique for probing various boundaries in the magnetosphere by bouncing low frequency radio waves off of them has been extensively studied. Such a technique is analogous to the way the under water world can be probed with sonar. About five years ago NASA convened a science working group to study the possibility of flying a magnetospheric imaging mission. This resulted in a number of proposals for such a mission, one of which was selected to be the first MIDEX mission, to be launched in early 2000. The mission is called IMAGE (Imager for Magnetopause to Aurora Global Exploration) and its P.I. is J. Burch at SwRI. The IMAGE spacecraft will carry imagers to view the plasmasphere, aurora, ring current, inner plasmasheet, and upflowing ionospheric ions as well as a radio sounder to probe the location, shape and dynamics of the magnetopause, plasmapause, etc. Between its selection last April and the non advocacy mission review, which takes place next spring, the IMAGE teams needs to further refine the design of the mission and its instruments. The theory and modeling (T&M) subgroup of this team has the task of demonstrating what kind of images the instruments on IMAGE will see as well as showing that useful scientific information can be extracted from such images. As a central element to the efforts of the T&M subgroup we have decided to simulate and create synthetic images for the magnetic cloud event of October, 1995. In this event a large cloud, with high plasma densities and strong magnetic fields, ejected from the sun collided with the earth's magnetosphere triggering a three day period of intense magnetic storms and substorms. This event was observed from a number of different spacecraft and on the ground so we have a good data set to work with. In our work we will place the IMAGE spacecraft in the magnetosphere on its proposed orbit, with its proposed instruments, to see what it would see had it been there. Existing models of the plasmasphere, ring current and magnetopause will be run for this event to give the structures for the imaging instruments. There are several models which are lacking and which need to be developed. These include a model for the cusp, the inner plasmasheet and the upflowing ions. My task this summer was to develop the upflowing ion model and use it to create synthetic images. Author

Ion Currents; Ion Emission; Magnetospheric Ion Density; Atmospheric Models; Flux Density

19980206257 Northwest Research Associates, Inc., Bellevue, WA USA

Further Investigations of Ionospheric Total Electron Content and Scintillation Effects on Transionospheric Radiowave Propagation

Andreasen, C. Charley, Northwest Research Associates, Inc., USA; Fremouw, Edward J., Northwest Research Associates, Inc., USA; Mazzella, Andrew J., Jr., Northwest Research Associates, Inc., USA; Rao, G. S., Northwest Research Associates, Inc., USA; Secan, James A., Northwest Research Associates, Inc., USA; Feb. 12, 1998; 41p; In English

Contract(s)/Grant(s): F19628-94-C-0067; AF Proj. DMSP

Report No.(s): AD-A345678; NWRA-CR-98-R177; AFRL-VS-HA-TR-98-0037; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effects of the ionosphere on numerous communication, navigation, and surveillance systems continue to be of Air Force concern. In this project, Northwest Research Associates (NWRA) is collaborating with researchers from Air Force Research Laboratory at Hanscom AFB and others to address these concerns in three broad areas. In the most advanced effort, operational code for running a gridded version of the WBMOD ionospheric scintillation model, called WBMGRID, with the full Scintillation Decision Aid (SCINDA) system was delivered to the 50th Weather Squadron (now the 55th Space Weather Squadron). The most extensive of the NWRA efforts involved careful use of two-frequency GPS receivers to measure ionospheric total electron content (TEC), which introduces range errors on operational GPS links. Central tasks in this effort included utilization of receivers at four operational sites of the Ionospheric Measuring System (IMS), continued development and refinement of the IMS employing a fifth receiver located at Hanscom, and assessment and analysis of the resulting data. The newest of the efforts goes beyond passive

observation of ionospheric effects on radiowave systems to preparation for active experiments in the High Frequency Active Auroral Research Program (HAARP).
DTIC
Electrons; Radio Waves; Ionospheric Propagation; Weather; Scintillation; Telecommunication; Radiant Flux Density

19980206259 Army War Coll., Carlisle Barracks, PA USA
New Madrid Seismic Zone
Norwood, J. D., Army War Coll., USA; Apr. 22, 1998; 49p; In English
Report No.(s): AD-A345624; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The New Madrid Seismic Zone is one of the most potentially dangerous natural hazards that exists anywhere in the continental USA. Having produced three of the greatest earthquakes known to man over a 60-day period during the winter of 1811-1812, its destructive potential is real. Though general knowledge of this seismic zone is increasing, it is still not well founded. The possibility of a near term major earthquake holds serious implications for the nation. When it occurs, it will have a significant impact upon the military. This paper reviews the history of the New Madrid Seismic Zone, explains likely effects of a major earthquake and the anticipated levels of damage and disruption that would result, and covers the latest available scientific analysis for the likelihood of a recurrence of a major event. Finally, the paper reviews the current status of DOD planning for the response and recovery roles of various military organizations.
DTIC
Earthquakes; Damage; Seismographs

19980206288 Commerce Dept., Asheville, NC USA
Detecting discontinuities in time series of upper air data: Demonstration of an adaptive filter technique
Zurbenko, I., State Univ. of New York, USA; Chen, J., State Univ. of New York, USA; Rao, S. T., State Univ. of New York, USA; [1997]; 29p; In English
Contract(s)/Grant(s): DE-AI05-90ER-61011
Report No.(s): DOE/ER/61011-T9; DE98-001242; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The issue of global climate change due to increased anthropogenic emissions of greenhouse gases in the atmosphere has gained considerable attention and importance. Climate change studies require the interpretation of weather data collected in numerous locations and/or over the span of several decades. Unfortunately, these data contain biases caused by changes in instruments and data acquisition procedures. It is essential that biases are identified and/or removed before these data can be used confidently in the context of climate change research. The purpose of this paper is to illustrate the use of an adaptive moving average filter and compare it with traditional parametric methods. The advantage of the adaptive filter over traditional parametric methods is that it is less effected by seasonal patterns and trends. The filter has been applied to upper air relative humidity and temperature data. Applied to generated data, the filter has a root mean squared error accuracy of about 600 days when locating changes of 0.1 standard deviations and about 20 days for changes of 0.5 standard deviations. In some circumstances, the accuracy of location estimation can be improved through parametric techniques used in conjunction with the adaptive filter.
DOE
Meteorological Parameters; Upper Atmosphere; Humidity; Greenhouse Effect; Discontinuity; Data Acquisition; Climatology; Climate Change

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19980203207 Communications Research Lab., Tokyo, Japan
Space Weather Forecast Program, Interim Report, Preface
Sagawa, Eiichi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 211-213; In English; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

The aim of the Space Weather Forecast Program is to develop a system that predicts the weather in the space environment near the earth, an environment that is influenced by the activities of the sun. When space weather forecasting becomes a reality, problems in the space environment will become much more manageable, both on the ground and in space. Problems include mal-

functions of satellites due to high-energy particles, radiation hazard posed to astronauts, and large induced currents on the ground power grids. to develop space weather forecasting, applied research on forecasting must be integrated with advances in solar and solar terrestrial research.
Derived from text
Aerospace Environments; Weather Forecasting; Earth Magnetosphere

19980203251 Ocean Prospects, Encinitas, CA USA
Comparison of Drogued and Undrogued Drift Buoys ***Final Report***
Pazan, Stephen E., Ocean Prospects, USA; Dec. 1997; 60p; In English
Contract(s)/Grant(s): N00014-95-C-6002
Report No.(s): AD-A341783; OP-97-2; NRL-CR/7401--98-0003; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This is the final report on a three year program to retrieve Lagrangian velocity estimates from observations of Naval AN/WSQ-6 drift buoys for the benefit of naval operations. Ocean Prospects has fulfilled the tasks specified in the contract, quality controlling wind and buoy data, making comparisons of drogued and undrogued buoy observations, and developing both I-D and 2-D linear regression models of buoy drift. Ocean Prospects archived and quality controlled 1,844,144 drogued WOCE buoy observations, 848A16 undrogued WOCE buoy observations, and 196,885 Naval ANJWSQ-6 buoy observations at synoptic time intervals, as well as synoptic fields of FNMOC and ECMWF winds. Meridional and zonal surface wind velocity components from the global synoptic FNMOC model and the global synoptic ECMWF model were interpolated to each Naval ANJWSQ-6 and WOCEFFOGA buoy position and date/time in the datasets. Seven 1-D linear regression models were evaluated for both the Navy vs. WOCE drogue-on dataset and the WOCE drogue-off vs. WOCE drogue-on dataset. Principal results from this analysis were: the constant term in the regression analysis was zero; both the regression coefficients and variance explained were the same within error for regressions using Navy buoy velocity or undrogued WOCE buoy velocity as dependent or predictor variables, i.e. the Navy buoys behaved like undrogued WOCE buoys; the regression coefficients and variance explained were the same within errors for either FNMOC or ECMWF winds and for the purposes of this study, either FNMOC or BCMWF winds were sufficient.
DTIC
Weather Forecasting; Buoys; Computer Programs; Wind Velocity; Regression Analysis

19980203354 World Meteorological Organization, World Climate Programme, Geneva, Switzerland
World Climate Programme Applications and Services
Regulatory Applications of the Relationships between Natural Gas Usage and Weather and Climate Information for the Application of Solar Energy; May 1997; 127p; In English; In Spanish; Also announced as 19980203355 through 19980203356
Report No.(s): WCASP-41; WMO/TD-816; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

The report is comprised of the following two articles: (1) Regulatory applications of the relationships between natural gas usage and weather; and (2) Climate information for the application of solar energy.
CASI
Energy Technology; Solar Energy Conversion; Natural Gas

19980203355 Public Service Co. of Missouri, Energy Analysis and Forecasting Group, Jefferson City, MO USA
Regulatory Applications of the Relationships Between Natural Gas Usage and Weather
Gray, James. A., Public Service Co. of Missouri, USA; Patterson, Dennis. L., Public Service Co. of Missouri, USA; Proctor, Michael. S., Public Service Co. of Missouri, USA; Warren, Henry. E., Public Service Co. of Missouri, USA; World Climate Programme Applications and Services; May 1997, pp. 1-40; In English; Also announced as 19980203354; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

This document provides the basics required for analysis and forecasting of natural gas usage for the determination of revenues and the revision of rates. The focus is on the Local Distribution Company (LDC) and its customers. Analysis of gas usage is required in a rate case in order to properly estimate the volumes and revenues that would be recovered from current rates under conditions of normal weather. Normal volumes are also required to evaluate proposed rates. In the context of the LDC's procurement of gas supply, forecasting of gas usage is required to determine both the daily usage profile and the peak day requirement.
Derived from text
Forecasting; Natural Gas; Utilities; Energy Consumption; Fuel Consumption; Weather

19980203356 World Meteorological Organization, Commission for Climatology, Geneva, Switzerland

Climate Information for the Application of Solar Energy

Robles-Gil, Sandra, World Meteorological Organization, Switzerland; Regulatory Applications of the Relationships between Natural Gas Usage and Weather and Climate Information for the Application of Solar Energy; May 1997, pp. 41-73; In English; In Spanish; Also announced as 19980203354; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Population growth, urbanization and industrialization have provoked an increasing energy demand that has been satisfied, for many years, by fossil fuels. Besides its exhaustion and the continuous increase in its cost, the combustion of the fossil fuels damages the environment and has an impact on human health. In view of this situation, there has been an increasing interest in developing new technologies that use various renewable energy sources and have less environmental impact, such as solar, wind, tidal and biomass. Solar energy is one of the energy resources with a wide geographical distribution. Nowadays, its contribution to the world's energy supply is very small, but it is considered an important long term option which will satisfy, together with conventional energy sources, the energy needs of the world in the future. Solar energy may contribute to a sustainable economic and environmental development in the future. However, an adequate institutional policy needs to be implemented to increase the progress of technology, which is linked to social problems. Likewise, the role that the climatologists have in providing information and advice regarding the potential of the solar resource, is essential in the development of the different systems of solar energy. The main objective of this work is to report the actual uses of the principal types of solar energy systems, based on their climatic, technological and economical context. This is to improve the dissemination of information on the application of climate knowledge and data, especially by national meteorological services, with the purpose to improve the planning, design and operation of solar energy systems, as well as to facilitate their more widespread use.

Author

Climate; Climatology; Energy Technology; Solar Energy Conversion

19980203396 Montana Tech of the Univ. of Montana, Butte, MT USA

A Lagrangian Approach to Studying Instantaneous Plume Dispersion and Concentration Fluctuations ***Final Report, Sep. 1994 - Mar. 1998***

Peterson, Holly G., Montana Tech of the Univ. of Montana, USA; Lamb, Brian K., Montana Tech of the Univ. of Montana, USA; Mar. 30, 1998; 46p; In English

Contract(s)/Grant(s): DAAH04-94-G-0349

Report No.(s): AD-A344446; ARO-33867.12-GS-DPS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall goal of the project was to develop a better understanding of plumes in the surface layer of the atmosphere on near-instantaneous time scales. In particular, an extensive database was acquired to characterize the diffusion of surface-level tracer plumes on short time scales for a range of meteorological conditions and amid a variety of surface roughness elements. Empirical and second-order closure methods were tested to predict the diffusion of plumes within 1 km of the source. A computer model was developed and tested to predict concentration fluctuations at fixed receptors located downwind of a ground-level contaminant source. Finally, a dual tracer instrument was developed to simultaneously measure fast-response concentrations of two tracers for use in the field to infer Lagrangian travel times of plume elements.

DTIC

Lagrangian Function; Plumes; Surface Roughness; Atmospheric Models

19980203452 Pacific-Sierra Research Corp., Santa Monica, CA USA

Worldwide Cloud Forecasts with Neural Networks, ***26 Aug. 1994 - 30 Apr. 1997***

Poehls, Kenneth A., Pacific-Sierra Research Corp., USA; Crandall, David M., Pacific-Sierra Research Corp., USA; ORourke, Kevin, Pacific-Sierra Research Corp., USA; Heikes, Kenneth E., Pacific-Sierra Research Corp., USA; May 01, 1998; 113p; In English

Contract(s)/Grant(s): DNA001-94-C-0149

Report No.(s): AD-A343697; PSR-2692; DSWA-TR-97-13; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Most approaches to weather and cloud forecasting entail the use of a large numerical weather prediction code. This project investigated an alternative approach to cloud forecasting based upon using a neural network (NN) to analyze and combine the basic meteorological elements of persistence, advection and evolution. The Worldwide Cloud Prediction Model (WCPM) is based upon a pixel by pixel implementation of a NN. The temporal evolution and advection are estimated from past satellite and numerical weather prediction data. Persistence of cloud properties at a pixel is estimated from past data. The forecast is based upon this pixel level analysis and is almost independent of changes in neighboring pixels. Over the limited data available, the NN performed somewhat better in tropical regions than the current HRCP model. The approach demonstrated the ability to predict both the advection and evolution of clouds. Performance was best in regions of significant cloud cover, regions of scattered clouds were smeared.

RMS prediction errors of about 20% were typical for the WCPM as compared to rms errors of about 30% for tropical HRCP predictions. An alternative, fully object oriented approach to the NN is outlined to improve the performance and forecast sharpness in regions of scattered clouds.
DTIC
Neural Nets; Clouds (Meteorology); Cloud Physics; Numerical Weather Forecasting

19980203546 Risoe National Lab., Meteorology and Wind Energy, Roskilde, Denmark
Meteorology and Wind Energy Department *Annual Report, 1996*
HaugeMadsen, P., Editor, Risoe National Lab., Denmark; DannemandAndersen, P., Editor, Risoe National Lab., Denmark; Skrumsager, B., Editor, Risoe National Lab., Denmark; Jul. 1997; 67p; In English
Report No.(s): RISO-R-948(EN); DE98-701663; ISBN 87-550-2251-0; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In 1996 the Meteorology and Wind Energy Department has performed research within the programme areas: (1) wind energy and (2) atmospheric processes. The objectives are through research in boundary layer meteorology, fluid dynamics, aerodynamics and structural mechanics to contribute with new knowledge within (1) wind energy in relation to development, manufacturing, operation and export as well as testing and certification of wind turbines, and (2) aspects of boundary-layer meteorology related to environmental and energy problems of society. The work is supported by the research programs of the Ministry of Environment and Energy, the Nordic Council of Ministers, EU as well as by industry. Through our research and development work we develop and provide methodologies including computer models for use by industry, institutions, and governmental authorities. In the long view we are developing facilities and programs enabling us to serve as a national and European centre for wind-energy and boundary-layer meteorological research. A summary of our activities in 1996 is presented.
DOE
Windpower Utilization; Boundary Layers; Meteorology; Wind Turbines; Research and Development

19980203649 Naval Postgraduate School, Monterey, CA USA
Calculating Tropical Cyclone Critical Wind Radii and Storm Size Using NSCAT Winds
Magnan, Scott G., Naval Postgraduate School, USA; Mar. 1998; 69p; In English
Report No.(s): AD-A343430; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Subjective and objective analyses of satellite scatterometer near-surface winds are utilized to estimate Tropical Cyclone (TC) critical wind radii and size over a region of the western North Pacific. An outer wind profile assuming a linear slope dependent on the TC latitude is used to determine the radial extent of cyclonic winds beyond a set radius. Inside the set radius, a partial conservation of angular momentum is assumed into the TC maximum wind radius and the 35, -50, and 100-kt radii are calculated. Nine TCs were investigated during the operating period of the NASA SCATterometer (NSCAT). Critical wind radii values in four quadrants (front, right, rear, and left) of the TCs are found to be comparable to the Joint Typhoon Warning Center (JTWC) critical wind radii values issued in warnings. The radial extent of cyclonic winds are also comparable to the radius of zero winds estimated by determining where the cyclonic flow turned to anticyclonic flow in the NSCAT sea-surface wind swaths.
DTIC
Anticyclones; Cyclones; Scatterometers; Tropical Storms; Radii; Atmospheric Circulation

19980203833 Los Alamos National Lab., NM USA
Remote sensing of thundercloud electric fields
Borovsky, J., Los Alamos National Lab., USA; Buchwald, M., Los Alamos National Lab., USA; Suszcynsky, D., Los Alamos National Lab., USA; [1997]; 4p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2319; DE97-008697; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Theoretical and experimental work was performed on emission of photons from the air within and above thunderclouds and within lightning channels. Predictions were made of the telltale emissions from ionized nitrogen molecules and these emissions were recorded. The measurements will be utilized to help to understand the nature of thundercloud-produced airglow.
DOE
Atmospheric Electricity; Cumulonimbus Clouds; Remote Sensing; Thunderstorms; Lightning; Photons

19980203847 Army Research Lab., Battlefield Environment Directorate, White Sands Missile Range, NM USA

A Revisit of the Field Artillery's Time-Space Wind Variability Equation ***Final Report***

Blanco, Abel J., Army Research Lab., USA; Haines, Patrick A., Army Research Lab., USA; Apr. 1998; 34p; In English

Report No.(s): AD-A343172; ARL-TR-1627; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The U.S. Army has derived artillery accuracy error budgets based on a time & space ballistic wind variance formula. The wind algorithm uses a midlatitude wind profile to derive the expected ballistic wind component variance. This time variability equation is reevaluated using 190 hourly upper air profiler soundings collected over Platteville, CO, representing 8 days of diverse weather conditions. Comparisons between the computed ballistic wind time variability and the equation estimated variability reveal the formula to be an unbiased estimator with 1 km precise agreement at a staleness of 1 h. The equation accuracy ranges from 1.5 to 3.0 ballistic km depending on a time staleness of 2 to 4 h, ballistic line, and season.

DTIC

Wind Velocity; Ballistics; Wind (Meteorology); Wind Profiles; Statistical Analysis

19980204690 Argonne National Lab., IL USA

Site scientific mission plan for the Southern Great Plains CART site: July-December 1997

Peppler, R. A., Oklahoma Univ., USA; Lamb, P. J., Oklahoma Univ., USA; Sisterson, D. L., Argonne National Lab., USA; Jul. 1997; 82p; In English

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

Report No.(s): ARM-97-002; DE98-000001; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site is designed to help satisfy the data needs of the Atmospheric Radiation Measurement (ARM) Program Science Team. This document defines the scientific priorities for site activities during the six months beginning on July 1, 1997, and looks forward in lesser detail to subsequent six-month periods. The primary purpose of this Site Scientific Mission Plan is to provide guidance for the development of plans for site operations. It also provides information on current plans to the ARM functional teams and serves to disseminate the plans more generally within the ARM Program and among the members of the Science Team. This document includes a description of the operational status of the site and the primary site activities envisioned, together with information concerning approved and proposed intensive observation periods (IOPs). This plan is a living document that is updated and reissued every six months as the observational facilities are developed, tested, and augmented and as priorities are adjusted in response to developments in scientific planning and understanding.

DOE

Atmospheric Radiation; Radiation Measurement; Climate Change; Earth Atmosphere; Numerical Data Bases; Solar Radiation

19980204878 Air Force Global Weather Central, Offutt AFB, NE USA

Freezing Precipitation

Weber, Eugene M., Air Force Global Weather Central, USA; Mar. 31, 1998; 133p; In English

Report No.(s): AD-A343975; AFWA/TN-98/001; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This technical note discusses three advection patterns favorable for freezing precipitation. Two graphs were developed based on 503 freezing precipitation occurrences during the past 11 years- a 1000- to 500-mb thickness graph and an 850-mb temperature graph. Two anticyclonic pressure patterns are discussed throughout the technical note. Relationships between inverted troughs and 850-mb lows are presented. Considerable discussion on synoptic patterns across the continental USA is included. This technical note is designed to help and train forecasters on various freezing precipitation scenarios.

DTIC

Synoptic Meteorology; Freezing; Forecasting

19980205530 Naval Research Lab., Monterey, CA USA

A Scalable Version of the Navy Operational Global Atmospheric Prediction System Spectral Forecast Model

Rosmond, Thomas E., Naval Research Lab., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 97-102; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The navy operational global atmospheric prediction system (NOGAPS) is the heart of the Fleet Numerical Meteorological and Oceanographic Center (FNMOC) operational NWP support to all branches of the Department of Defense. The Naval Research Laboratory (NRL) is responsible for NOGAPS design and computer implementation. NOGAPS has been operational at FNMOC since 1982 and has been through several computer system upgrades and design changes during that time. The spectral

forecast model component of NOGAPS is similar in formulation to global models run at other major operational NWP centers around the world. Operationally it runs multi-tasked on a Cray C90 using 10-15 processors with a sustained performance of 400 Mflops/processor. The operational resolution is currently T159L30. In addition to the operational application NOGAPS is run by NRL scientists at a variety of lower resolutions for coupled atmosphere/ocean modeling research, data assimilation studies, long-term integrations such as AMIP, and singular vector/adjoint model research. Price/performance considerations are driving many supercomputer applications away from expensive vector architectures and toward scalable architectures built around commodity-based components. Numerical weather prediction models such as the NOGAPS spectral forecast model is an example of such an application. FNMOC is currently planning a switch to a scalable architecture for their primary computational resource over the next 2-3 years, and NOGAPS is the most prominent application to be ported to the new system. In anticipation of a new operational platform for NOGAPS, a distributed memory NOGAPS based on message passing (MPI) has been developed and is being tested and optimized. In part 2 of this report the design criteria and priorities of the new code are discussed. Part 3 describes the design of the computationally intensive spherical harmonic transforms. Part 4 discusses some overall model performance issues and load balance problems. Part 5 presents some conclusions, lessons learned, and future plans.
Author
Numerical Weather Forecasting; Supercomputers; Cray Computers; Oceanography; Computerized Simulation; Parallel Processing (Computers); Massively Parallel Processors

19980205538 California Univ., Lawrence Berkeley Lab., National Energy Research Scientific Computing Center, Berkeley, CA USA
Parallel Atmospheric Data Assimilation
Ding, Chris H. Q., California Univ., Lawrence Berkeley Lab., USA; Lyster, Peter M., California Univ., Lawrence Berkeley Lab., USA; Lawson, Jay W., California Univ., Lawrence Berkeley Lab., USA; Guo, Jing, California Univ., Lawrence Berkeley Lab., USA; daSilva, Arlindo, California Univ., Lawrence Berkeley Lab., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 163; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

Atmospheric data such as temperature, moisture, winds, etc., collected by satellites and ground observation stations provide only partial information about the atmosphere. They are assimilated to numerical forecasts to provide a coherent, evolving state of the global atmosphere. The data analysis system, the Physical-space Statistical Analysis System (PSAS) developed at the Data Assimilation Office at NASA's Goddard Space Flight Center, requires computing resources far beyond the capabilities of even the state-of-the-art vector supercomputers. We describe an efficient and scalable implementation of the PSAS on distributed-memory massively parallel supercomputers such as Intel Paragon and Cray T3E; the implementations achieves superb performance as demonstrated by detailed performance analysis of systematic runs on up to 512 processors on Paragon, T3D and T3E. Consequently, the solution time is reduced to 24.6 seconds on 512-PE T3E from 5 hours on a single head of Cray C90 for a real problem of 80,000 observations, a 740-fold reduction of turn-around time. We will discuss the code structures and the modular programming approach used to separate the original codes from those for parallelization.
Author
Parallel Processing (Computers); Massively Parallel Processors; Cray Computers; Supercomputers; Scientific Visualization; Computerized Simulation; Numerical Weather Forecasting

19980205798 Commerce Dept., Boulder, CO USA
Shipboard measurements of the cloud-capped marine boundary layer during FIRE/ASTEX
[1997]; 9p; In English
Contract(s)/Grant(s): DE-AI02-92ER-61366
Report No.(s): DOE/ER/61366-T1; DE97-009330; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Results are reported on measurements of the cloud-capped marine boundary layer during FIRE/ASTEX. A method was developed from the ASTEX dataset for measuring profiles of liquid water content, droplet size and concentration from cloud radar/microwave radiometer data in marine boundary layer clouds. Profiles were also determined from the first three moments of the Doppler spectrum measured in drizzle with the ETL cloud radar during ASTEX.
DOE
Marine Meteorology; Atmospheric Boundary Layer; Metrology; Data Acquisition; Radar Data; Procedures

19980206078 Los Alamos National Lab., NM USA

Coupled ocean-atmosphere model system for studies of interannual-to-decadal climate variability over the North Pacific Basin and precipitation over the Southwestern USA

Lai, Chung-Chieng A., Los Alamos National Lab., USA; [1997]; 12p; In English

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

Report No.(s): LA-UR-97-3367; DE98-000083; 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 ultimate objective of this research project is to make understanding and predicting regional climate easier. The long-term goals of this project are (1) to construct a coupled ocean-atmosphere model (COAM) system, (2) use it to explore the interannual-to-decadal climate variability over the North Pacific Basin, and (3) determine climate effects on the precipitation over the Southwestern USA. During this project life, three major tasks were completed: (1) Mesoscale ocean and atmospheric model; (2) global-coupled ocean and atmospheric modeling: completed the coupling of LANL POP global ocean model with NCAR CCM2+ global atmospheric model; and (3) global nested-grid ocean modeling: designed the boundary interface for the nested-grid ocean models.

DOE

Atmospheric Models; Climate; Annual Variations; Research and Development; Precipitation (Meteorology)

19980206121 Meteorological Satellite Center, Tokyo, Japan

Characteristics of the Cloud Pattern and the Rainfall Area in Kanto Area Associated with Passing Cold Front

Tsuchiya, Akio, Meteorological Satellite Center, Japan; Meteorological Satellite Center Technical Note; Feb. 1998; ISSN 0388-9653, No. 35, pp. 29-43; In Japanese; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The relationship between the cloud pattern and the rainfall area in Kanto area caused by a passing cold front is examined. The results are as follows: (1) When there is precipitation in the Kanto area, an organized cloud area develops on the cold front with a cirrus buldge, which passes over Kanto area. (2) When there is little precipitation, the cloud band associated with the cold front is poor and there is no formation of the organized cloud area.

Author

Cold Fronts; Rain; Precipitation (Meteorology); Cirrus Clouds; Cloud Cover

19980206122 Meteorological Satellite Center, Tokyo, Japan

A Statistical Investigation to Evaluate Present Performance of Automatic Computation and Effect of Manual Procedures in the MSC

Sakai, Makoto, Meteorological Satellite Center, Japan; Nishimura, Syuji, Meteorological Satellite Center, Japan; Fujita, Yukio, Meteorological Satellite Center, Japan; Meteorological Satellite Center Technical Note; Feb. 1998; ISSN 0388-9653, No. 35, pp. 15-27; In Japanese; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The Meteorological Satellite Center (MSC) operationally extracts cloud motion wind vectors (CMWVs) using GMS images. Upper level CMWVs are computed through automatic and manual procedures. A statistical investigation to evaluate present performance of automatic computation and effect of manual procedures is presented. The manual procedures improved the accuracy of upper level CMWVs very much. For example, the root mean square error (RMSE) of wind vector difference between upper level CMWV and radiosonde observed wind, which is 13.1 m/s for automatic computation, is improved to 7.8 m/s after the manual procedures.

Author

Computation; Root-Mean-Square Errors; Wind Direction; Wind Velocity; Data Processing; Statistical Analysis

19980206258 Naval Postgraduate School, Monterey, CA USA

Extension of the Systematic Approach to Tropical Cyclone Track Forecasting in the Eastern and Central North Pacific

Boothe, Mark A., Naval Postgraduate School, USA; Dec. 1997; 150p; In English

Report No.(s): AD-A345627; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This study extends an earlier study (White 1995) of the application of the Systematic Approach to tropical cyclone track forecasting of Carr and Elsberry to the eastern and central North Pacific, and contrasts these cases with those in the western North Pacific. The data sample is first expanded to seven years (1990-1996). Modifications to the environment structure conceptual models are: (1) introduction of two Dominant Ridge synoptic regions named Ridge Poleward and Ridge Equatorward based on the bowed orientation of the subtropical anticyclone; and (2) combining the Weak Westerlies and Accelerating Westerlies into

just one synoptic region called Midlatitude Westerlies. Only eight synoptic pattern/region combinations are needed to classify all of the 1858 cases. Additions to the transitional mechanisms include: (1) the formation and dissipation of the mid-level low; (2) monsoon trough formation; and (3) orography. A new transition climatology reveals that a large fraction of transitions occur between the regions of the Standard pattern. Subtropical Ridge Modulation and Vertical Wind Shear are determined to be the most important transitional mechanisms. Synoptic analysis sequences are provided to illustrate the synoptic pattern/regions and the primary transitions.
DTIC
Weather Forecasting; Tropical Storms; Forecasting; Atmospheric Circulation; Anticyclones

19980206289 Commerce Dept., Asheville, NC USA
Improved Magnus' form approximation of saturation vapor pressure
Alduchov, O. A., National Oceanic and Atmospheric Administration, USA; Eskridge, R. E., National Oceanic and Atmospheric Administration, USA; [1997]; 20p; In English
Contract(s)/Grant(s): DE-AI05-90ER-61011
Report No.(s): DOE/ER/61011-T6; DE98-001239; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Relative humidity is usually measured in aerological observations and dew point depression is usually reported in upper-air reports. These variables must frequently be converted to other moisture variables in meteorological analysis. If relative humidity is converted to vapor pressure, most humidity variables can then be determined. Elliott and Gaffen reviewed the practices and procedures of the US radiosonde system. In their paper, a comparison of the relative errors was made between the saturation vapor pressure formulations of Tetens (1930), Goff-Gratch (1946), Wexler (1976), and Buck (1981). In this paper, the authors will expand the analysis of Elliott and Gaffen by deriving several new saturation vapor pressure formulas, and reviewing the various errors in these formulations. They will show that two of the new formulations of vapor pressure over water and ice are superior to existing formulas. Upper air temperature data are found to vary from about +50 C to (minus)80 C. This large variation requires a saturation vapor pressure equation to be accurate over a large temperature range. While the errors introduced by the use of relatively inaccurate conversion equations are smaller than the errors due to the instruments, dewpoint coding errors, and dewpoint conversion algorithms (Elliott and Gaffen, 1993); they introduce additional systematic errors in humidity data. The most precise formulation of vapor pressure over a plane surface of water was given by Wexler (1976). The relative errors of Tetens' (1930) formula and one due to Buck (1981) (Buck's equation is recommended in the Federal Meteorological Handbook No. 3, 1991) are shown. The relative errors in this table are the predicted value minus the Wexler value divided by the Wexler value.
DOE
Aerology; Algorithms; Atmospheric Temperature; Coding; Dew Point; Procedures; Handbooks

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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.

19980203457 Woods Hole Oceanographic Inst., MA USA
Estimation of Dissipation Rates and Bottom Stress in the Coastal Ocean ***Final Report, 1 Jan. 1995 - 31 Dec. 1996***
Trowbridge, John H., Woods Hole Oceanographic Inst., USA; May 04, 1998; 3p; In English
Contract(s)/Grant(s): N00014-95-1-0112
Report No.(s): AD-A343859; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The work funded by this grant addressed robust methods for estimation of dissipation rate and Reynolds stress based on turbulence measurements in the coastal ocean. The work resulted in two publications. The first was an evaluation, based primarily on intensive laboratory tests, of the acoustic Doppler velocimeter (ADV) as a turbulence sensor. The second was a description, based on theoretical considerations and a field test, of a novel technique for measuring Reynolds stress in the presence of surface waves, which involves differencing measurements obtained from spatially separated sensors.
DTIC
Turbulence; Estimates; Dissipation; Stress Measurement; Oceans; Coasts; Shear Stress

19980203468 SACLANT Undersea Research Centre, La Spezia, Italy

The Ocean Wave Dynamo: A Source of Magnetic Ambient Noise

Waterman, Jurgen, SACLANT Undersea Research Centre, Italy; Sep. 1997; 43p; In English

Report No.(s): AD-A344644; SACLANTCEN-SR-264; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The electromagnetic dynamo field of sea surface waves, a consequence of the Lorentz force, has been measured with two simultaneously operating, closely spaced tri-axial magnetometers. Measurements from a magnetometer located in the center of a small, uninhabited island served to compensate measurements from a near-shore magnetometer for large-scale magnetic pulsations (basically of ionospheric origin), leaving the ocean wave dynamo field, effective close to shore only, as the dominant residual magnetic field. Height and period of waves and swell were recorded with a vertical accelerometer (wave rider buoy) floating nearby on the sea surface. Amplitude and phase relationships between the three vector components of the magnetic field differences yield an ocean wave vector consistent with swell propagating northeastward. The magnetic field data further demonstrate that the water mass motion close to shore was not confined to a vertical plane (as would be the case for freely propagating gravity waves in the open ocean). The motion occurred in a plane inclined at about 40 deg from the horizontal (roughly twice the inclination of the island flanks). Ten night-time intervals of three hours each were analysed, and for every interval, the peak power of the surface waves (inferred from the wave rider measurements) was compared with the peak power of the residual horizontal magnetic field (after the background field had been removed). Their ratio yields the height of a hypothetical magnetometer above the surface of the open sea. Not only are the hypothetical heights computed for the ten different intervals similar, they are also approximately equal to the horizontal distance between the shoreline and the site of the near-shore magnetometer.

DTIC

Magnetic Fields; Detection; Ocean Surface; Ambience; Water Waves; Magnetic Variations; Noise (Sound); Surface Waves

19980203738 Los Alamos National Lab., NM USA

Benchmarking ocean circulation models on massively parallel computers

Poling, D. A., Los Alamos National Lab., USA; [1997]; 7p; In English

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

Report No.(s): LA-UR-97-2569; DE97-008682; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

General circulation models are becoming the premier theoretical tools for studying the complex structure of the global climate. GEONET was envisioned as exercising the resources developed for the nuclear weapons program to address environmental problems. The similarity of circulation models to weapons codes made them an attractive field for them to develop expertise. The author hoped to become an active player in mainline climate research through computer simulation. This is the final report of a three-year, Laboratory-Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The intention of this research was to establish the Laboratory in mainstream climate research in conjunction with the GEONET project.

DOE

Atmospheric General Circulation Models; Computerized Simulation; Massively Parallel Processors; Ocean Currents; Nuclear Weapons; Climatology

19980205541 Cray Research, Inc., Eagan, MN USA

Issues in the Design of Parallel Ocean Circulation Models

Sawdey, Aaron C., Cray Research, Inc., USA; OKeefe, Matthew T., Minnesota Univ., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 199-205; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this extended abstract we describe a programming model for parallel ocean circulation codes. We have applied this model to the Miami Isopycnic Coordinate Ocean Model (MICOM) and are in the process of applying it to the Princeton Ocean Model (POM). The model exploits highly parallel machines that have memory and network hierarchies to achieve scalable, efficient performance combined with ease of programming.

Author

Ocean Models; Applications Programs (Computers); Ocean Dynamics; Oceanography; Fluid Dynamics; Scientific Visualization; Computer Programming

19980205543 Naval Research Lab., Bay Saint Louis, MS USA

Performance of Barotropic Ocean Models on Shared and Distributed Memory Computers

Piacsek, Steve, Naval Research Lab., USA; Wallcraft, Alan, Naval Research Lab., USA; Jayakumar, P., University of Southern

Mississippi, USA; Lonergan, Luke, Northrop Grumman Corp., USA; Young, M., Naval Research Lab., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 209-224; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The efficiency of explicit time integration schemes for barotropic models of the Mediterranean were investigated, in context of the vectorization and parallel modeling approaches employed on different architectures. The main focus of interest was the scalability and MFlops output of the codes as a function of domain size. For simulations with real winds, mesh sizes ranged from 25 km down to 1.8 km (grids of 180 x 64 to 2048 x 1024), with the coarse resolution resolving only major straits like that of Sicily, and the high resolution even narrow straits like Gibraltar and Messina. Since the memory requirement of these grids only ranged to 70 Mbytes, we also performed simulations with idealized, precomputed winds for which mesh sizes ranged down to 280m, to produce a total memory requirement of 4 Gbytes. The analysis and interpretation of the latter results for the Mediterranean has not been performed yet. The explicit scheme consisted of the leap-frog scheme for the Coriolis, pressure gradient and advection terms, and 'lagged' times for the diffusion terms. The platforms utilized included the CM500-E (with CMF), the Cray C90 and T90 (with FT90 -O3 auto-tasking), the Cray T3E (with HPF and MPI), the SGI Origin2000 (with f77 -pfa -O2 power fortran, HPF and MPI), the IBM SP2 (with HPF) and the Sun Global Works (with HPF). The MPI version of this code employed a 2-D tiling decomposition, and parallel runs were performed up to 512 processors on the T3E and up to 64 processors on the SGI Origin. The T3E 512 processors achieved an 82 % scaling efficiency relative to 32 CPU'S. The SGI 64 processors achieved a scaling efficiency of 100 % vs. 32 processors, but less than lineax for smaller number of processors. The auto-tasking versions were quite efficient even for small program sizes (17 Mb) and for small number of processors, with the SGI -pfa compiler option (with -O2 optimization) giving scalings of 1.9, 3.7, and 15.4 for 2, 4 and 16 CPU'S, respectively, while the Cray T90 -O3 option (with FT90) gave scalings of 3.6 and 6.6 for 4 and 8 processors, respectively. MFlops output reached 11.7 GFlops for the 512 node T3E, and 7.4 GFlops for the 128 node 02K.

Author

Ocean Models; Barotropism; Gibraltar; Scientific Visualization; Computerized Simulation; Applications Programs (Computers)

19980205544 Rutgers Univ., Inst. of Marine and Coastal Sciences, New Brunswick, NJ USA

Parallel Performance of a 3D Spectral Element Ocean Model

Iskandarani, Mohamed, Rutgers Univ., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 225; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

In the present work, we investigate the scalability and parallel performance of a new three-dimensional spectral element ocean model. This new model solves the hydrostatic and Boussinesq primitive equations. It features a spectral element discretization in all three space dimensions with an unstructured grid in the horizontal, and a terrain-following structured discretization in the vertical direction. The computational tasks in the new model consist of time-integrating the barotropic components of the flow, calculating the three-dimensional tendencies, solving the implicit system of equations, and updating the diagnostic variables of pressure, density and vertical velocity. Here, we present our parallel implementation of the above tasks. We also present our analysis of several numerical experiments in order to identify the break-down of the computational cost among the tasks listed above. The numerical experiments also serve to illustrate the scalability and performance of the model in a typical basin-scale oceanic simulation.

Author

Ocean Models; Barotropic Flow; Three Dimensional Models; Flow Characteristics; Oceanography; Scientific Visualization; Computerized Simulation

19980205545 Brookhaven National Lab., Upton, NY USA

Massively Parallel Implementation of a High Order Domain Decomposition Equatorial Ocean Model

Ma, Hong, Brookhaven National Lab., USA; McCaffrey, Joseph W., Naval Research Lab., USA; Piacsek, Steve, Naval Research Lab., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 227-238; In English; Also announced as 19980205520

Contract(s)/Grant(s): DE-AC02-98CH-10886; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The present work is about the algorithms and parallel constructs of a spectral element equatorial ocean model. It shows that high order domain decomposition ocean models can be efficiently implemented on massively parallel architectures, such as the Connection Machine Model CM5. The optimized computational efficiency of the parallel spectral element ocean model comes not only from the exponential convergence of the numerical solution, but also from the work-intensive, medium-grained, geometry-based data parallelism. The data parallelism is created to efficiently implement the spectral element ocean model on the distributed-memory massively parallel computer, which minimizes communication among processing nodes. Computational

complexity analysis is given for the parallel algorithm of the spectral element ocean model, and the model's parallel performance on the CM5 is evaluated. Lastly, results from a simulation of wind-driven circulation in low-latitude Atlantic ocean are described. Author

Massively Parallel Processors; Memory (Computers); Parallel Processing (Computers); Distributed Memory; Ocean Models; Oceanography; Scientific Visualization; Computerized Simulation

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LIFE SCIENCES (GENERAL)

19980203273 Florida Univ., Gainesville, FL USA

Journal of Quantum Chemistry, Quantum Biology Symposium No. 24 ***Final Report, 28 Jan. 1997 - 27 Jan 1998***

Oehrn, Yngve, Editor, Florida Univ., USA; Sabin, John R., Editor, Florida Univ., USA; Zerner, Michael C., Editor, Florida Univ., USA; Lowdin, Per-Oloy, Editor, Florida Univ., USA; International Journal of Quantum Chemistry; Mar. 1997; ISSN 0020-7608; Volume 65, No. 6; 186p; In English; Application of Fundamental Theory to Problems of Biology and Pharmacology International, 1-7 Mar. 1997, Saint Augustine, FL, USA

Contract(s)/Grant(s): DAAG55-97-1-0020

Report No.(s): AD-A344264; ARO-36224.1-PH-CF; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The 37th Annual Sanibel Symposium, organized by the faculty, students, and staff of the Quantum Theory Project of the University of Florida, was held on March 1-7, 1997. The meeting was again held at the Ponce de Leon Conference Center in St. Augustine, Florida. The symposium followed the established format with plenary and poster sessions. This year, the schedule was shortened somewhat with a compact seven-day integrated program of quantum biology, quantum chemistry, and condensed matter physics. The topics of the sessions covered by these proceedings include Quantum Biology, Quantum and Classical Molecular Dynamics, Protein Structure and Folding, Monte Carlo Simulations, and Free Energy Calculations of Biological Molecules. The articles have been subjected to the ordinary refereeing procedures of the International journal of Quantum Chemistry. The articles presented in the sessions on quantum chemistry, condensed matter physics, and associated poster sessions are published in a separate issue of the International Journal of Quantum Chemistry.

DTIC

Molecular Biology; Quantum Chemistry; Conferences; Quantum Theory; Pharmacology

19980203719 Sandia National Labs., Albuquerque, NM USA

LDRD project: Semiconductor surface-emitting microcavity laser spectroscopy for analysis of biological cells and microstructures ***Final Report***

Gourley, P. L., Sandia National Labs., USA; McDonald, A. E., Sandia National Labs., USA; Gourley, M. F., Washington Hospital Center, USA; Bellum, J., Coherent Technologies, Inc., USA; Aug. 1997; 30p; In English

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

Report No.(s): SAND-97-1988; DE97-009148; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This article discusses a new intracavity laser technique that uses living or fixed cells as an integral part of the laser. The cells are placed on a GaAs based semiconductor wafer comprising one half of a vertical cavity surface-emitting laser. After placement, the cells are covered with a dielectric mirror to close the laser cavity. When photo-pumped with an external laser, this hybrid laser emits coherent light images and spectra that depend sensitively on the cell size, shape, and dielectric properties. The light spectra can be used to identify different cell types and distinguish normal and abnormal cells. The laser can be used to study single cells in real time as a cell-biology lab-on-a-chip, or to study large populations of cells by scanning the pump laser at high speed. The laser is well-suited to be integrated with other micro-optical or micro-fluidic components to lead to micro-optical-mechanical systems for analysis of fluids, particulates, and biological cells.

DOE

Cells (Biology); Laser Spectroscopy; Laser Cavities; Real Time Operation; Semiconductor Lasers; Surface Emitting Lasers; Cytology; Gallium Arsenides

19980203828 Los Alamos National Lab., NM USA

Computer simulation of protein solvation, hydrophobic mapping, and the oxygen effect in radiation biology

Pratt, L. R., Los Alamos National Lab., USA; Garcia, A. E., Los Alamos National Lab., USA; Hummer, G., Los Alamos National Lab., USA; [1997]; 22p; In English

Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2321; DE97-008596; 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 project at the Los Alamos National Laboratory. Hydrophobic effects are central to the structural stability of biomolecules, particularly proteins, in solution but are not understood at a molecular level. This project developed a new theoretical approach to calculation of hydrophobic effects. This information theory approach can be implemented with experimental, including computer simulation-experimental, information. The new theory is consistent with, builds upon, and subsumes previous integral equation and scaled particle statistical thermodynamic modes of hydrophobic effects. the new theory is sufficiently simple to permit application directly to complex biomolecules in solution and to permit further expansion to incorporate more subtle effects.
DOE
Biochemistry; Computerized Simulation; Proteins; Solvation; Oxygen; Molecular Biology

19980204708 Forest Service, Pacific Northwest Research Station, Portland, OR USA
Phytomass in Southeast Alaska
Mead, B. R., Forest Service, USA; May 1998; 62p; In English
Report No.(s): PB98-148919; FSRP-PNW-505; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Phytomass tables are presented for the southeast Alaska archipelago. Average phytomass for each sampled species of tree, shrub, grass, forb, lichen, and moss in 10 forest and 4 nonforest vegetation types is shown. These data provide a tool for estimating habitat carrying capacity for many wildlife species. They also may be used for estimating extent of the resources for tranditional uses, such as berry production, and relative abundance of other plants that may be important to a subsistence lifestyle. Tree phytomass is reported for the entire aboveground tree, thereby allowing estimates of total fiber content.
NTIS
Biomass; Vegetation; Archipelagoes

19980206166 North Carolina Univ., Dept. of Physical Science, Pembroke, NC USA
Preliminary Work in Obtaining Site-Directed Mutants of Hen Egg White Lysozyme
Holmes, Leonard D., North Carolina Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Protein crystal growth studies are recognized as a critical endeavor in the field of molecular biotechnology. The scientific applications of this field include the understanding of how enzymes function and the accumulation of accurate information of atomic structures, a key factor in the process of rational drug design. NASA has committed substantial investment and resources to the field of protein crystal growth and has conducted many microgravity protein crystal growth experiments aboard shuttle flights. Crystals grown in space tend to be larger, denser and have a more perfect habit and geometry. These improved properties gained in the microgravity environment of space result largely from the reduction of solutal convection, and the elimination of sedimentation at the growing crystal surface. Shuttle experiments have yielded many large, high quality crystals that are suitable for high resolution X-ray diffraction analysis. Examples of biologically important macromolecules which have been successfully crystallized during shuttle missions include: lysozyme, isocitrate lyase, gamma-interferon, insulin, human serum albumin and canavalin. Numerous other examples are also available. In addition to obtaining high quality crystals, investigators are also interested in learning the mechanisms by which the growth events take place. Crystallization experiments indicate that for the enzyme HEWL, measured growth rates do not follow mathematical models for 2D nucleation and dislocation-led growth of tetragonal protein crystals. As has been suggested by the laboratory of Marc L. Pusey, a possible explanation for the disagreement between observation and data is that HEWL tetraconal crystals form by aggregated units of lysozyme in supersaturated solutions. Surface measurement data was shown to fit very well with a model using an octamer unit cell as the growth unit. According to this model, the aggregation pathway and subsequent crystal growth is described by: monomer ----- > dimer ------ > tetramer ----- > octamer ----- > higher order. It is believed that multimer aggregation of lysozyme occurs by interaction at specific binding sites on the surface of the protein crystals. If the presence of discrete binding sites and the aggregation hypothesis is true, then it follows that the alteration of the binding site(s) should have significant effect on the measurements obtained during growth experiments. Site-directed mutagenesis allows the specific alteration of proteins by replacement, deletion or addition of specific amino acid residues. This report outlines the approach for this strategy and the progress made thus far toward that end.
Author
Protein Crystal Growth; Lysozyme; Gravitational Effects; Biotechnology; Enzymes; Space Processing; Protein Synthesis; Mutagens; Deoxyribonucleic Acid; Macromolecules

19980206204 Alabama Univ., Dept. of Biological Sciences, Huntsville, AL USA

Receptor Expression in Rat Skeletal Muscle Cell Cultures

Young, Ronald B., Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

One on the most persistent problems with long-term space flight is atrophy of skeletal muscles. Skeletal muscle is unique as a tissue in the body in that its ability to undergo atrophy or hypertrophy is controlled exclusively by cues from the extracellular environment. The mechanism of communication between muscle cells and their environment is through a group of membrane-bound and soluble receptors, each of which carries out unique, but often interrelated, functions. The primary receptors include acetyl choline receptors, beta-adrenergic receptors, glucocorticoid receptors, insulin receptors, growth hormone (i.e., somatotropin) receptors, insulin-like growth factor receptors, and steroid receptors. This project has been initiated to develop an integrated approach toward muscle atrophy and hypertrophy that takes into account information on the populations of the entire group of receptors (and their respective hormone concentrations), and it is hypothesized that this information can form the basis for a predictive computer model for muscle atrophy and hypertrophy. The conceptual basis for this project is illustrated in the figure below. The individual receptors are shown as membrane-bound, with the exception of the glucocorticoid receptor which is a soluble intracellular receptor. Each of these receptors has an extracellular signalling component (e.g., innervation, glucocorticoids, epinephrine, etc.), and following the interaction of the extracellular component with the receptor itself, an intracellular signal is generated. Each of these intracellular signals is unique in its own way; however, they are often interrelated.

Author

Atrophy; Gravitational Effects; Microgravity; Muscles; Receptors (Physiology)

52
AEROSPACE MEDICINE

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

19980203583 Civil Aeromedical Inst., Oklahoma City, OK USA

Aeromedical Aspects of Melatonin: An Overview *Final Report*

Sanders, D. C., Civil Aeromedical Inst., USA; Chaturvedi, Arvind K., Civil Aeromedical Inst., USA; Hordinsky, Jerry R., Civil Aeromedical Inst., USA; Mar. 1998; 22p; In English

Contract(s)/Grant(s): AM-B-97-TOX-202

Report No.(s): DOT/FAA/AM-98/10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Melatonin, a pineal hormone present in the blood of humans and other species, has a distinct diurnal variation in its biosynthesis and, therefore, in its concentration. This variation has suggested the possibility of a regulatory function in day/night-dependent physiological processes, such as sleep, and has led scientists to explore the effects of administered melatonin on the modulation of circadian rhythms. For the self-treatment of sleep disorders and other benefits, melatonin usage has been extolled, to the extent that 20 million new consumers were added to the U.S. retail market in 1995. Its principal aeromedical application has been in the experimental treatment of jet lag effects. For aircraft passengers, melatonin administration at destination-bedtime appears to improve sleep quality and to decrease the time required to reestablish normal circadian rhythms. For international aircrews, who travel through multiple time zones without time to adapt to new environments, taking melatonin prior to arriving home may further impair already disturbed circadian rhythms. Its use to adjust to shiftwork changes by air traffic controllers, aircraft maintenance workers, and support personnel is even more controversial. Limited studies suggest that giving this hormone to shift workers should be done only under controlled conditions and that taking it at the wrong time may actually impair job performance. Because of its possible interaction with certain medications and the changes in its concentrations observed in some clinical conditions, the practitioner must exercise caution during the medical certification of airmen. The variations in the concentration of melatonin can be effectively determined by radioimmunoassay, high-performance liquid chromatography, and gas chromatography-mass spectroscopy analytical techniques. These techniques are capable of measuring the human daytime (10 pg/mi) and nighttime (30- 120 pg/mi) melatonin in plasma/serum. Melatonin measurements in victims of accidental deaths may allow forensic scientists and accident investigators to utilize the relationship between its concentration and the time of day when death occurred. The most accurate estimations of the time of death result from analysis of melatonin content of the whole pineal body, whereas less accurate estimates are obtained from serum and urine analyses-pineal levels of melatonin are unlikely to be altered by exogenous melatonin, but its blood and urine levels would change. Its high blood levels in a daytime crash victim would suggest exogenous supple-

mentation. The possible interfering effects of postmortem biochemical processes on melatonin concentrations in whole blood and in other tissues are not
Author
Biochemistry; Pharmacology; Toxicology; Jet Lag; Accident Investigation; Diurnal Variations

19980203927 Army Research Inst. of Environmental Medicine, Natick, MA USA
Joint Service Lightweight Integrated Suit Technology Program: Heat Strain Evaluation in an Environmental Chamber and in the Field
Levine, Leslie, Army Research Inst. of Environmental Medicine, USA; Johnson, Richard F., Army Research Inst. of Environmental Medicine, USA; Teal, Walter B., Jr., Army Research Inst. of Environmental Medicine, USA; Cadarette, Bruce S., Army Research Inst. of Environmental Medicine, USA; Merullo, Donna J., Army Research Inst. of Environmental Medicine, USA; Mar. 1998; 209p; In English; Prepared in collaboration with Geo-Centers, Inc., Newton, MA.
Report No.(s): AD-A343851; USARIEM-TR-70-25; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The Joint Service Lightweight Integrated Suit Technology (JSLIST) Program, defined in a 1993 Memorandum of Agreement signed by representatives of the U.S. Marines, Army, Navy, and Air Force, is responsible for overseeing development, production, and deployment of the next generation of chemical/biological protective suits. This report is of two human studies conducted to: (1) address the services requirement for new garments that impose less heat stress than current protective garments, and (2) provide data for the Health Hazard Assessment. The suits tested included overgarment, undergarment and duty uniform concepts. The field study was conducted at Yuma Proving Ground, AZ in the summer of 1995, and a controlled environmental chamber study was conducted in the summer of 1996 at the USA Army Research Institute of Environmental Medicine and the USA Navy Clothing and Textile Research Facility, Natick, MA. Physiological measures were made of rectal temperature, skin temperature, heart rate, sweating rate, and test time; while questionnaires evaluated subjective symptoms of heat illness. The results of the field and chamber studies indicate that the Army's Battledress Overgarment imposes the most heat strain, the Marine Saratoga and Navy Chemical Protective Overgarment impose the least, and the JSLIST prototype garments imposed heat strain that ranged between the worst and best controls.
DTIC
Body Temperature; Signs and Symptoms; Protective Clothing; Heat Tolerance; Test Chambers

19980203938 Los Alamos National Lab., NM USA
Distributed telemedicine for the National Information Infrastructure
Forslund, D. W., Los Alamos National Lab., USA; Lee, Seong H., Los Alamos National Lab., USA; Reverbel, F. C., Los Alamos National Lab., USA; [1997]; 6p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2047; DE97-008716; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

TeleMed is an advanced system that provides a distributed multimedia electronic medical record available over a wide area network. It uses object-based computing, distributed data repositories, advanced graphical user interfaces, and visualization tools along with innovative concept extraction of image information for storing and accessing medical records developed in a separate project from 1994-5. In 1996, we began the transition to Java, extended the infrastructure, and worked to begin deploying TeleMed-like technologies throughout the nation. Other applications are mentioned.
DOE
Telemedicine; Computer Networks; Information Systems; Graphical User Interface

19980205633 Veridian, Dayton, OH USA
Variability of Hearing Protector Attenuation Measurement Data: A View of Interlaboratory Studies ***Interim Report, Jan. 1997 - Jan 1998***
Nixon, Charles W., Veridian, USA; Jan. 1998; 48p; In English
Contract(s)/Grant(s): F41624-95-C-6014; AF Proj. 7184
Report No.(s): AD-A343956; AFRL-HE-WP-SR-1998-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of national and international measurement standards is to provide consensus procedures that produce reliable qualitative and quantitative data. A standard measurement procedure is expected to produce similar results when implemented by different users. The effectiveness of hearing protection devices in noisy environments is determined using procedures that comply with hearing protector attenuation measurement standards. However, the values collected under these specified conditions do not show the expected levels of repeatability. Results in one laboratory are usually not repeat in others. The inability to achieve the

expected similarity of results is attributed to the numerous sources of variability in the measurement processes and facilities. Some sources of variability cannot be eliminated; others may be minimized with knowledge about the sources and proper actions initiated to counteract them. Variability is so extensive in these data that utilization of the results can increase the probability of incorrect conclusions. Variability among interlaboratory comparison studies with each using the same measurement standard are reviewed and discussed. This discussion is intended primarily, but not exclusively, for those who may not be fully informed about the measurement of hearing protector attenuation.
DTIC
Probability Theory; Variability; Analogies; Hearing

19980205634 Veridian, Dayton, OH USA
Articulated Total Body Model, Version 5, User's Manual
Cheng, Huaining, Veridian, USA; Rizer, Annette L., Veridian, USA; Obergefell, Louise A., Veridian, USA; Feb. 1998; 107p; In English
Contract(s)/Grant(s): F-41624-95-C-60114; AF Proj. 7184
Report No.(s): AD-A343957; AFRL-HE-WP-TR-1998-0015; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The Articulated Total Body (ATB) Model is used by the Air Force Research Laboratory (AFRL) and other organizations, companies ad educational institutions for predicting gross human body response in various dynamic environments, especially automobile crashes and aircraft ejection with wind blast exposure. The ATB-V Model introduces three new simulation tools: (1) water force simulation, (2) joint actuator simulation, and (3) deformable segments, along with several minor changes. This User's Guide accompanies the release of the ATB-V version. It contains comprehensive information on the ATB model and its input structure. It is restructured completely from the previous version's User Guide with extensive modifications. Section 1 provides guidelines on how to Install and the ATB program. Section 2 gives a general description of the ATB model and its structure. An overview of the ATB input data and output files is provided in Section 3. The appendices contain example input and output files from the model.
DTIC
Computerized Simulation; Predictions; Deformation; Education; Actuators

19980205843 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Thermal Environment of Litter Positions and Human Responses Onboard Hercules C-130 Aircraft
Walsh, Margaret M., Air Force Inst. of Tech., USA; May 15, 1998; 95p; In English
Report No.(s): AD-A344548; AFIT-98-011; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This non-experimental, descriptive correlational research study examined the thermal environment of lifter positions and human responses onboard the Hercules C-130 aircraft. The C-13O aircraft is a cargo aircraft that can be configured to transport patients. Thermal stress is one of eight stresses of flight patients experience in the airborne environment. The study measured ambient air temperature, air flow, perception of thermal environment, perception of thermal comfort, tympanic temperature and skin temperature. Measurements were obtained preflight, post flight and every fifteen minutes inflight.
DTIC
Thermal Stresses; Thermal Environments; Responses; Thermal Comfort

53
BEHAVIORAL SCIENCES

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

19980203353 Minnesota Univ., Dept. of Psychology, Minneapolis, MN USA
Cognitive Modeling and Task Analysis: Basic Processes and Individual Differences ***Final Report, 1 Apr. - 15 Dec. 1997***
Ackerman, Phillip L., Minnesota Univ., USA; Dec. 1997; 7p; In English
Contract(s)/Grant(s): F49620-97-1-0209; AF Proj. 2313
Report No.(s): AD-A339222; AFRL-SR-BL-TR-98-0245; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The multi-pronged research program is aimed at developing and empirically evaluating an integrated component approach that determines how critical task characteristics and human operator characteristics interact to produce degraded performance under high workload conditions. The approach involves four major facets: (1) a synthetic task platform modeled on the U.S.A.F. Airborne Warning and Control Systems (AWACs) Weapons Director tasks; (2) a basic processes model of human information

processing dimensions; (3) a model of individual differences characteristics; and (4) a military relevant simulation for testing and validation of the integrated process individual differences model.
DTIC
AWACS Aircraft; Warning Systems; Workloads (Psychophysiology)

19980206093 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Color Constancy: Color Recovery from Biased Illumination
Hwang, Po-Wie, National Tsing Hua Univ., Taiwan, Province of China; Hsu, Wen-Hsing, National Tsing Hua Univ., Taiwan, Province of China; Chen, Yung-Sheng, Yuan-Ze Inst. of Tech., Taiwan, Province of China; Cheng, Fang-Hsuan, Chung-Hua Polytechnic Inst., Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 177-187; In English
Contract(s)/Grant(s): NSC81-0408-E007-530; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In color vision, it is of great importance to steadily extract color descriptors under various illuminative conditions. This is called color constancy. In general, the reflected light of an object is dependent on two components which are the illumination of the environment and the surface reflectance of the object. If we don't have enough information about the scene, we could not correctly say the color that we see is real or biased by the ambient light. Thus, all we can do is to feel it in global view. to estimate the surface reflectance even when the spectral distribution of the ambient light is unknown, an algorithm consisting of a finite-dimensional model, a homomorphic model, a statistical model, and a recovery model, is proposed. Some experiments conducted under different illuminative conditions confirm that the proposed algorithm is feasible.
Author
Color; Spectral Reflectance; Mathematical Models; Image Reconstruction; Light Transmission; Statistical Distributions

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

19980203656 Mystech Associates, Inc., Falls Church, VA USA
Representation of Non Visual Stimuli as a Precursor to Mannequin Stimulation over the Internet ***Final Report, 23 Sep. 1997 - 30 Apr. 1998***
Lyell, M. J., Mystech Associates, Inc., USA; Apr. 30, 1998; 252p; In English
Contract(s)/Grant(s): M67004-97-C-0047
Report No.(s): AD-A343396; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Report developed under SBIR contract. This effort resulted in a "Human Response to Stimuli" Federation Object Model (FOM). During this effort, an investigation into the representation of stimuli vis-a-vis the human recipient was performed. A Stimuli simulation object model and a Physiological simulation object model were developed prior to the construction of the FOM. As the present effort did not originate with legacy simulations. the first issue was to address the conceptual model of the mission space. In the development of the Stimuli SOM, the questions of scalability, relevance of stimuli, and characterization of stimuli were addressed. The effort resulted in the creation of a set of informational attributes and the concept of simple versus complex stimuli. Both "local" and "global" stimuli are considered. In the representation of the human body, physiological functioning guided the development of the Physiological SOM. Object oriented techniques were heavily utilized in populating this SOM. The question of extensibility, which has ramifications for distance education, is discussed. Different emphasis on intended utilization of the Federation resulted in two divergent FOM structures. Scenarios relevant to this Federation are presented in detail.
DTIC
Visual Perception; Human Reactions; Human Body; Visual Stimuli; Stimulation; Psychological Factors

19980206160 Texas A&M Univ., Bioengineering Program, College Station, TX USA
Evaluation of an Anthropometric Human Body Model for Simulated EVA Task Assessment
Etter, Brad, Texas A&M Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

One of the more mission-critical tasks performed in space is extravehicular activity (EVA) which requires the astronaut to be external to the station or spacecraft, and subsequently at risk from the many threats posed by space. These threats include, but

are not limited to: no significant atmosphere, harmful electromagnetic radiation, micrometeoroids, and space debris. to protect the astronaut from this environment, a special EVA suit is worn which is designed to maintain a sustainable atmosphere (at 1/3 atmosphere) and provide protection against the hazards of space. While the EVA suit serves these functions well, it does impose limitations on the astronaut as a consequence of the safety it provides. Since the astronaut is in a virtual vacuum, any atmospheric pressure inside the suit serves to pressurize the suit and restricts mobility of flexible joints (such as fabric). Although some of the EVA suit joints are fixed, rotary-style joints, most of the mobility is achieved by the simple flexibility of the fabric. There are multiple layers of fabric, each of which serves a special purpose in the safety of the astronaut. These multiple layers add to the restriction of motion the astronaut experiences in the space environment. Ground-based testing is implemented to evaluate the capability of EVA-suited astronauts to perform the various tasks in space. In addition to the restriction of motion imposed by the EVA suit, most EVA activity is performed in a micro-gravity (weight less) environment. to simulate weightlessness EVA-suited testing is performed in a neutral buoyancy simulator (NBS). The NBS is composed of a large container of water (pool) in which a weightless environment can be simulated. A subject is normally buoyant in the pressurized suit; however he/she can be made neutrally buoyant with the addition of weights. In addition, most objects the astronaut must interface with in the NBS sink in water and flotation must be added to render them ”weightless”. The implementation of NBS testing has proven to invaluable in the assessment of EVA activities performed with the Orbiter and is considered to be a key step in the construction of the International Space Station (ISS). While the NBS testing is extremely valuable, it does require considerable overhead to maintain and operate. It has been estimated that the cost of utilizing the facility is approximately $10,000 per day. Therefore it is important to maximize the utility of NBS testing for optimal results. One important aspect to consider in any human/worksite interface is the considerable wealth of anthropometric and ergonomic data available. A subset of this information specific to EVA activity is available in NASA standard 3000. The difficulty in implementing this data is that most of the anthropometric information is represented in a two-dimensional format. This poses some limitations in complete evaluation of the astronaut’s capabilities in a three-dimensional environment. Advances in computer hardware and software have provided for three-dimensional design and implementation of hardware with the advance of computer aided design (CAD) software. There are a number of CAD products available and most companies and agencies have adopted CAD as a fundamental aspect of the design process. Another factor which supports the use of CAD is the implementation of computer aided manufacturing (CAM) software and hardware which provides for rapid prototyping and decreases the time to product in the design process. It is probable that most hardware to be accessed by astronauts in EVA or IVA (intravehicular activity) has been designed by a CAD system, and is therefore represented in three-dimensional space for evaluation. Because of the implementation of CAD systems and the movement towards early prototyping, a need has arisen in industry and government for tools which facilitate the evaluation of ergonomic consideration in a three-dimensional environment where the hardware has been designed by the CAD tools. One such product is Jack which was developed by the University of Pennsylvania with funding from several government agencies, including NASA. While the primary purpose of Jack is to model human figures in a ground-based (gravity) environment, it can be utilized to evaluate EVA-suited activities as well. The effects of simulated gravity must be turned off by turning off ”behaviors”. Although Jack provides human figures for manipulation, the primary instrument to be evaluated for EVA mobility is the work envelope provided by the EVA suit. An EVA Jack suit model has been developed by NASA-JSC and was utilized in this study. This suit model provided a more restrictive motion environment as expected for an EVA suited subject. As part of this study, the anthropometric dimensions for a 50th percentile male were compared with basic anthropometric data and were found to be representative for the population group expected in the NASA flight program. The joints for the suit were created in a manner which provided consistent performance with EVA reach envelopes published in NASA standard #3000.
Derived from text
Anthropometry; Space Suits; Extravehicular Activity; Human Body; Human Factors Engineering; Models; Joints (Junctions); Computerized Simulation; Neutral Buoyancy Simulation

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COMPUTER OPERATIONS AND HARDWARE

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

19980203224 Rome Air Development Center, Griffiss AFB, NY USA
Numerical Simulations of Scattering in a Two-Photon Optical Data Storage System
Kann, Joshua L., Rome Air Development Center, USA; Oct. 1997; 29p; In English
Contract(s)/Grant(s): AF Proj. 4594
Report No.(s): AD-A339242; RL-TR-97-124; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Scattering effects in a two-photon optical data storage system are numerically studied. Surface scattering analysis using a scalar, beam propagation model is performed. The problem is analyzed by computing scattering from randomly varying surfaces, and also by Fourier surface decomposition. Scattering induced by propagation through pages of randomly recorded data marks is also studied using a hybrid finite difference time domain angular spectrum model. Both surface and bulk scattering are shown to influence the spatial properties of the optical beam. Results and some possible implications are presented.
DTIC
Optical Memory (Data Storage); Finite Difference Theory

19980203248 Rising Edge Technologies, Herndon, VA USA
Design of an Advanced Development Model Optical Disk-Based Redundant Array of Independent Disks (RAID) High Speed Mass Storage Subsystem ***Final Report, Jul. 1994 - Sep. 1996***
Lewis, Michael E., Rising Edge Technologies, USA; Maffei, Donald M., Rising Edge Technologies, USA; Schutte, Michael M., Rising Edge Technologies, USA; Oct. 1997; 220p; In English
Contract(s)/Grant(s): F30602-94-C-0046; AF Proj. 3192
Report No.(s): AD-A341320; RL-TR-97-184; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The objective of this effort is to design, fabricate, test, deliver and support an Optical Redundant Array of Independent Risks (O-RAID) subsystem for use at Rome Laboratory to demonstrate mass data storage and retrieval operations. In developing new concepts and systems for mass storage, performance and reliability are important features. The O-RAID storage subsystem is designed to enhance the capabilities offered by traditional optical disk drives and RAID storage systems. The O-RAID connects to a variety of host computer systems to provide a high performance, highly reliable mass storage system. The O-RAID design combines the redundant features prescribed to magnetic disk storage with the infinite near line capabilities, removability and archivability of optical disk technology. The subsystem design derives as an integrated storage product consisting of multiple optical disk drives designed to appear as a single disk to a host computer.
DTIC
Design Analysis; Models; Fabrication; Performance Tests; Arrays; Optical Data Storage Materials

19980203453 Eastman Kodak Co., Rochester, NY USA
High Capacity Optical Jukebox ***Final Report, Sep. 1994 - Nov. 1997***
Matukewicz, Dan, Eastman Kodak Co., USA; Williams, Chris, Eastman Kodak Co., USA; Apr. 1998; 27p; In English
Contract(s)/Grant(s): F30602-94-C-0047; AF Proj. 3192
Report No.(s): AD-A343702; AFRL-IF-RS-TR-1998-28; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Air Force Research Laboratory, Information Directorate has been performing research and development in the area of large capacity optical disk storage technology for several years. One area of particular interest is the development of an erasable, large-format (14 inch diameter) optical disk media and a suitable, high-performance optical recording head. A large-format disk provides for extremely large storage capacity in excess of 10 gigabytes with future expansion to 25 gigabytes. The ability to quickly and randomly access large data files is critical as the Air Force increasingly relies on digital imagery, maps, charts and video for multi-sensor exploitation, aircraft mission planning and other time-sensitive military applications. The original objective of this effort was to develop and deliver an automated optical disk jukebox which held 50 erasable optical disks. However, due to changing business conditions, the effort was redirected toward an investigation of those high-risk technologies which may limit future product commercialization. An important element of this effort was to leverage the contractor's current Write-Once, Read Many (WORM) optical jukebox product which promised to reduce the overall technical risk and shorten the development schedule. With today's emphasis on commercial off-the-shelf (COTS) solutions, this approach developed optical media and a disk drive architecture that maps well into future commercialization activities to the benefit of both parties.
DTIC
Technologies; Digital Data; Imagery; Optical Disks; Architecture (Computers); Read-Only Memory Devices; Optical Data Storage Materials; Disk Operating System (DOS)

19980203493 Oregon Graduate Inst. of Science and Technology, Pacific Software Research Center, Portland, OR USA
Language Definition DSDL for Hawk
Matthews, John, Oregon Graduate Inst. of Science and Technology, USA; Cook, Byron, Oregon Graduate Inst. of Science and Technology, USA; Launchbury, John, Oregon Graduate Inst. of Science and Technology, USA; Apr. 22, 1998; 55p; In English
Contract(s)/Grant(s): F19628-96-C-0161
Report No.(s): AD-A343302; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Modern microprocessors require an immense investment of time and effort to create and verify, from the high level architectural design downwards. We are exploring ways to increase the productivity of design engineers by creating a domain specific language for specifying and simulating processor architectures. We believe that the structuring principles used in modern functional programming languages, such as static typing, parametric polymorphism, first class functions, and lazy evaluation provide a good formalism for such a domain specific language, and have made initial progress by creating a library on top of the functional language Haskell. We have specified the integer subset of an out of order, superscalar DLX microprocessor, with register renaming, a reorder buffer, a global reservation station, multiple execution units, and speculative branch execution. Two key abstractions of this library are the signal abstract data type (ADT), which models the simulation history of a wire, and the transaction ADT, which models the state of an entire instruction as it travels through the microprocessor.
DTIC
Microprocessors; Productivity; Design Analysis; Programming Languages; Computer Programming; Architecture (Computers)

19980203645 Naval Postgraduate School, Monterey, CA USA
Handheld Computer Applications in the Navy Command Environment
Surovchak, Robert D., Naval Postgraduate School, USA; Mar. 1998; 325p; In English
Report No.(s): AD-A343534; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

As society becomes increasingly information-oriented, the drive for more capable machines to retrieve, store, process and present such information anywhere, at anytime becomes paramount to success. This is true of USA Navy and Marine Corps officers who must manage large amounts of information while operating in remote areas. Today's very small, portable computers known as "palmtops" are capable of running powerful scaled-down versions of contemporary operating systems. When coupled with a transmission medium, palmtops represent a portable computer that can be used to communicate and process information in ad hoc environments. The Naval Postgraduate School Staff Officer Palmtop Computer Project is designed to analyze the effectiveness of Windows CE-based palmtop computers as an aide to professional Naval officers. The study project provides Naval officers with a popular palmtop computer and allows them to use the device for a four week period. During this time participants are encouraged to use the palmtop for work and personal information tasks. The primary complaints with these devices are ergonomically oriented. There is no convenient and reliable method of data entry and they cannot be easily carried while in uniform. Results from the study indicate that current Windows CE "handheld PCs" are not appropriate for use in this capacity. Recommendations for more useful portable personal computers complete this research.
DTIC
Portable Equipment; Microcomputers; Computer Techniques; Navy; Military Technology

19980203916 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Proving Correctness of a Controller Algorithm for the RAID Level 5 System
Vaziri, Mandana, Massachusetts Inst. of Tech., USA; Lynch, Nancy, Massachusetts Inst. of Tech., USA; Wing, Jeannette M., Carnegie-Mellon Univ., USA; Mar. 1998; 14p; In English; Fault-Tolerant Computing, 1998, Unknown
Contract(s)/Grant(s): F33615-93-1-1330; F30602-97-2-0031
Report No.(s): AD-A343411; CMU-CS-98-117; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Most RAID controllers implemented in industry are complicated and difficult to reason about. This complexity has led to software and hardware systems that are difficult to debug and hard to modify. to overcome this problem Courtright and Gibson have developed a rapid prototyping framework for RAID architectures which relies on a generic controller algorithm. The designer of a new architecture needs to specify parts of the generic controller algorithm and must justify the validity of the controller algorithm obtained. However the latter task may be difficult due to the concurrency of operations on the disks. This is the reason why it would be useful to provide designers with an automated verification tool tailored specifically for the RAID prototyping system. As a first step towards building such a tool, our approach consists of studying several controller algorithms manually, to determine the key properties that need to be verified. This paper presents the modeling and verification of a controller algorithm for the RAID Level 5 System. We model the system using I/O automata, give an external requirements specification and prove that the model implements its specification. We use a key invariant to find an error in a controller algorithm for the RAID Level 6 System.
DTIC
Algorithms; Program Verification (Computers); Computer Programs; Proving; Architecture (Computers); Correction; Fault Tolerance; Automata Theory

19980205521 Recherche en Prevision Numerique, Dorval, Quebec Canada

Performance of MC2 and the ECMWF IFS Forecast Model on the Fujitsu VPP700 and NEC SX-4M

Desgagne, Mike, Recherche en Prevision Numerique, Canada; Dent, David, European Centre for Medium-Range Weather Forecasts, UK; Thomas, Steve, Recherche en Prevision Numerique, Canada; Valin, Michael, Recherche en Prevision Numerique, Canada; Mozdzynski, George, European Centre for Medium-Range Weather Forecasts, UK; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 1-11; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The NEC SX-4M cluster and Fujitsu VPP700 supercomputers are both based on custom vector processors using low-power CMOS technology. Their basic architectures and programming models are however somewhat different. A multi-node SX-4M cluster contains up to 32 processors per shared memory node, with a maximum of 16 nodes connected via the proprietary NEC IXS fiber channel crossbar network. A hybrid combination of inter-node MPI message-passing with intra-node multi-tasking or threads is possible. The Fujitsu VPP700 is a fully distributed-memory vector machine with a scalable crossbar interconnect which also supports MPI. The parallel performance of the MC2 model for high-resolution mesoscale forecasting over large domains and of the IFS RAPS 4.0 benchmark are presented for several different machine configurations. These include an SX-4/32 with 8 GB main memory unit (MMU), an SX-4/32M cluster (SX-4/16, 8 GB MMU + SX-4/16, 4 GB MMU) and up to 80 PE's of the VPP700. Author

Supercomputers; Memory (Computers); Distributed Memory; CMOS

19980205528 Recherche en Prevision Numerique, Dorval, Quebec Canada

Optimizing MC2 for RISC Architectures: Forecast Accuracy Versus Performance

Thomas, Steve, Recherche en Prevision Numerique, Canada; Hacker, Joshua, British Columbia Univ., Canada; Desgagne, Michel, Recherche en Prevision Numerique, Canada; Stull, Roland, British Columbia Univ., Canada; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 77-93; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Current generation RISC microprocessors operate at clock frequencies ranging up to 1 GHz with the ability to complete two or more floating point operations (flops) per clock cycle. to sustain a significant percentage of peak performance, large secondary L2 cache memories based on fast SRAM technology are essential. Single processor optimizations are presented for the MC2 model code on the MIPS R10000 and SUN UltraSparc 2 microprocessors. Ensemble forecast techniques for high resolution mesoscale simulations are applied to assess the impact of aggressive floating point optimizations on forecast accuracy. Parallel benchmarks of the MC2 model (adiabatic kernel + physics) on the SGI/Cray Origin 2000 and Fujitsu AP3000 are also presented. The relative efficiency of line relaxation preconditioners for minimal residual Krylov iterative solvers is reported in the context of real-time mesoscale forecasting.

Author

Weather Forecasting; Mesometeorology; Cray Computers; Mesoscale Phenomena; Optimization; Computerized Simulation; Scientific Visualization

19980205650 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK

Asynchronous Microprocessors: From High Level Model to FPGA Implementation

Lloyd, L., Newcastle-upon-Tyne Univ., UK; Heron, K., Newcastle-upon-Tyne Univ., UK; Koelmans, A. M., Newcastle-upon-Tyne Univ., UK; Yakovlev, A. V., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 34p; In English

Report No.(s): PB98-147853; TRS-610; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to determine the applicability of both programmable software tools and programmable hardware for asynchronous logic applications an implementation, employing FPGA devices, of the instruction decode and the instruction execution stages of an asynchronous microprocessor, the ADLX, is presented. The foundation for that microprocessor is based on the employment of event driven logic, specifically 2-phase transition signalling, that functions within the conceptual framework of a Sutherland micro pipeline. The entire design has been constructed from a series of VHDL descriptions that have been compiled and simulated using both the Cypress WARP VHDL Development System and the AMD MACHXL software packages. A number of the asynchronous specific areas of the ADLX have been synthesized using Petrify, a Petri Net tool designed for the manipulation of concurrent specifications of asynchronous control circuits.

NTIS

Pipelining (Computers); Petri Nets; Microprocessors; Hardware Description Languages; Synchronism; Software Development Tools

19980205817 National Inst. of Standards and Technology, Software Diagnostics and Conformance Testing Div., Gaithersburg, MD USA

Experience Report: Comparing an Automated Conformance Test Development Approach with a Traditional Development Approach

Goldfine, A., National Inst. of Standards and Technology, USA; Fisher, G., National Inst. of Standards and Technology, USA; Rosenthal, L., National Inst. of Standards and Technology, USA; Apr. 1998; 46p; In English

Report No.(s): PB98-149172; NISTIR-6114; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes a project at the National Institute of Standards and Technology (NIST) that investigated the effectiveness of using automated software test generation methods to help develop conformance tests for implementations of specifications of software standards. Recently, several technologies that automate parts of the software test development process have appeared. This paper describes a case study that compared the use of a particular automated method (the Assertion Defintion Language (ADL), developed by Sun Microsystems, Inc.) to develop conformance tests, compared with the use of traditional methods, when both methods were applied to the same standard software specifications.

NTIS

Programming Languages; Effectiveness; Product Development; Performance Tests; Architecture (Computers)

61
COMPUTER PROGRAMMING AND SOFTWARE

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

19980203228 Naval Postgraduate School, Monterey, CA USA

A Static Secure Flow Analyzer for a Subset of Java

Harvey, James D., Naval Postgraduate School, USA; Mar. 1998; 98p; In English

Report No.(s): AD-A343709; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

As the number of computers and computer systems in existence has grown over the past few decades, we have come to depend on them to maintain the security of private or sensitive information. The execution of a program may cause leaks of private or sensitive information from the computer. Static secure flow analysis is an attempt to detect these leaks prior to program execution. It is possible to analyze programs by hand, but this is often impractical for large programs. A better approach is to automate the analysis, which is what this thesis explores. We describe some previous research and give background information about secure flow analysis. A secure flow analyzer is presented. It implements a secure flow type inference algorithm, for a subset of Java 1.0.2, using a parser generator called Java Compiler Compiler (JavaCC). Semantic actions are inserted into a grammar specification to perform the secure flow analysis on a given program.

DTIC

Software Engineering; Data Processing; Statics; Programming Languages; Computers; Computer Information Security; Compilers

19980203237 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

A Reverse-Engineering Environment Framework ***Final Report***

Tilley, Scott, Carnegie-Mellon Univ., USA; Apr. 1998; 55p; In English

Contract(s)/Grant(s): F19628-95-C-0003

Report No.(s): AD-A343688; CMU/SEI-98-TR-005; ESC-TR-98-005; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes a framework for reverse engineering environments used to aid program understanding. The framework is based on a descriptive model that categorizes important support mechanism features based on a hierarchy of attributes. The attributes include cognitive model support, reverse-engineering tasks, canonical activities that are characteristic of the reverse-engineering process, quality attributes supported by the reverse-engineering environment, and miscellaneous characteristics.

DTIC

Software Engineering; Reverse Engineering; Environments

19980203330 University of Southern California, Information Sciences Inst., Marina del Rey, CA USA

VEIL: Research in Knowledge Representation for Computer Vision ***Final Report, Sep. 1993 - Dec. 1996***

Russ, Thomas A., University of Southern California, USA; Price, Keith, University of Southern California, USA; MacGregor, Robert B., University of Southern California, USA; Nevatia, Ram, University of Southern California, USA; Salemi, Behnam,

University of Southern California, USA; Feb. 1998; 74p; In English
Contract(s)/Grant(s): F30602-93-C-0064; AF Proj. H767
Report No.(s): AD-A341150; RL-TR-97-213; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The VEIL (Vision Environment Integrating Loom) project integrated advanced Knowledge Representation (KR) technology (Loom) with image understanding technology. The major innovations are as follows: 1) Use of declarative knowledge (as opposed to procedural knowledge) in vision systems made extending the recognition capabilities of the software easier. 2) Facilitated integrating high-level vision routines (recognizing sequences of scenes) with low-level routines that recognize picture elements. 3) Declarative knowledge enabled interaction with the system at a level of abstraction appropriate to the domain task. This included associating collateral information with the objects recognized by low-level image understanding programs. Loom is a powerful tool incorporating strong, frame-based representation capabilities, explicit term subsumption, and several powerful reasoning paradigms (including logical deduction, object-oriented methods, and production rules). Loom also provides knowledge representation integrity through consistency checking and truth maintenance. Infusing these facilities into the vision problem area, where strong KR capabilities have not yet been developed, significantly altered and improved the methodology for constructing vision systems. Finally, Loom was interfaced to a variety of vision processing elements to provide a new tool of extended capabilities. The result is a powerful software environment for the development of vision systems.
DTIC
Computer Programs; Computer Vision; Knowledge Representation; Object-Oriented Programming

19980203344 Air Force Research Lab., Vehicles Directorate, Wright-Patterson AFB, OH USA
Missile Datcom: User's Manual: 1997 FORTRAN 90 ***Final Report, 1 Apr. 1993 - 31 Dec. 1997***
Blake, William B., Air Force Research Lab., USA; Feb. 1998; 110p; In English
Contract(s)/Grant(s): Proj-2403
Report No.(s): AD-A344707; AFRL-VA-WP-TR-1998-3009; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report is a user's manual for the 1997 fortran 90 revision of the missile datcom computer program. In missile preliminary design it is necessary to quickly and economically estimate the aerodynamics of a wide variety of missile configuration designs. Since the ultimate shape and aerodynamic performance are so dependent upon the subsystems utilized, such as payload size, propulsion system selection and launch mechanism, the designer must be capable of predicting a wide variety of configurations accurately. The fundamental purpose of Missile Datcom is to provide an aerodynamic design tool which has the predictive accuracy suitable for preliminary design, and the capability for the user to easily substitute methods to fit specific applications.
DTIC
Missile Configurations; Systems Engineering; Missiles; User Manuals (Computer Programs); FORTRAN

19980203404 Army Research Lab., Aberdeen Proving Ground, MD USA
MPI and HPF Performance in a DEC Alpha Cluster ***Final Report, Oct. - Dec. 1997***
Shires, Dale, Army Research Lab., USA; May 1998; 65p; In English
Report No.(s): AD-A343800; ARL-TR-1668; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

There are several different types of parallel computer architectures in use today. Some of these are large machines that house hundreds of processors with low- to mid-range computing capabilities. A different type of parallel computer architecture becoming increasingly popular is that of the cluster. Clusters are basically networked workstations: each containing 1 to approx. 30 processors with mid- to high-range computing capabilities. While arguments can be made for both paradigms, clusters seem to be gaining in popularity. They provide fast computation through multiplicity and fast processor throughput. Furthermore, code reuse on different cluster environments is now possible with the adoption of standard interprocessor communication tools like the Message-Passing Interface (MPI) and High Performance FORTRAN (HPF). This report compares and contrasts the performance of MPI and HPF on a currently available computer cluster.
DTIC
FORTRAN; Architecture (Computers); Computation; Interprocessor Communication; Parallel Computers; Comparison

19980203419 Energia Nucleare e Delle Energie Alternative, Centro Richerche Casaccia, Rome, Italy
Faster image I/O on quadrics through data packing and unpacking
Taraglio, S., Energia Nucleare e Delle Energie Alternative, Italy; Valentinotti, F., Energia Nucleare e Delle Energie Alternative, Italy; Mar. 1997; ISSN 1120-5571; 11p; In English
Report No.(s): ENEA-RT-INN-97-02; RT/INN-97-2; DE97-765454; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

We present extremely simple but efficient algorithm able to enhance the I/O performances of the Quadrics super computer family, while loading images. The algorithm packs/unpacks integer data into 4 bytes floating point numbers, the standard word of the machine. The resulting performances are interesting for image analysis applications.
DOE
Algorithms; Data Processing; Supercomputers

19980203451 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Steps in an Architecture Tradeoff Analysis Method: Quality Attribute Models and Analysis ***Final Report***
Barbacci, M., Carnegie-Mellon Univ., USA; Carriere, S., Carnegie-Mellon Univ., USA; Longstaff, T., Carnegie-Mellon Univ., USA; Weinstock, C., Carnegie-Mellon Univ., USA; Feiler, P., Carnegie-Mellon Univ., USA; May 1998; 45p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A343692; CMU/SEI-97-TR-029; ESC-TR-97-029; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents some of the steps in an emerging architecture tradeoff analysis method (ATAM). The objective of the method is to provide a principled way to understand a software architecture's fitness with respect to multiple competing quality attributes: (1) modifiability, (2) security, (3) performance, availability, and (4) so forth. These attributes can interact or conflict-improving one often comes at the price of worsening one or more of the others, thus it is necessary to trade off among multiple software quality attributes at the time the software architecture of a system is specified, and before the system is developed. This report illustrates typical quality attribute models, analyses, and tradeoffs using a small real-time industrial application.
DTIC
Systems Analysis; Architecture (Computers); Tradeoffs

19980203483 Naval Postgraduate School, Monterey, CA USA
Computer Programs Supporting Instruction in Acoustics
Melody, Kevin A., Naval Postgraduate School, USA; Mar. 1998; 120p; In English
Report No.(s): AD-A343632; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Acoustics is a field of study not easily understood and laboratory experiments which might shed light on problems in acoustics are complex and expensive to accomplish. Computers have become a valuable tool in many fields of study in order to examine problems which would be difficult and expensive, if not impossible to study using traditional methods. This thesis is an extension of work previously completed by Thomas Green to support instruction utilizing the text, Fundamentals of Acoustics, Third Edition, John Wiley & Sons, Inc., by Coppens, Frey, Kinsler, and Sanders. The fourth edition of Fundamentals of Acoustics is currently in revision and the computer programs explained in this thesis will be used to support it. All programs utilize MATLAB, a widely accepted programming language for accomplishing numerical analysis of engineering problems. The benefit of these programs will be very dependant on students using them in conjunction with the text.
DTIC
Computer Programs; Acoustics; User Manuals (Computer Programs); Computer Aided Design

19980203495 Massachusetts Inst. of Tech., Cambridge, MA USA
Applications of the Theory of Distributed and Real Time Systems to the Development of Large-Scale Timing Based Systems ***Progress Report***
Lynch, Nancy, Massachusetts Inst. of Tech., USA; Mar. 1998; 12p; In English
Contract(s)/Grant(s): F19628-95-C-0118
Report No.(s): AD-A343281; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We continued our project on the IOA language and toolset, which are designed to support our 'abstract distributed programming'formal approach to distributed system design and analysis.
Derived from text
Real Time Operation; Timing Devices; Data Processing; Computer Systems Simulation

19980203500 Defence Science and Technology Organisation, Electronic and Surveillance Research Lab., Salisbury, Australia
Supporting a Component-Based Software Engineering Approach for the Development of Takari Products and Future Command and Control Systems
Vernik, R. J., Defence Science and Technology Organisation, Australia; Phillips, M. P., Defence Science and Technology Organisation, Australia; Landherr, S. F., Defence Science and Technology Organisation, Australia; Dec. 1997; 46p; In English
Report No.(s): AD-A343198; DSTO-TR-0596; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses issues related to the methods and tools required to support the development and evolution of future generations of Command Control Communications Intelligence and Information Warfare (C3I/IW) systems. It focuses on concepts and approaches defined as part of the Takari programme and considers issues related to tool support for the development of Takari Capability and Technology Demonstrators (CTDs) such as the proposed Experimental C3I Technology Environment (EXC3ITE). A Component-Based Software Engineering (CBSE) lifecycle, which includes both Domain Engineering and Product Engineering, is proposed as a possible development strategy. A tool categorisation framework is defined to help define tool requirements. An initial survey of CBSE tools provides examples of currently available tools which could be considered for each of the tool categories.
DTIC
Software Engineering; Procedures; Information Systems; Command and Control; Communication Networks; Information Management

19980203653 Naval Postgraduate School, Monterey, CA USA
An Approach to Mobile Agent Security in Java
Virden, Roy J., Naval Postgraduate School, USA; Mar. 1998; 98p; In English
Report No.(s): AD-A343420; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

For many years, people have talked about the advantages of programs that can roam networks and provide services for a client. The programs, called agents, have many military applications as well. Among them, for instance, is data mining, where an agent is dispatched to find information for a client. There are security risks associated with agents. For instance, in the data mining example, a client must be able to trust the information returned. If a trusted node in a network can be spoofed, then an untrusted node can easily corrupt the results of the mining operation. This thesis presents a protocol to guard against this sort of attack. The protocol assumes that every trusted host knows all other trusted hosts. Though unrealistic for some commercial applications, it seems like a reasonable assumption for military applications.
DTIC
Computer Networks; Protocol (Computers); Mining; Military Technology

19980203655 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Pthreads for Dynamic Parallelism
Narlikar, Girija J., Carnegie-Mellon Univ., USA; Blelloch, Guy E., Carnegie-Mellon Univ., USA; Apr. 1998; 23p; In English
Contract(s)/Grant(s): DABT63-96-C-0071
Report No.(s): AD-A343398; CMU-CS-98-114; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Expressing a large number of lightweight, parallel threads in a shared address space significantly cases the task of writing a parallel program. Threads can be dynamically created to execute individual parallel tasks; the implementation schedules these threads onto the processors and effectively balances the load. However, unless the threads scheduler is designed carefully, such a parallel program may suffer poor space and time performance. Th this paper, we evaluate the performance of a native, lightweight POSIX threads (Pthreads) library on a shared memory machine using a set of parallel benchmarks that dynamically create a large number of threads. by studying the performance of one of the benchmarks, matrix multiply, we show how simple, yet provably good modifications to the library can result in significantly improved space and time performance. With the modified Pthreads library, each of the parallel benchmarks performs as well as its coarse-grained, hand-partitioned counterpart. These results demonstrate that, provided we use a good scheduler, the rich functionality and standard API of Pthreads can be combined with the advantages of dynamic, lightweight threads to result in high performance.
DTIC
Software Engineering; Loads (Forces); Threads; Parallel Processing (Computers)

19980203662 Army Research Lab., Sensors and Electron Devices Directorate, Adelphi, MD USA
Video Compression using Vector Quantization ***Interim Report, May - Jul. 1997***
Venkatraman, Mahesh, Army Research Lab., USA; Kwon, Heesung, Army Research Lab., USA; Nasrabadi, Nasser M., Army Research Lab., USA; May 1998; 46p; In English
Report No.(s): AD-A344253; ARL-TR-1535; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents some results and findings of our work on very-low-bit-rate video compression systems using vector quantization (VQ). We have identified multiscale segmentation and variable-rate coding as two important concepts whose effective use can lead to superior compression performance. Two VQ algorithms that attempt to use these two aspects are presented: one based on residual vector quantization and the other on quadtree vector quantization. Residual vector quantization is a successive approximation quantizer technique and is ideal for variable-rate coding. Quadtree vector quantization is inherently a multiscale

coding method. The report presents the general theoretical formulation of these algorithms, as well as quantitative performance of sample implementations.
DTIC
Video Compression; Vector Quantization; Image Processing; Video Signals; FLIR Detectors

19980203702 Texas Univ., Inst. for Fusion Studies, Austin, TX USA
On exactly conservative integrators
Bowman, J. C., Max-Planck-Inst. fuer Plasmaphysik, Germany; Shadwick, B. A., California Univ., USA; Morrison, P. J., Texas Univ., USA; Jun. 1997; 11p; In English
Contract(s)/Grant(s): DE-FG03-96ER-54346
Report No.(s): DOE/ER/54346-791; IFSR-791; DE97-007993; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Traditional explicit numerical discretizations of conservative systems generically predict artificial secular drifts of nonlinear invariants. These algorithms are based on polynomial functions of the time step. The authors discuss a general approach for developing explicit algorithms that conserve such invariants exactly. They illustrate the method by applying it to the truncated two-dimensional Euler equations.
DOE
Algorithms; Two Dimensional Models; Conservation Laws; Differential Equations; Integrators

19980203732 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
The Fox Project: Advanced Language Technology for Extensible Systems
Harper, Robert, Carnegie-Mellon Univ., USA; Lee, Peter, Carnegie-Mellon Univ., USA; Pfenning, Frank, Carnegie-Mellon Univ., USA; Jan. 1998; 27p; In English
Contract(s)/Grant(s): ARPA ORDER-C533
Report No.(s): AD-A341557; CMU-CS-98-107; CMU-CS-FOX-98-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It has been amply demonstrated in recent years that careful attention to the structure of systems software can lead to greater flexibility, reliability, and ease of implementation, without incurring an undue penalty in performance. It is our contention that advanced programming languages particularly languages with a mathematically rigorous semantics, and featuring higher-order functions, polymorphic types, and a strong module system are ideally suited to expressing such structure. Indeed, our previous research has shown that the use of an advanced programming language can have a fundamental effect on system design, leading naturally to system architectures that are highly modular, efficient, and allow re-use of code. We are thus working to demonstrate the viability and benefits of advanced languages for programming real world systems, and in particular Active Networks. to achieve this, we have organized our research into the areas of language technology, safety infrastructure, compiler technology, and applications. This report describes the current plans for this effort, which we refer to as the Fox project.
DTIC
Computer Networks; High Level Languages; Technology Utilization

19980203741 Oak Ridge National Lab., TN USA
An algorithm for noisy image segmentation
Xu, Ying, Oak Ridge National Lab., USA; Olman, V., Oak Ridge National Lab., USA; Uberbacher, E. C., Oak Ridge National Lab., USA; 1997; 10p; In English; 15th; Energy Engineering Sciences, 14-16 May 1997, Argonne, IL, USA
Contract(s)/Grant(s): DE-AC05-84OR-21400
Report No.(s): CONF-9705121-4; DE97-008474; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This paper presents a segmentation algorithm for gray-level images and addresses issues related to its performance on noisy images. It formulates an image segmentation problem as a partition of an image into (arbitrarily-shaped) connected regions to minimize the sum of gray-level variations over all partitioned regions, under the constraints that (1) each partitioned region has at least a specified number of pixels, and (2) two adjacent regions have significantly different ”average” gray-levels. to overcome the computational difficulty of directly solving this problem, a minimum spanning tree representation of a gray-level image has been developed. With this tree representation, an image segmentation problem is effectively reduced to a tree partitioning problem, which can be solved efficiently. to evaluate the algorithm, the authors have studied how noise affects the performance of the algorithm. Two types of noise, transmission noise and Gaussian additive noise, are considered, and their effects on both phases

of the algorithm, construction of a tree representation and partition of a tree, are studied. Evaluation results have shown that the algorithm is stable and robust in the presence of these types of noise.
DOE
Algorithms; Image Processing; Random Noise

19980203768 Oregon Graduate Inst. of Science and Technology, Pacific Software Research Center, Portland, OR USA
Reduction-Based Optimizer
Visser, Eelco, Oregon Graduate Inst. of Science and Technology, USA; Benaissa, Zine-el-Abidine, Oregon Graduate Inst. of Science and Technology, USA; Tolmach, Andrew, Oregon Graduate Inst. of Science and Technology, USA; Apr. 22, 1998; 14p; In English
Contract(s)/Grant(s): F19628-96-C-0161; F19628-93-C-0069
Report No.(s): AD-A343376; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe a language for defining term rewriting strategies, and its application to the production of program optimizers. Valid transformations on program terms can be described by a set of rewrite rules; rewriting strategies are used to describe when and how the various rules should be applied in order to obtain the desired optimization effects. Separating rules from strategies in this fashion makes it easier to reason about the behavior of the optimizer as a whole, compared to traditional monolithic optimizer implementations. We illustrate the expressiveness of our language by using it to describe a simple optimizer for an ML-like intermediate representation. The basic strategy language uses operators such as sequential composition, choice, and recursion to build transformers from a set of labeled unconditional rewrite rules. We also define an extended language in which the side-conditions and contextual rules that arise in realistic optimizer specifications can themselves be expressed as strategy-driven rewrites. We show that the features of the basic and extended languages can be expressed by breaking down the rewrite rules into their primitive building blocks, namely matching and building terms in restricted environments. This primitive representation forms the basis of a simple implementation that generates efficient C code.
DTIC
Software Engineering; High Level Languages; Languages

19980203848 Oregon Graduate Inst. of Science and Technology, Pacific Software Research Center, Portland, OR USA
Initial Suite of Small Language Definitions and Implementations for DSDL
Lewis, Jeffrey R., Oregon Graduate Inst. of Science and Technology, USA; Launchbury, John, Oregon Graduate Inst. of Science and Technology, USA; Apr. 22, 1998; 147p; In English
Contract(s)/Grant(s): F19628-96-C-0161
Report No.(s): AD-A343303; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Domain specific languages are small, special purpose languages created to describe computational solutions in a particular problem domain. Domain specific languages have proven themselves useful many times over; however, the cost of defining and implementing a domain specific language can be high. An approach that avoids the overhead of domain specific language definition is to define an embedded language i.e. a collection of definitions in a sufficiently expressive host language. Embedding a domain specific language places high demands on a host language. The host language must be able to express the essence of the domain, while not sacrificing too much in syntax. This report, presents a suite of seven examples of embeddings using the functional programming language Haskell.
DTIC
Software Engineering; Programming Languages; Computer Programming

19980203892 Cornell Univ., Mathematical Sciences Inst., Ithaca, NY USA
Logic Programs, Well-orderings and Forward Chaining
Marek, W. V., Kentucky Univ., USA; Nerode, A., Cornell Univ., USA; Remmel, J. B., California Univ., San Diego, USA; Mar. 31, 1998; 53p; In English
Contract(s)/Grant(s): DAAH04-96-1-0341
Report No.(s): AD-A344201; TR-98-05; ARO-35873.65-MA-MUR; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We investigate the construction of stable models of general propositional logic programs. We show that a forward-chaining technique, supplemented by a properly chosen safeguards can be used to construct stable models of logic programs. Moreover, the proposed method has the advantage that if a program has no stable model, the result of the construction is a stable model of a subprogram. Further, in such a case the proposed method isolates the inconsistency of the program, that is it points to the part

of the program responsible for the inconsistency. The results of computations are called stable submodels. We prove that every stable model of a program is a stable submodel. We investigate the complexity issues associated with stable submodels.
DTIC
Mathematical Logic; Program Verification (Computers); Computer Programs

19980203907 North Carolina Univ., Dept. of Computer Science, Raleigh, NC USA
Synthesis of ESI Equivalence Class Combinational Circuit Mutants
Harlow, J., North Carolina Univ., USA; Brglez, F., North Carolina Univ., USA; Oct. 1997; 11p; In English
Contract(s)/Grant(s): DAAH04-94-G-0280
Report No.(s): AD-A344593; ARO-38616.8-EL; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Despite more than a decade of experience with the use of standardized benchmark circuits, meaningful comparisons of EDA algorithms remain elusive. In this paper, we introduce an entirely new methodology for characterizing the performance of Binary Decision Diagram (BDD) software. Our method involves the synthesis of large equivalence classes of Entropy Signature Invariant (ESI) circuits, based on a known reference circuit. We demonstrate that such classes induce controllable distributions of BDD algorithm performance, which provide the foundation for statistically significant comparison of different algorithms.
DTIC
Algorithms; Standardization

19980203968 Los Alamos National Lab., NM USA
The delayed coupling method: An algorithm for solving banded diagonal matrix problems in parallel
Mattor, N., Lawrence Livermore National Lab., USA; Williams, T. J., Lawrence Livermore National Lab., USA; Hewett, D. W., Lawrence Livermore National Lab., USA; Dimits, A. M., Lawrence Livermore National Lab., USA; [1997]; 10p; In English; IMACS 1997 World Congress on Scientific Computing Modeling and Applied Mathematics, 24 - 29 Aug. 1997, Berlin, Germany
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1605; CONF-970876-1; DE97-008306; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We present a new algorithm for solving banded diagonal matrix problems efficiently on distributed-memory parallel computers, designed originally for use in dynamic alternating-direction implicit partial differential equation solvers. The algorithm optimizes efficiency with respect to the number of numerical operations and to the amount of interprocessor communication. This is called the 'delayed coupling method' because the communication is deferred until needed. We focus here on tridiagonal and periodic tridiagonal systems.
DOE
Algorithms; Matrices (Mathematics); Parallel Computers; Partial Differential Equations; Interprocessor Communication; Memory (Computers)

19980203971 Los Alamos National Lab., NM USA
Adaptive composite overlapping mesh algorithms on message passing architectures
Brown, D. L., Los Alamos National Lab., USA; Quinlan, D. J., Los Alamos National Lab., USA; Chesshire, G. S., Los Alamos National Lab., USA; Henshaw, W. D., Los Alamos National Lab., USA; Berndt, M., Colorado Univ., USA; [1997]; 6p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2169; DE97-008590; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This project developed high-level computational tools that facilitate the development of fluid flow simulation software using the adaptive composite overlapping mesh method. An objective-oriented approach was take which used the C++ programming language to develop libraries containing C++ classes that provide abstractions of the basic operations required to assemble the required simulation software. Through this approach, it was also possible to hide many of the details of the computations required on parallel computer architectures. Result is the basis for a high-level programming environment that facilitates the development of high-resolution simulation software on serial or parallel computer architectures for the equations describing fluid flow in regions with complex geometry.
DOE
Computerized Simulation; Computational Grids; Computer Programming; Algorithms; Fluid Flow

19980204709 National Inst. of Standards and Technology, Manufacturing Systems Integration Div., Gaithersburg, MD USA
Integration Strategies for the Reactive Scheduling
Thomas, D. W., National Inst. of Standards and Technology, USA; Jun. 1998; 16p; In English
Report No.(s): PB98-148760; NISTIR-6171; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Shop floor operations can be optimized by scheduling applications that not only create an initial schedule but also allow feedback from data collection systems to enable re-scheduling. Interfaces required to integrate the various commercial applications within such a reactive system are being developed at the National Institute of Standards and Technology (NIST).
NTIS
Data Acquisition; Computer Aided Manufacturing; Integrated Library Systems; Programming (Scheduling)

19980205006 North Carolina State Univ., Dept. of Computer Science, Raleigh, NC USA
Optimization of Placement Driven by the Cost of Wire Crossing
Kapur, Nevin, North Carolina State Univ., USA; Ghosh, Debabrata, North Carolina State Univ., USA; Brglez, Franc, North Carolina State Univ., USA; Oct. 1997; 12p; In English
Contract(s)/Grant(s): DAAH04-94-G-0280
Report No.(s): AD-A344498; ARO-33616.7-EL; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We conjecture that good column-based placements can be produced by minimizing two wire crossing numbers: (1) the total wire crossing of all edges between cells in the wiring channel, and (2) the maximum wire crossing on the imaginary cutlines that separate cells on the opposite ends of the channels. We leverage the canonical form of the multi-level bipartite directed graph to formalize a unit-grid model that allows us to define and evaluate parameters such as total wire crossing, critical wire crossing, total wire length, critical wire length, critical wire density, total wire density, as well as height, width, and area of the embedded graph. We implemented a prototype placement algorithm TOCO that minimizes the cost of wire crossing, and a universal unit-grid based placement evaluator place-eval. We have designed a number of statistical experiments to demonstrate the feasibility and the promise of the proposed approach.
DTIC
Wire; Crossings; Costs; Wiring; Experiment Design

19980205007 General Accounting Office, Washington, DC USA
Year 2000 Computing Crisis: An Assessment Guide, Exposure Draft
Willemssen, J. C., General Accounting Office, USA; Franklin, W. S., General Accounting Office, USA; Feb. 1997; 34p; In English
Report No.(s): AD-A344518; GAO/AIMD-10.1.14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The year 2000 date conversion poses a global challenge to the information technology industry. Every organization, whether federal or private, must ensure that its information systems are fully year 2000 compliant well before December 31, 1999. While the year 2000 problem is not technically challenging, it is massive and complex. For many agencies, the year 2000 conversion program will be the largest project ever to be managed and implemented by their information resource management organizations. This guide presents a structured approach and a checklist to aid federal agencies in planning, managing, and evaluating their year 2000 programs. The guide draws heavily on the work of the Best Practices Subcommittees of the Interagency Year 2000 Committee, and incorporates guidance and practices identified by leading organizations in the information technology industry.
DTIC
Computer Programs; Data Management; Information Systems; Exposure; Information Management

19980205520 NASA Goddard Space Flight Center, Greenbelt, MD USA
Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications
OKeefe, Matthew, Editor, Minnesota Univ., USA; Kerr, Christopher L., Editor, International Business Machines Corp., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998; 320p; In English; 2nd; Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications, 15-18 Jun. 1998, Scottsdale, AZ, USA; Sponsored by Department of Energy, USA; Also announced as 19980205521 through 19980205553
Report No.(s): NASA/CP-1998-206860; Rept-98B00049; NAS 1.55:206860; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

This report contains the abstracts and technical papers from the Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications, held June 15-18, 1998, in Scottsdale, Arizona. The pur-

pose of the workshop is to bring together software developers in meteorology and oceanography to discuss software engineering and code design issues for parallel architectures, including Massively Parallel Processors (MPP's), Parallel Vector Processors (PVP's), Symmetric Multi-Processors (SMP's), Distributed Shared Memory (DSM) multi-processors, and clusters. Issues to be discussed include: (1) code architectures for current parallel models, including basic data structures, storage allocation, variable naming conventions, coding rules and styles, i/o and pre/post-processing of data; (2) designing modular code; (3) load balancing and domain decomposition; (4) techniques that exploit parallelism efficiently yet hide the machine-related details from the programmer; (5) tools for making the programmer more productive; and (6) the proliferation of programming models (F--, OpenMP, MPI, and HPF).
Author
Massively Parallel Processors; Software Engineering; Data Structures; Distributed Memory; Parallel Processing (Computers); Systems Engineering; Structured Programming; Software Development Tools; Conferences; Ocean Models; Atmospheric Models

19980205524 Princeton Univ., Geophysical Fluid Dynamics Lab., NJ USA
Key Elements of the User-Friendly, GFDL SKYHI General Circulation Model
Hemler, Richard S., Princeton Univ., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 29-43; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

SKYHI is a grid-point atmospheric general circulation model which was developed at the NOAA Geophysical Fluid Dynamics Laboratory nearly twenty years ago. The model is global, and extends in the vertical from the ground to about 80 km. SKYHI has been used to investigate various tropospheric, stratospheric and mesospheric phenomena, including sudden stratospheric warmings, the quasi-biennial oscillation, ozone depletion, gravity wave-mean flow interactions and chemical and tracer transport problems. A concise description of the model equations, numerics and physics may be found in Jones et al.; a more detailed description is found in Hamilton et al. Jones et al. describe changes made to the model in order to port it to the Thinking Machines Corporation CM-5 machine at Los Alamos National Laboratory. This paper concentrates on changes made to the model that significantly enhance the ability of the SKYHI user to quickly and easily modify the model code to initiate, run and analyze new scientific experiments, and to attach new features to the model with a minimum of difficulty. Section 2 discusses the development of the generic SKYHI code in which the efficient use of human resources is balanced with the efficient use of machine resources. Section 3 defines the basic structure of SKYHI and the current meaning of "modularity" as used by SKYHI. In section 4, two of the important new user-friendly "modules" of SKYHI are presented, along with examples of their use. Section 5 discusses the parallel performance and scaling of SKYHI on CRAY PVP shared memory and CRAY T3E distributed memory machines, while Section 6 serves as a summary.
Derived from text
Atmospheric General Circulation Models; Oceanography; Cray Computers; Flow Characteristics; Applications Programs (Computers); Computer Programs; Geophysics; Gravity Waves; Wave Propagation

19980205537 NASA Goddard Space Flight Center, Greenbelt, MD USA
I/O Parallelization for the Goddard Earth Observing System Data Assimilation System (GEOS DAS)
Lucchesi, Rob, NASA Goddard Space Flight Center, USA; Sawyer, W., Maryland Univ., USA; Takacs, L. L., NASA Goddard Space Flight Center, USA; Lyster, P., Maryland Univ., USA; Zero, J., NASA Goddard Space Flight Center, USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 157-161; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The National Aeronautics and Space Administration (NASA) Data Assimilation Office (DAO) at the Goddard Space Flight Center (GSFC) has developed the GEOS DAS, a data assimilation system that provides production support for NASA missions and will support NASA's Earth Observing System (EOS) in the coming years. The GEOS DAS will be used to provide background fields of meteorological quantities to EOS satellite instrument teams for use in their data algorithms as well as providing assimilated data sets for climate studies on decadal time scales. The DAO has been involved in prototyping parallel implementations of the GEOS DAS for a number of years and is now embarking on an effort to convert the production version from shared-memory parallelism to distributed-memory parallelism using the portable Message-Passing Interface (MPI). The GEOS DAS consists of two main components, an atmospheric General Circulation Model (GCM) and a Physical-space Statistical Analysis System (PSAS). The GCM operates on data that are stored on a regular grid while PSAS works with observational data that are scattered irregularly throughout the atmosphere. As a result, the two components have different data decompositions. The GCM is decomposed horizontally as a checkerboard with all vertical levels of each box existing on the same processing element(PE). The dynam-

ical core of the GCM can also operate on a rotated grid, which requires communication-intensive grid transformations during GCM integration. PSAS groups observations on PEs in a more irregular and dynamic fashion.
Derived from text
Earth Observing System (EOS); Atmospheric General Circulation Models; Periodic Variations; Meteorological Satellites

19980205540 Naval Research Lab., Bay Saint Louis, MS USA
A Comparison of Several Scalable Programming Models
Wallcraft, Alan J., Naval Research Lab., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 183-197; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The NRL Layered Ocean Model (NLOM) is written in the tiled data parallel programming style, and uses an application specific programming interface to isolate operations that require communication. This allows different scalable programming models to be ”plugged” into NLOM with relatively little effort. NLOM is similar to other OGCM’s, except that it uses a direct Helmholtz’s equation solver as part of its semi-implicit time scheme and typically runs with a very large horizontal extent and very few layers in the vertical. There are now several FORTRAN-based SPMD programming models to choose from on machines with a hardware global memory: a) MPI-1 message passing, b) MPI-2 put/get, c)BSP, d)SHMEM, e) F--, f) OpenMP, and g) HPF. These models are compared and contrasted based on actual experience with NLOM and related kernel benchmarks.
Author
Parallel Programming; Computer Programming; Kernel Functions; Scaling; Applications Programs (Computers); Machine-Independent Programs

19980205542 Applied Parallel Research, Inc., Sacramento, CA USA
Optimizing POP for a Cache Based Architecture
Levesque, John M., Applied Parallel Research, Inc., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 207; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

Today the major computational resources for the scientific community are cache based processors with high megahertz rates and multiple functions units, their Macho flop numbers approach a Gigaflop for a single processor. When researchers port their application to these systems they see anywhere from 4 to 100 MFLOPS. The cause for this lower flop rate is the utilization of the cache on the microprocessor. Given a very high megahertz rate the memory cannot keep up with the processor and the cache is placed between memory and the CPU to provide higher memory bandwidth. This high memory bandwidth is only achieved when all of the cache line fetched to the cache is used. The Parallel Ocean Program (POP) was developed for the CM5 and MPP’s in FORTRAN 90. When first ported to the SGI - Origin it achieved a maximum of 30-40 MFLOPS on a single processor. Over the past six months the performance of POP has been increased to over 100 MFLOPS per node. In order to achieve this increase in performance, cache utilization was increased to the point that there are no cache misses other than those from the first fetch of a line into cache. In the process of optimizing POP we developed a strategy and used tools that can be applied to other applications. The approach was to map out the computational arrays in the cache for the major looping structures. The layout of the initial POP program resulted in significant level 1 and 2 cache misses due to the two way associative cache. We found that re-mapping the arrays to eliminate these misses was facilitated by moving the depth dimension of the arrays to the first index. This also necessitated that the K (depth) loop become the inner loop for the computation. The cache mapping was performed using a cache analysis tool named CacheVU. The study found that the F90 array syntax was not conducive to cache re-use and that the F90 program used many temporary arrays that hurt cache utilization. The solution to this problem, given that the POP developer desired to program in F90 array syntax was to translate the F90 to F77 using a pre-processor called zAPR. The details of the zAPR translation were formulated during the POP analysis. Cooperation between the tool developers and the POP developers has resulted in a F90 programming style that can be efficiently translated into optimal code.
Author
Architecture (Computers); Computer Design; Distributed Memory; Massively Parallel Processors; Memory (Computers); Microprocessors

19980205549 Cray Research, Inc., Eagan, MN USA
Co-Array FORTRAN: Current Status and Recent Results with MICOM
Carpenter, Ilene, Cray Research, Inc., USA; Numrich, Robert W., Cray Research, Inc., USA; Sawdey, Aaron, Cray Research, Inc., USA; Reid, John, Rutherford Appleton Lab., UK; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 265-267; In English; Also announced as 19980205520;

No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Co-array FORTRAN, formerly known as F[2,3,4,5,6], is a simple extension to FORTRAN 90/95, which uses a second set of array subscripts to address that array in different processes. Co-array FORTRAN is very close in spirit to the one-sided message-passing library (SHMEM) and can be thought of as syntax for the one-sided get/put model that is incorporated into the FORTRAN language. It adopts a Single-Program-Multiple-Data (SPMD) programming model, in which a single program is replicated to a number of images, each with its own local data. Within each image, the normal rules of FORTRAN apply, as if it were a single program. Each image has a unique index associated with it and executes asynchronously. The programmer uses explicit synchronization procedures as needed. This information and its relevance to MICOM is presented.

Derived from text

FORTRAN; Syntax; Computer Programming; Data Structures; Numerical Analysis; Arrays

19980205550 Virginia Univ., Computer Science Dept., Charlottesville, VA USA

Metacomputing: What's in it for me?

Lindahl, Greg, Virginia Univ., USA; Grimshaw, Andrew, Virginia Univ., USA; Ferrari, Adam, Virginia Univ., USA; Holcomb, Katherine, Virginia Univ., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 269-276; In English; Also announced as 19980205520

Contract(s)/Grant(s): N66001-96-C-8527; DE-FD02-96ER-25290; LD-9391; D-459000-16-3C; SC-H607305A; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

We are often asked by applications programmers, 'What exactly is a metasystem, and why should I care?' This paper attempts to answer this question from an applications perspective, pointing out concrete ways in which the current practices of high performance scientific computing can possibly be improved.

Author

Networks; Network Analysis; Human Factors Engineering; Man Machine Systems

19980205599 University of Southern California, Center for Software Engineering, Los Angeles, CA USA

Next Generation Software Processes and Their Environment Support ***Final Report, Jun. 1994 - 1997***

Boehm, Barry, University of Southern California, USA; Apr. 1998; 41p; In English

Contract(s)/Grant(s): F30602-94-C-0195; AF Proj. B131

Report No.(s): AD-A344536; AFRL-IF-RS-TR-1998-42; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The USC Center for Software Engineering has developed a negotiation-based approach to software system requirements engineering, architecting, development, and management. It is based on three primary foundations: (1) Theory W, a management theory and approach. It is based on making winners of all of the system's key stakeholders as a necessary and sufficient condition for project success. (2) The WinWin Spiral Model, an extension to the Spiral Model of the software process. It is described further below. (3) The WinWin groupware tool for facilitating distributed stakeholders' negotiation of mutually satisfactory (WinWin) system specifications. The original spiral model Boelun, 1988 uses a cyclic approach to develop increasingly detailed elaborations of a software system's definition, culminating in incremental releases of the system's operational capability. Each cycle involves four main activities: (1) Elaborate the system or subsystem's product and process objectives, constraints, and alternatives. (2) Evaluate the alternatives with respect to the objectives and constraints. Identify and resolve major sources of product and process risk. (3) Elaborate the definition of the product and process. (4) Plan the next cycle, and update the life cycle plan, including partition of the system into subsystems to be addressed in parallel cycles. This can include a plan to terminate the project if it is too risky or infeasible. Secure the management's commitment to proceed as planned.

DTIC

Software Engineering; Product Development; Systems Analysis

19980205632 Oregon Graduate Inst. of Science and Technology, Pacific Software Research Center, Portland, OR USA

[Activities of Oregon Graduate Institute of Science and Technology], ***1 Jan. - 31 Mar. 1998***

Mar. 31, 1998; 73p; In English

Contract(s)/Grant(s): F19628-96-C-0161

Report No.(s): AD-A343374; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Compilers for ML and Haskell use intermediate languages that incorporate deeply embedded assumptions about order of evaluation and side effect. We propose an intermediate language into which one compile both ML and Haskell. Thereby facilitating the sharing of ideas and infrastructure and supporting language developments that move each language in the direction of the other. Achieving this goal without compromising the ability to compile as good code as a more direct route put to be much more

subtle than we expected. We address this challenge using monads and unpointed types, identify two alternative language designs and explore the eboices they embody.
DTIC
High Level Languages; Compilers; Multiprogramming

19980205649 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
ERTL: An Extension to RTL for Requirements Analysis for Hybrid Systems
deLemos, R., Newcastle-upon-Tyne Univ., UK; Hall, J., Newcastle-upon-Tyne Univ., UK; Jul. 1997; 26p; In English
Report No.(s): PB98-147903; TRS-568; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Real Time Logic (RTL), assumes as its model of time, a total order isomorphic to the natural numbers. In this paper, we provide extensions to RTL which allow reasoning about absolute timings for both continuous and discrete time, and reasoning about system behavior in the value and time domains by parametrizing predicates in terms of system variables.
NTIS
Real Time Operation; Formalism; Logic Programming

19980205669 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Decision Support Paradigms for Prescribing in General Practice: Lessons from the PRODIGY Trials
Sugden, R. C., Newcastle-upon-Tyne Univ., UK; Purves, I. N., Newcastle-upon-Tyne Univ., UK; Jul. 1997; 24p; In English
Report No.(s): PB98-147895; TRS-588; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes two different paradigms used by the PRODIGY project to develop clinical prescribing decision support systems. The first system has been specified by the Sowerby Unit, instantiated by the 5 largest UK GP system suppliers and evaluated by 150 general practices. The second system has been specified to incorporate lessons learned from the first set of field trials, and will be ready for trials in the second quarter of 1997. The paper describes the two different paradigms used for decision support and the process of evaluating the systems via user trials.
NTIS
Decision Support Systems; Software Engineering; Processing

19980205670 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Object-Based Approach to Modelling and Analysis of Failure Properties
Cepin, M., Newcastle-upon-Tyne Univ., UK; deLemos, R., Newcastle-upon-Tyne Univ., UK; Mavko, B., Newcastle-upon-Tyne Univ., UK; Riddle, S., Newcastle-upon-Tyne Univ., UK; Saeed, A., Newcastle-upon-Tyne Univ., UK; Aug. 1997; 22p; In English
Report No.(s): PB98-147887; TRS-598; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

As a basis for the required qualitative evidence, we propose an object-based approach that allows modeling of both the application and software domains. From the object class model of a system and a formal specification of the failure properties of its components, we generate a graph of failure propagation over object classes, which is then used to generate a graph in terms of object instances in order to conduct fault tree analysis.
NTIS
Software Engineering; Failure; Applications Programs (Computers); Fault Trees; Object-Oriented Programming; Safety

19980205779 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Co-ordinated Exception Handling in Distributed Object Systems: From Model to System Implementation
Xu, J., Newcastle-upon-Tyne Univ., UK; Romanovsky, A., Newcastle-upon-Tyne Univ., UK; Randell, B., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 36p; In English
Report No.(s): PB98-147861; TRS-612; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Exception handling in distributed and concurrent programs is a difficult task though it is often necessary. One major difficulty is that the process of handling an exception may need to involve multiple concurrent components when they are cooperating to solve a global problem.
NTIS
Coordination; Concurrent Processing; Object-Oriented Programming; Distributed Processing

19980205819 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Transaction Model for Real-Time Systems
Haveman, J., Newcastle-upon-Tyne Univ., UK; Paynter, S., Newcastle-upon-Tyne Univ., UK; Armstrong, J., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 32p; In English

Report No.(s): PB98-147929; TRS-607; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes a real-time transaction model for the specification of functional and timing requirements of task in real-time systems, which allows for the rigorous decomposition of end-to-end timing properties in the refinement of these tasks.
NTIS

Real Time Operation; Formalism; Functional Design Specifications; Mathematical Models

19980205821 Oak Ridge National Lab., TN USA

PAC learning using Nadaraya-Watson estimator based on orthonormal systems

Qiao, Hongzhu, Fort Valley State Coll., USA; Rao, N. S. V., Oak Ridge National Lab., USA; Protopopescu, V., Oak Ridge National Lab., USA; 1997; 16p; In English; International Workshop on Algorithmic Learning Theory, 6 - 8 Oct. 1997, Berlin, Germany
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-971067-1; DE97-007785; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Regression or function classes of Euclidean type with compact support and certain smoothness properties are shown to be PAC learnable by the Nadaraya-Watson estimator based on complete orthonormal systems. While requiring more smoothness properties than typical PAC formulations, this estimator is computationally efficient, easy to implement, and known to perform well in a number of practical applications. The sample sizes necessary for PAC learning of regressions or functions under sup norm cost are derived for a general orthonormal system. The result covers the widely used estimators based on Haar wavelets, trigonometric functions, and Daubechies wavelets.
DOE

Trigonometric Functions; Statistical Analysis; Learning; Euclidean Geometry

19980205829 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Parallel PAB3D: Experiences with a Prototype in MPI

Guerinoni, Fabio, Virginia State Univ., USA; Abdol-Hamid, Khaled S., Analytical Services and Materials, Inc., USA; Pao, S. Paul, NASA Langley Research Center, USA; Apr. 1998; 22p; In English
Contract(s)/Grant(s): NAS1-19480
Report No.(s): AD-A345621; ICASE-IR-31; NASA-CR-1998-207636; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

PAB3D is a three-dimensional Navier Stokes solver that has gained acceptance in the research and industrial communities. It takes as computational domain, a set disjoint blocks covering the physical domain. This is the first report on the implementation of PAB3D using the Message Passing Interface (MPI), a standard for parallel processing. We discuss briefly the characteristics of the code and define a prototype for testing. The principal data structure used for communication is derived from preprocessing ”patching”. We describe a simple interface (COMMSYS) for MPI communication, and some general techniques likely to be encountered when working on problems of this nature. Last, we identify levels of improvement from the current version and outline future work.
DTIC

Message Processing; Data Structures; Parallel Processing (Computers); Computer Networks

19980206092 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Conflict Resolution of Definitions Between Conceptual Construction Components and CAAD Applications

Shih, Naai-Jung, National Taiwan Inst. of Tech., Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 189-198; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The purpose of this paper is to study the representation difference and their influence between the definitions in computer-aided architecture design (CAAD) applications and construction components. The study emphasizes the restrictions and solutions of current built-in functions in most commercial applications. Based on the practice and theoretical definition of construction components in architecture, encountered problems and potential solutions were studied in recognizing spaces from predefined representation in displaying, simulation, and recording tasks. Representation and simulation can be categorized into 2D drawings and 3D objects. Applications in general can only define simple and primitive-like objects. Simulation efficiency is in reverse proportion to the complexity of represented objects. The complexity is influenced by the availability of built-in functions, acceptance of foreign definition and modeling methods, the difference between existing and new definitions, the support occurring among different definitions, the capability in performing quantity estimation, etc. This paper presents problems and solutions through construction components, such as columns, beams, ceilings, wall configurations, wall openings, finishes, room boundaries, floors,

bill of materials, and symbols. Most of the components or their variations exceed the description and predefined function of most application programs. Through redefining components and the comprehension of applied functions, the efficiency and effectiveness in manipulating design information can be improved.
Author
Computer Aided Design; Structural Design; Architecture; Buildings; Construction Materials

19980206136 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
A Study on Fuzzy Algorithm of Traffic Assignment Model
Chang, Mei-Shiang, National Central Univ., Taiwan, Province of China; Chen, Huey-Kuo, National Central Univ., Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 139-150; In English Contract(s)/Grant(s): NSC83-0410-E-008-033; NSC84-0410-E-008-029; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

This paper describes the solution of the traffic assignment model under fuzzy information. The assumption about perfect network information is relaxed. The fuzzy algorithm, successive representative method, is proposed in this study. This algorithm assigns a set of O-D trip rates to a transportation network in which the link travel times are fuzzy. The assignment assumes that route choice is based on fuzzy link travel times. The fuzzy travel times are modeled not only as fuzzy numbers, but also as flow dependence. This dependence is accounted for by assuming that the fuzzy travel time for each link is a fuzzy mapping of the flow on that link. Four fuzzy operations are used in the successive representative method, including fuzzy addition, fuzzy multiplication, fuzzy comparison and defuzzification. Our algorithm is exemplified by the road network around Osaka. Sensitivity analysis of the algorithm are also presented.
Author
Transportation Networks; Fuzzy Systems; Systems Analysis; Mathematical Models; Traffic Control

19980206138 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
A Repertory Grid Approach for Software Components Classification and Retrieval
Lai, Sen-Tarng, National Taiwan Inst. of Tech., Taiwan, Province of China; Yang, Chien-Chiao, National Taiwan Inst. of Tech., Taiwan, Province of China; Lien, Chih-Cheng, Soochow Univ., Taiwan, Province of China; Journal of Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 117-130; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Software reuse is an important approach to increase software quality and productivity. There are many factors that may affect the result of software reuse. Among them, software component classification and retrieval are two important factors. Identifying the major component attributes is a necessary condition for creating high efficiency component classification and retrieval. In this paper, we define a component attribute set and its major operations to identify the relationships between two components. In order to increase the efficiency of software reuse, we apply the repertory grid technique which is a more popular skill in knowledge acquisition tools to the component classification and retrieval. According to the identified component relationships and the concept of the repertory grid technique, the component classification model can be created, the reasonable candidate component ranking approach can be presented, and an algorithm for selecting a set of components with combination potential and mutual complement capability can be provided.
Author
Software Engineering; Software Reuse; Mathematical Models; Computer Programs; Software Development Tools

19980206139 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Image Compression Scheme with Embedded Multilevel Block Truncation Coding Based on Human Visual Effect
Kuo, Chun-Hung, Tatung Inst. of Tech., Taiwan, Province of China; Chen, Chang-Fuu, National Inst. of Technology, Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 103-116; In English; Sponsored in part by the Tatung Company
Contract(s)/Grant(s): Tatung-81-1207-40; Tatung-81-1207-38; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In this paper, we first propose a new embedded multilevel block truncation coding (BTC) technique. Unlike Differential Pulse Code Modulation (DPCM), Vector quantization (VQ), and general multilevel BTC algorithms which determine the image quality at a time, the embedded multilevel BTC improves the image quality largely and progressively until obtaining an image with excellent quality. In order to reduce the bit rate efficiently, we propose a perception model and utilize it to develop a pruning algorithm. The pruning algorithm removes the useless information, which the human eyes are not sensitive to, generated by the embedded multilevel BTC. The simulation results indicate that the bit rate with the proposed method is much less than that with the DPCM

and general multilevel BTC under the same objective criterion, PSNR, or subjective criterion. This paper also shows that the computation complexity of the proposed method is much less than that with VQ under the same high quality reconstructed image.
Author
Image Processing; Data Compression; Coding; Algorithms; Embedding; Visual Discrimination

19980206270 Management Communications and Control, Inc., Arlington, VA USA
Demonstration of Iconic, Graphic, Data Flow Programming for High Performance Real Time Workstations, Phase 2, Option *Final Report*
Ecklund, N. Carl, Management Communications and Control, Inc., USA; May 20, 1998; 63p; In English
Contract(s)/Grant(s): NOOO14-96-C-0208
Report No.(s): AD-A345691; MCCI-98-ONR-002; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

As the Navy adopts COTS processors for signal processing systems, there is a need for desktop workstations with either embedded or attached COTS processing systems to act as platforms for development and maintenance of algorithms for embedded signal processing systems. Under the basic Phase II program, MCCI has integrated the PGM based Autocoding Toolset developed under the DARPA funded RASSP program with rapid prototyping tools developed under this SBIR. In the Phase II option program, MCCI demonstrated use of the PGM programming environment for high performance workstations by implementing five (5) application graphs representative of submarine sonar passive broadband and narrowband processing. Requirements specifications were implemented as PGM graphs and autocoded into executable code. Test signal generators and displays were developed to allow exercising the applications on the company's high performance multi-computer workstation. The report describes each application, PGM graphs, and examples of output from the autocoded implementations.
DTIC
Computer Programming; Real Time Operation; Graphs (Charts); Programming Environments; Workstations; Information Flow; Signal Processing

19980206275 Los Alamos National Lab., NM USA
A VLSI optimal constructive algorithm for classification problems
Beiu, V., Los Alamos National Lab., USA; Draghici, S., Wayne State Univ., USA; Sethi, I. K., Wayne State Univ., USA; [1997]; 6p; In English; International Conference on Artificial Neural Networks, 7 - 10 Oct. 1997, Lausamme, Switzerland
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1609; CONF-971072-1; DE97-008305; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

If neural networks are to be used on a large scale, they have to be implemented in hardware. However, the cost of the hardware implementation is critically sensitive to factors like the precision used for the weights, the total number of bits of information and the maximum fan-in used in the network. This paper presents a version of the Constraint Based Decomposition training algorithm which is able to produce networks using limited precision integer weights and units with limited fan-in. The algorithm is tested on the 2-spiral problem and the results are compared with other existing algorithms.
DOE
Very Large Scale Integration; Neural Nets; Algorithms

19980206291 Argonne National Lab., IL USA
Computational experience with a dense column feature for interior-point methods
Wenzel, M., Argonne National Lab., USA; Czyzyk, J., Argonne National Lab., USA; Wright, S., Argonne National Lab., USA; Aug. 1997; 18p; In English
Contract(s)/Grant(s): W-31109-ENG-38
Report No.(s): ANL/MCS-TM-227; DE98-001226; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Most software that implements interior-point methods for linear programming formulates the linear algebra at each iteration as a system of normal equations. This approach can be extremely inefficient when the constraint matrix has dense columns, because the density of the normal equations matrix is much greater than the constraint matrix and the system is expensive to solve. In this report the authors describe a more efficient approach for this case, that involves handling the dense columns by using a Schur-complement method and conjugate gradient interaction. The authors report numerical results with the code PCx, into which the technique now has been incorporated.
DOE
Conjugate Gradient Method; Linear Programming

19980206292 Sandia National Labs., Albuquerque, NM USA

Enabling department-scale supercomputing

Greenberg, D. S., Sandia National Labs., USA; Hart, W. E., Sandia National Labs., USA; Phillips, C. A., Sandia National Labs., USA; [1997]; 21p; In English; Algorithms for Parallel Processing, 16-20 Sep. 1996, Minneapolis, MN, USA

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

Report No.(s): SAND-97-2604C; CONF-9609401; DE98-001177; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Department of Energy (DOE) national laboratories have one of the longest and most consistent histories of supercomputer use. The authors summarize the architecture of DOE's new supercomputers that are being built for the Accelerated Strategic Computing Initiative (ASCI). The authors then argue that in the near future scaled-down versions of these supercomputers with petaflop-per-weekend capabilities could become widely available to hundreds of research and engineering departments. The availability of such computational resources will allow simulation of physical phenomena to become a full-fledged third branch of scientific exploration, along with theory and experimentation. They describe the ASCI and other supercomputer applications at Sandia National Laboratories, and discuss which lessons learned from Sandia's long history of supercomputing can be applied in this new setting.

DOE

Physical Factors; Supercomputers

19980206293 Sandia National Labs., Albuquerque, NM USA

Simulation and off-line programming at Sandia's Intelligent Systems and Robotics Center

Xavier, P. G., Sandia National Labs., USA; Fahrenholtz, J. C., Sandia National Labs., USA; McDonald, M., Sandia National Labs., USA; [1997]; 9p; In English; Robot Simulation and Off-line Programming, 21-23 Oct. 1997, Seattle, WA, USA

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

Report No.(s): SAND-97-2605C; CONF-9710107; DE98-001175; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

One role of the Intelligent Robotics and System Center (ISRC) at Sandia National Laboratories is to address certain aspects of Sandia's mission to design, manufacture, maintain, and dismantle nuclear weapon components. Hazardous materials, devices, and environments are often involved. Because of shrinking resources, these tasks must be accomplished with a minimum of prototyping, while maintaining high reliability. In this paper, the authors describe simulation, off-line programming/planning, and related tools which are in use, under development, and being researched to solve these problems at the ISRC.

DOE

Robotics; Prototypes; Nuclear Weapons; Hazardous Materials

19980206322 Los Alamos National Lab., NM USA

Rapid space hardware development through computer-automated testing

Masters, D. S., Los Alamos National Lab., USA; Ruud, K. K., Los Alamos National Lab., USA; 1997; 13p; In English; 11th; Conference on Small Satellites, 15 - 18 Sep. 1997, Logan, UT, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

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

Report No.(s): LA-UR-97-3429; SSC-97-XI-4; CONF-970991-; DE98-000283; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

FORTE, the Fast On-Orbit Recording of Transient Events small satellite designed and built by Los Alamos and Sandia National Laboratories, is scheduled for launch in August, 1997. In the spirit of (open quotes)better, cheaper, faster(close quotes) satellites, the RF experiment hardware (receiver and trigger sub-systems) necessitated rapid prototype testing and characterization in the development of space-flight components. This was accomplished with the assembly of engineering model hardware prior to construction of flight hardware and the design of component-specific, PC-based software control libraries. Using the LabVIEW(reg sign) graphical programming language, together with off-the-shelf PC digital I/O and GPIB interface cards, hardware control and complete automation of test equipment was possible from one PC. Because the receiver and trigger sub-systems employed complex functions for signal discrimination and transient detection, thorough validation of all functions and illumination of any faults were priorities. These methods were successful in accelerating the development and characterization of space-flight components prior to integration and allowed more complete data to be gathered than could have been accomplished without

automation. Additionally, automated control of input signal sources was carried over from bench-level to system-level with the use of networked Linux workstation utilizing a GPIB interface.
DOE
Automatic Control; Programming Languages; Computer Techniques; Prototypes; Actuators

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COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19980203230 Naval Postgraduate School, Monterey, CA USA
Internetworking: Distance Learning 'To Sea' Via Desktop Videoconferencing Tools and IP Multicast Protocols
Glover, Mark V., Naval Postgraduate School, USA; Mar. 1998; 137p; In English
Report No.(s): AD-A343708; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

While deployed at sea, sailors are traditionally provided much of their education at sea through correspondence and pace courses. But with recent developments in the Internet and videoconferencing, it is now feasible to deliver real time educational material anywhere, even to a ship at sea. This thesis investigates the current status of networked desktop videoconferencing technology, and its use in support of Joint Vision 2010, with respect to Distance Learning. It provides an analysis of videoconferencing protocols, standards, and applications, as well as a videoconferencing pilot project. The objective of the analysis is to determine the viability and economical benefits of using videoconferencing technology and collaboration tools, from the desktop, as a means for simultaneously delivering synchronous and asynchronous distance learning material from an academic location to multiple students at remote locations. The results show that desktop videoconferencing technology, via IP based networks in the Defense Information Infrastructure, is a viable tool that can add numerous economical benefits, such as a decreased spending for travel and eliminating the need to rely on large, room-based systems.
DTIC
Internets; Protocol (Computers); Seas; Teleconferencing; Video Communication; Viability

19980203341 General Accounting Office, Washington, DC USA
YEAR 2000 COMPUTING CRISIS: Strong Leadership Today Needed to Prevent Future Disruption of Government Services
Feb. 24, 1997; 10p; In English
Report No.(s): AD-A344576; GAO/T-AIMD-97-51; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This testimony discusses the 'Year 2000' computer compliance problem which could cause potential failure of all government programs which provide benefits. General Accounting Office (GAO) has developed a guide that constitutes a framework for agencies to assess their readiness for year 2000 compliance. This guide is divided into five phases; awareness assessment, renovation, validation, and implementation.
DTIC
Software Engineering; Leadership; Management Planning; Disrupting; Failure

19980203472 North Carolina State Univ., Dept. of Computer Science, Raleigh, NC USA
National Benchmark Program in Microelectronic Systems Design Automation ***Final Report***
Brglez, Franc, North Carolina State Univ., USA; Dec. 30, 1997; 20p; In English
Contract(s)/Grant(s): DAAH04-94-G-0280
Report No.(s): AD-A344686; ARO-33616.11-EL; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final report of the National Benchmark Program in Microelectronic Systems Design Automation. This project was initiated on the premise that by leveraging the evolving technologies of the Internet, one can greatly improve the ad hoc benchmarking efforts of the past decade. Specifically, using the Internet, we have laid the groundwork for collaborative efforts of researchers from university and industry to engage in the following three major projects: (1) internet based benchmark data synthesis and archival workflows: conceiving and sharing new data to evaluate existing and new algorithms; (2) internet based algorithm and tool evaluation workflows: supporting not only user transparent algorithm and tool encapsulation but also adopting and adapting the proven design of experiments methodology to execute a series of collaborative and peer reviewed benchmarking experi-

ments with existing and new algorithms; and (3) internet based statistical evaluation and results archival workflows: organizing tables of results to support various standardized forms of results evaluation and database archival of result summaries.
DTIC
Systems Engineering; Design Analysis; Evaluation; Algorithms; Data Bases

19980203474 Army Construction Engineering Research Lab., Champaign, IL USA
Web-Enabled Design Review and Lessons Learned ***Final Report***
East, E. William, Army Construction Engineering Research Lab., USA; Apr. 1998; 84p; In English
Report No.(s): AD-A344693; CERL-TR-98/31; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Department of Defense invests significant capital in building new facilities; approximately $11.2 billion in Fiscal Year 1996. Conventional facility delivery processes and practices that were once satisfactory are increasingly expensive, labor intensive, and not fully automated or integrated. State of the art automation technology is the best hope to keep pace with requirements to reduce design and construction errors, reduce resource requirements, and optimize mission performance. This report discusses one aspect of facility delivery; the design review process. The Design Review and Checking System (DrChecks) is the next step in the evolution of previous USACERL developed products to support the technical, design, and Biddability, Constructibility, Operability (BCO) review process. This document describes: (1) the requirements and constraints considered in this research, (2) requirements for an integrated system of lessons learned, (3) minimum requirements to install and test the distribution version of DrChecks, and (4) the steps required to implement a distributed lessons learned system. to test the prototype system requires an Intel Pentium processor and a 2 GB hard drive compatible with HTML 2.0. Client systems must be linked to the Internet using TCP/IP protocols with a minimum connection speed of 9600 bps.
DTIC
Computer Aided Design; Project Management; Quality Control; Design Analysis; Procedures; Q Factors

19980203501 Kansas Univ., Dept. of Electrical Engineering, Lawrence, KS USA
Detectability Models and Waveform Design for Multiple Access Low Probability-of-Intercept Networks ***Final Report***
Oct. 31, 1997; 124p; In English
Contract(s)/Grant(s): F49620-94-1-0023
Report No.(s): AD-A343189; AFRL-SR-BL-TR-98-0384; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Increased demands for communications in the tactical battlefield have fueled the development of multiple access Low Probability of Intercept networks. Most detectability studies of LPI networks have focused on the individual links of the network, in which the intercept and detectability calculations are conducted for a single network transmitter. The research reported here examines a different approach to network detectability analysis: It is assumed that the interceptor does not attempt to distinguish one emitter from another, but rather decides only if a network is operating or not. what distinguishes this approach from conventional link intercept analysis is that detection decisions are based on energy received from multiple sources. Two network detection models are developed. A dispersed network intercept model is appropriate for scenarios in which the network transmitters are dispersed throughout a given tactical region, and the interceptor is inside the network. The interception area for the specified probabilities of detection and false alarm is used as a performance metric. A stand-off network intercept model is used for situations in which the network transmitters are collocated and the interceptor is standing off. For this model, a network LPI quality factor is developed as a performance metric. Both models are developed for a frequency hopping code division multiple access network, using a wideband radiometer and filter band binary moving window detector as potential intercept receivers.
DTIC
Multiple Access; Network Analysis; Detection; Low Aspect Ratio; Jamming; Communication Networks; Probability Theory

19980203729 Florida Univ., Dept. of Computer and Information Sciences, Gainesville, FL USA
Support for Temporal Events in Sentinel: Design, Implementation, and Preprocessing ***Final Report, Jul. 1995 - Mar. 1997***
Chakravarthy, S., Florida Univ., USA; Lee, H., Florida Univ., USA; Kim, H., Florida Univ., USA; Feb. 1998; 60p; In English
Contract(s)/Grant(s): F30602-95-1-0030; AF Proj. R427
Report No.(s): AD-A341306; RL-TR-97-214; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This effort performs research in the area of active databases. During the last decade, the functionality of databases has been extended to encompass a large range of applications which tend to be very complex in nature with concomitant increase in database size requirements. Monitoring and reactive capabilities have been added to existing conventional DBMSs without application or user intervention is one of the directions taken to deal with non-traditional real world applications. A self reacting DBMS is termed active. The active DBMS typically accepts ECA (event condition action) rules which specify situations that need to be monitored and reacts to those situations under certain conditions. An active DBMS adds three new features to a passive DBMS: (1) Rule

Interface to define ECA rules, (2) Event detect mechanism to detect the events specified through the rule interface, (3) Action execution mechanism to execute the action of the rule whose condition evaluates to true when the event occurs. This effort extends DBMS Sentinel by completing the local event detector to support temporal events, and by pre-processing the Snoop event rule specification language to generate appropriate calls to the event detector.
DTIC
Sentinel System; Data Bases; Data Management; Preprocessing; Software Engineering

19980203730 Naval Postgraduate School, Monterey, CA USA
Real-Time Event Execution Monitoring
Drummond, John J., Naval Postgraduate School, USA; Sep. 1997; 149p; In English
Report No.(s): AD-A341536; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Currently the Computer Aided Prototyping System software development environment provides monitoring techniques for real-time tasking execution times. However, these techniques are constrained in that there is only a provision for simple error messages to be presented upon execution failure such as that caused by a missed deadline. This approach necessitates that the software system designer haphazardly guess a task set execution time. This thesis performed an examination of fine grain execution timing. This work was accomplished through the development of a program to perform true dynamic run time data collection of the typical task set execution exhibited within a real-time environment. The results of this work is an accurate and efficient real-time task set execution monitoring software program which assists in overcoming the problem of task set execution run time prediction. The program itself has been embedded within the Computer Aided Prototyping System environment and is an enhancement over the previous monitoring technique by providing the system designer with true and accurate run time execution times. The validation of the thesis work has been performed by successful design and development of time critical real-time prototype software within the Computer Aided Programming System using the execution monitoring program.
DTIC
Computer Aided Design; Real Time Operation; Prototypes; Monitors

19980204732 National Inst. of Standards and Technology, High Performance Systems and Services Div., Gaithersburg, MD USA
Evaluation of Applications on a Loosely-Coupled Cluster
Salamon, W., National Inst. of Standards and Technology, USA; Mink, A., National Inst. of Standards and Technology, USA; Indovina, M., National Inst. of Standards and Technology, USA; Courson, M., National Inst. of Standards and Technology, USA; Apr. 1998; 30p; In English
Report No.(s): PB98-144488; NISTIR-6148; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NIST is building a distributed testbed of heterogeneous workstations connected via an Asynchronous Transfer Mode (ATM) network. The purpose of the ATM cluster testbed is twofold: one is production and the other is research. The production focus is concerned with evaluating the benefit of bringing ATM to the desktop and determining the scalability and viability of such an environment for some of the NIST high performance computation workload. The research focus is concerned with integrating performance measurement for application tuning and developing light weight models that can be used to dynamically steer applications based on real-time measurements. The authors' initial efforts of porting and tuning parallel codes in this distributed environment are discussed.
NTIS
Asynchronous Transfer Mode; Workloads (Psychophysiology); Real Time Operation; Heterogeneity; Workstations

19980205009 California Univ., Berkeley, CA USA
Performance Evaluation of Media Synchronization Losses in the Continuous Media Toolkit
Wijesekera, D., California Univ., USA; Parikh, S., California Univ., USA; Varadarajan, S., California Univ., USA; Srivastava, J., California Univ., USA; Nerode, A., California Univ., USA; Feb. 1998; 21p; In English
Contract(s)/Grant(s): DAAH04-98-1-0341
Report No.(s): AD-A344574; TR-98-04; ARO-35873.69-MA-MUR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a performance analysis of synchronization services provided by the Berkeley Continuous Media Toolkit (CMT). The quality of audio video synchronization is measured against processor and network loads for both remote and local clients. The metrics of analysis are the perceptible and tolerable human perceptual limits reported by Steinmetz, and another metric designed to measure synchronization of lossy media streams. It is shown that according to Steinmetz, metric CMT provides imperceptible audio video mis-synchronization for about 10 seconds, and tolerable synchronization for about 13 seconds from the start

of the clips for local clients under low processor loads. It is also shown that under high loads, synchronization is achieved at the cost of losing media frames.
DTIC
Video Signals; Signal Processing; Performance Prediction; Evaluation; Performance Tests; Synchronism

19980205011 General Accounting Office, Washington, DC USA
YEAR 2000 COMPUTING CRISIS: Risk of Serious Disruption to Essential Government Functions Calls for Agency Action Now
Feb. 27, 1997; 11p; In English
Report No.(s): AD-A344584; GAO/T-AIMD-97-52; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This testimony discusses the ”Year 2000” computer compliance problems which could cause serious disruption in all federal agencies. The enormous challenge to this problem is managerial rather than technical. This report recommends a five phase guide for agencies to assess agency readiness. The five phases are; awareness assessment, renovation, validation, and implementation.
DTIC
Software Engineering; Risk; Proving; Management Planning

19980205055 National Inst. of Standards and Technology, Scalable Parallel Systems and Applications Group, Gaithersburg, MD USA
WebSubmit: Web-Based Applications with Tcl
McCormack, R. P., National Inst. of Standards and Technology, USA; Koontz, J. E., National Inst. of Standards and Technology, USA; Devaney, J., National Inst. of Standards and Technology, USA; Jun. 1998; 18p; In English
Report No.(s): PB98-148752; NISTIR-6165; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this paper, we illustrate the basic structure of WebSubmit, applications within this environment, Tcl implementation and design specifics, and future directions for the software and project.
NTIS
Interprocessor Communication; World Wide Web; Software Development Tools; Command Languages

19980205522 European Centre for Medium-Range Weather Forecasts, Reading, UK
Parallelization of the ECMWF Integrated Forecasting System
Mozdzynski, George, European Centre for Medium-Range Weather Forecasts, UK; Dent, David, European Centre for Medium-Range Weather Forecasts, UK; Hamrud, Mats, European Centre for Medium-Range Weather Forecasts, UK; Isaksen, Lars, European Centre for Medium-Range Weather Forecasts, UK; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 13; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only
The Integrated Forecasting System (IFS) at the European Center for Medium-Range Weather Forecasts (ECMWF) consists of a large suite of software used primarily to produce a daily 10 day forecast. Key components of the IFS include the processing of observations, a 4 dimensional variational assimilation scheme, and a 10 day forecast model integration using an approx. 60 km grid. In the past, the parallelization of the IFS has concentrated on the forecast model component, and today this continues to show near ideal scaling on many of the parallel computer systems available today. This model has recently been enhanced to support parallel I/O by using some new facilities provided in the MPI2 standard. Results of scalability experiments using these MPI-IO facilities are compared with parallel I/O package developed at ECMWF. The processing of the observations is an integral part of meteorological data assimilation. The volume of such observational data is growing rapidly with the availability of new satellite data, and requires parallel processing to keep runtimes to an acceptable level. Observations are stored in a highly compressed BUFR format, which is the WMO standard format for the interchange of observation data. The encoding and decoding of BUFR format files is inherently scalar in nature and does not benefit from vectorization. to resolve this, a new and more flexible observational data format has been developed at ECMWF called Central Memory Array or CMA format. The objective is to use CMA format where possible and to constrain the use of BUFR format to archive purposes. An overview of how the IFS performs observation processing is described. In the last year, ECMWF has introduced a new data assimilation system based on the 4D-Variational analysis method. This method involves the use of adjoint and tangent linear forecast models, and minimization of global cost functions based on observational information and background forecast field information. This method is computationally intensive and requires parallel processing in order to meet time critical requirements. Further, issues of load balance arise from

the distribution and cost of processing observations. This paper presents an overview of these issues and how they resolved, together with performance data from the FUJITSU VPP700 system at ECMWF.
Author
Parallel Processing (Computers); Weather Forecasting; Parallel Computers; Meteorological Parameters; Data Systems

19980205523 Environment Canada, Canadian Centre for Climate Modelling and Analysis, Victoria, British Columbia Canada
Coarse-Grain Parallelization of the CCCma Atmospheric GCM on a NEC SX-4
Denis, Bertrand, Environment Canada, Canada; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 15-27; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

CCCma operates spectral atmospheric general circulation models on the super computer system at the Canadian Meteorological Centre (CMC) in Dorval, Quebec. This system includes a multi-node NEC SX-4 Symmetric Multiprocessor (SMP). The nodes are made of vector-parallel platform with 4 to 8 GB of central memory and 16 to 32 CMOS-based vector processors, each with a peak performance of 2 Gigaflops. Presently, the NIEC SX-4 cluster at CMC has one 32-processor node (SX-4/32) and two 16-processor nodes (SX-4/16). An older version of the model (GCM2) is used in CCCma's coupled climate model, which includes atmosphere, ocean and dynamical sea-ice components. GCM2 operates at "T32" resolution in the horizontal and has 10 levels in the vertical. A newer version (GCM3) operates at T47 or T63 resolution in the horizontal and has 32 levels in the vertical. GCM3 enjoys a number of improvements over GCM2, including a double transform methodology, optimal topography to reduce Gibbsian ripples, a new deep convection scheme, improved radiation code, a new land surface scheme (CLASS) and optionally, a semi-Lagrangian treatment of tracers. We will describe how we have parallelized GCM2 and GCM3 and will report on how we took advantage of the existing code design to get satisfactory performance with the least effort in the context of a coarse grain parallelization on an SMP machine. Diverse strategies concerning the domain decomposition, memory allocation, spectral transform, load balance, and synchronizations will be presented.
Author
Software Engineering; Applications Programs (Computers); Oceanography; Atmospheric General Circulation Models; Multiprocessing (Computers); Climate Models

19980205525 NASA Goddard Space Flight Center, Greenbelt, MD USA
Design and Performance Analysis of a Massively Parallel Atmospheric General Circulation Model
Schaffer, Daniel S., General Sciences Corp., USA; Suarez, Max J., NASA Goddard Space Flight Center, USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 45-55; In English; Also announced as 19980205520
Contract(s)/Grant(s): RTOP 622-24-47; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In the 1990's computer manufacturers are increasingly turning to the development of parallel processor machines to meet the high performance needs of their customers. Simultaneously, atmospheric scientists study weather and climate phenomena ranging from hurricanes to El Nino to global warming that require increasingly fine resolution models. Here, implementation of a parallel atmospheric general circulation model (GCM) which exploits the power of massively parallel machines is described. Using the horizontal data domain decomposition methodology, this FORTRAN 90 model is able to integrate a 0.6 deg. longitude by 0.5 deg. latitude problem at a rate of 19 Gigaflops on 512 processors of a Cray T3E 600; corresponding to 280 seconds of wall-clock time per simulated model day. At this resolution, the model has 64 times as many degrees of freedom and performs 400 times as many floating point operations per simulated day as the model it replaces.
Author
Massively Parallel Processors; Parallel Processing (Computers); Atmospheric General Circulation Models; Oceanography; Scientific Visualization; Computerized Simulation; FORTRAN

19980205526 Deutscher Wetterdienst, Offenbach am Main, Germany
Requirements and Problems in Parallel Model Development at DWD
Schaettler, Ulrich, Deutscher Wetterdienst, Germany; Doms, Guenther, Deutscher Wetterdienst, Germany; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 57-68; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Nearly 30 years after introducing the first computer model for weather forecasting, the Deutscher Wetterdienst (DWD) develops the 4th generation of its numerical weather prediction (NWP) system. It consists of a global grid point model (GME) based on a triangular grid and a non-hydrostatic Lokal Modell (LM). The operational demand for running this new system is immense and can only be met by parallel computers. Regarding former NWP models, several new problems had to be taken into account

during the design phase of the system. Most important are the portability (including efficiency of the programs on several computer architectures) and an easy code maintainability. Also, the organization and administration of the work done by developers from different teams and institutions is more complex than it used to be. This paper describes the modular approach used for the design of the LM and discusses the effects on the development. Some results of investigations from GMD (German National Research Center for Information Technology) and the software engineering company Pallas are presented on how the LM will perform on different computer architectures and how new hardware will influence the programming style used.
Author
Weather Forecasting; Software Engineering; Numerical Weather Forecasting; Computerized Simulation; Oceanography; Scientific Visualization; Atmospheric General Circulation Models; Applications Programs (Computers); Massively Parallel Processors

19980205527 Meteorological Office, Numerical Modelling Div., Bracknell, UK
Experiences with Parallelisation of the Unified Model at the UK Meteorological Office
Rawlins, Frederick, Meteorological Office, UK; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 69-75; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Unified Model (UM) is the suite of software developed and used at the Met. Office for atmosphere and ocean numerical modelling. The UM is the central component both of operational numerical weather forecasts, and of all climate prediction research studies carried out at the Met. Office (within the Hadley Centre). A range of temporal and spatial scales, including global and regional domains, is supported in the formulation of the UM and allows it to be used in a number of different model configurations, for a variety of operational and research activities. Following the introduction of the UM into operational service in 1991, both its formulation and capabilities have been significantly enhanced. Parallelisation of the model to take advantage of distributed memory platforms is a continuation of this process. The code structure of the UM was developed in FORTRAN77 with standard extensions, including allocation of dynamic memory. I/0 operations are coded in C as an aid to portability across platforms. Original developments and operational running began on an 8 CPU Cray-YMP, subsequently to be replaced by a 16 CPU Cray-C90. For these shared memory architectures, parallelisation was achieved by autotasking through pre-processor directives, with little involvement by programmers. Most programming efforts for optimisation went into maximizing vector lengths and ensuring that DO loops vectorized. In order to take advantage of a massively parallel computer (MPP) with distributed memory, it was necessary to make substantial changes to the code. Hence, a migration strategy was planned for a project that would take several years, starting from a team of 3 and building to include over 50 staff at the height of development activities.
Author
Applications Programs (Computers); Parallel Processing (Computers); Numerical Weather Forecasting; Massively Parallel Processors; Cray Computers; Oceanography; Atmospheric Models; Computerized Simulation

19980205529 San Diego Supercomputer Center, San Diego, CA USA
A Theoretical and Experimental Analysis of Parallel Complexity of Weather and Climate Algorithms Using the Shallow Water Benchmark Suite
Chukkapalli, Giri, San Diego Supercomputer Center, USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 95; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

In this paper, we evaluate the parallel complexity of weather and climate algorithms with the help of the governing equations and the initial-boundary conditions (I.B.V.P). We define a true measure of simulation efficiency which encompasses various partial measures of efficiencies such as parallel speedups. With this definition in mind, we evaluate the advantages and disadvantages of various spatial and temporal discretization schemes in mapping the weather and climate dynamics onto the massively parallel computers. Using this analysis, a conservative, semi-implicit, weak Lagrange-Galerkin (WLG) Finite Element (FE) scheme on unstructured spherical triangular grid is developed to solve the well-accepted shallow water benchmark problem. Results from various benchmark tests show that the current algorithm is sequentially efficient and accurate. The code is parallelized both in shared memory (P4) and message passing paradigm (MPI). The parallel computation partitioning strategy is designed to achieve good load balance and minimize interprocess communication. by overlapping communications and computations, the communication latencies resulting from the Lagrange-Galerkin algorithm are minimized, thereby achieving good parallel speedups. Results from a wide range of parallel platforms including Cray T3E(260), HP Exemplar(256), IBM SP2(128), Berkeley NOW(100), SGI power, challenge(32) and KSR1(32) show that the present parallel algorithm is efficient, portable, and scalable.

Using a timeline analysis of the present algorithm, we identify the reasons for parallel performance degradation and provide possible remedies for minimizing it. We address the design issues that need to be considered for the code to be efficiently portable. Author

Massively Parallel Processors; Parallel Processing (Computers); Parallel Computers; Finite Element Method; Cray Computers; Scientific Visualization; Computerized Simulation; Numerical Weather Forecasting

19980205533 Argonne National Lab., Mathematics and Computer Science Div., IL USA

The Same-Source Parallel MM5

Michalakas, John, Argonne National Lab., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 129-137; In English; Also announced as 19980205520 Contract(s)/Grant(s): W-31-109-eng-38; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

With the March 1998 release of the Penn State University/NCAR Mesoscale Model (MM5), the official version of the model (MM5v2 Release 8) now runs on distributed memory (DM) message-passing platforms. Under an IBM-funded effort, source translation and runtime library support minimize the impact of parallelization on the original model source code with the result that the majority of code is line-for-line identical with the original version. Parallel performance and scaling are equivalent to earlier, hand-parallelized versions; the modifications have no effect when the code is compiled and run without the DM option. Supported computers include the IBM SP2, Cray T3E, and Fujitsu VPP. The approach is compatible with shared-memory parallelism, allowing DM/SM hybrid parallelization on distributed memory clusters of SMP. Preliminary results show that scalability on distributed shared memory computers such as the SGI Origin 2000 also benefits from a distributed memory programming model. Author

Cray Computers; Multiprocessing (Computers); Parallel Processing (Computers); Massively Parallel Processors; Distributed Memory; Memory (Computers)

19980205551 Oak Ridge National Lab., TN USA

Impact of Communication Protocol on Performance

Worley, Patrick H., Oak Ridge National Lab., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 277-288; In English; Also announced as 19980205520 Contract(s)/Grant(s): DE-AC05-96OR-22464; ASC-96-0028N; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

On previous generation MPP systems, interprocessor communication often represented a significant fraction of the runtime of production parallel codes, and the choice of communication transport layer and communication protocol were important steps in porting and tuning application codes. Processor, network, and transport layer performance continue to improve, and the sensitivity of performance to these implementation issues needs to be reexamined. In this paper we use the PSTSWM parallel application code to examine: 1) single processor performance; 2) peak achievable point-to-point communication performance; 3) performance variation of kernels as a function of communication protocols; 4) performance of vendor-supplied collective communication routines; and 5) performance sensitivity of full code to choice of parallel implementation for the SGI/Cray Research T3E and Origin 2000, using both the MPI and SHMEM libraries to implement interprocessor communication. While other researchers have looked at communication performance on these machines, this study differs in that we examine the effect on performance of an application code.
Author

Protocol (Computers); Point to Point Communication; Interprocessor Communication; Communication Networks; Cray Computers

19980205552 Iowa State Univ. of Science and Technology, Computer Science Dept., Ames, IA USA

Parallelization Agent: A Knowledge-Based System

Kothari, Suraj C., Iowa State Univ. of Science and Technology, USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 289-297; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Parallelization Agent (PA) is a knowledge-based system for parallelizing 3-dimensional, time marching, explicit finite difference science codes. The MM5, RAMS, RADM and a couple of other codes have been parallelized with help of the PA. It was possible to parallelize the MM5 code in two weeks as opposed to several years it took for manual parallelization by a team of expert programmers. The PA provides a customized but flexible environment for parallelizing atmospheric science codes. It supports portable higher level abstractions that simplify the process of parallel programming by automating tedious details of parallel programming and hiding low level architectural details. The PA has an interactive capability for exchanging information about spe-

cific applications. This interaction is closer to the way application program methods are understood and communicated by humans.
Author
Expert Systems; Parallel Programming; Programmers; Time Marching; Meteorology

19980205553 Pacific-Sierra Research Corp., Santa Monica, CA USA
DEEP: A Development Environment for Parallel Programs
Brode, Brian Q., Pacific-Sierra Research Corp., USA; Warber, Chris R., Pacific-Sierra Research Corp., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 299-312; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The use of the DEEP development environment to analyze parallel program performance is described. The full integrated environment contains tools for the creation, analysis and debugging of parallel programs. All information is related back to the original parallel source code. This paper describes the program analysis portion of DEEP and describes its use on parallel programs with distributed memory (message passing with MPI, data parallel with HPF and Data Parallel C), and shared memory (automatic parallelization and OpenMP).
Author
Parallel Programming; Applications Programs (Computers); Program Verification (Computers); C (Programming Language); Software Engineering

19980205627 Rutherford Appleton Lab., Chilton, UK
RALPAR-RAL Mesh Partitioning Program. Version 2.0
Fowler, R. F., Rutherford Appleton Lab., UK; Greenough, C., Rutherford Appleton Lab., UK; Feb. 1998; ISSN 1362-0223; 64p; In English
Report No.(s): PB98-142771; RAL-TR-98-025; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document describes Version 2.0 of the ralpar mesh partitioning tool. This tool implements a wide range of basic mesh partitioning algorithms for unstructured finite element type meshes in two and three dimensions using direct and graph based methods. The tools provides some simple display options and commands for storing information about the partitions generated.
NTIS
Unstructured Grids (Mathematics); Parallel Processing (Computers)

19980205671 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Transaction Decomposition: Refinement of Timing Constraints
Haveman, J., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 26p; In English
Report No.(s): PB98-147879; TRS-611; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper shows some aspects of the application of real-time transaction model that aims to provide a systematic way to develop distributed real-time systems, from the first specification of the functionality and timing properties of its tasks.
NTIS
Real Time Operation; Constraints; Utilization

19980205789 Oak Ridge National Lab., TN USA
Use of SSH on a compartmented mode workstation
Tolliver, J. S., Oak Ridge National Lab., USA; Dillow, D., Lockheed Martin Energy Systems, Inc., USA; 1997; 7p; In English; National Information Systems Security Conference, 7 Oct. 1997, Baltimore, MD, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-971034-3; DE97-007781; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

SSH stands for ”Secure Shell”. It is now a user shell like csh or ksh. Instead it is a widely-used means to accomplish secure, encrypted communication among cooperating nodes. It is a secure replacement for the ”r-commands”, r-login, and rcp. SSH is free for noncommercial use and builds and runs on most any UNIX platform. A Compartmented Mode Workstation (CMW) is an example of a secure or ”trusted” operating system. The use of SSH on a CMW introduces security problems unless the SSH source code is modified to take advantage of the security features of the CMW. This paper describes the port and use of SSH on one particular brand of CMW.
DOE
Security; Communication; Computer Networks

19980205810 Sandia National Labs., Albuquerque, NM USA

Using PDM to create a virtually integrated manufacturing enterprise

Lapetina, N., Sandia National Labs., USA; Neugebauer, G., Sandia National Labs., USA; [1997]; 5p; In English; Integrated Product and Process Design Symposium, 27 - 29 Oct. 1997, Fort Worth, TX, USA

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

Report No.(s): SAND-97-1926C; CONF-971071-2; DE97-007975; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

In late 1993, the authors' mission expanded from engineering design to also encompass production of neutron generator devices. They completed a gap analysis of the tools needed to support this emerging production assignment and, as a result, introduced a Product Data Management (PDM) system. This implementation includes basic PDM features, Web access, interfaces to the production floor and suppliers, and other utilities. They carefully strategized, piloted and assessed the integration of the PDM system into their business. Their efforts have prepared them to enter the next tier to further integrate their key operational resources to include their external suppliers.

DOE

Manufacturing; Management Systems; Mission Planning; Product Development

19980205812 Los Alamos National Lab., NM USA

AMR++: A design for parallel object-oriented adaptive mesh refinement

Quinlan, D., Los Alamos National Lab., USA; [1997]; 6p; In English; IMA: Structured Adaptive Mesh Refinement Grid Methods, 12 - 13 Mar. 1997, Minneapolis, MN, USA

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

Report No.(s): LA-UR-97-2877; CONF-9703118; DE98-000830; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Adaptive mesh refinement computations are complicated by their dynamic nature. In the serial environment they require substantial infrastructures to support the regridding processes, intergrid operations, and local bookkeeping of positions of grids relative to one another. In the parallel environment the dynamic behavior is more problematic because it requires dynamic distribution support and load balancing. Parallel AMR is further complicated by the substantial task parallelism, in addition to the obvious data parallelism, this task parallelism requires additional infrastructure to support efficiently. The degree of parallelism is typically dependent upon the algorithms in use and the equations being solved. Different algorithms have significant compromises between computation and communication. Substantial research work is often required to define efficient methods and suitable infrastructure. The purpose of this paper is to introduce AMR++ as an object-oriented library which forms a part of the OVERTURE framework, a much larger object-oriented numerical framework developed and supported at Los Alamos National Laboratory and distributed on the Web for the last several years.

DOE

Computational Grids; Grid Generation (Mathematics); Object-Oriented Programming; Computer Programs; Numerical Analysis

19980206157 Auburn Univ., Dept. of Computer Science and Engineering, AL USA

New Interfaces to Web Documents and Services

Carlisle, W. H., Auburn Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper reports on investigations into how to extend capabilities of the Virtual Research Center (VRC) for NASA's Advanced Concepts Office. The work was performed as part of NASA's 1996 Summer Faculty Fellowship program, and involved research into and prototype development of software components that provide documents and services for the World Wide Web (WWW). The WWW has become a de-facto standard for sharing resources over the internet, primarily because web browsers are freely available for the most common hardware platforms and their operating systems. As a consequence of the popularity of the internet, tools, and techniques associated with web browsers are changing rapidly. New capabilities are offered by companies that support web browsers in order to achieve or remain a dominant participant in internet services. Because a goal of the VRC is to build an environment for NASA centers, universities, and industrial partners to share information associated with Advanced Concepts Office activities, the VRC tracks new techniques and services associated with the web in order to determine the their usefulness for distributed and collaborative engineering research activities. Most recently, Java has emerged as a new tool for providing

internet services. Because the major web browser providers have decided to include Java in their software, investigations into Java were conducted this summer.
Derived from text
Computer Programs; Information Dissemination; Internet Resources; Information Systems; World Wide Web

19980206201 Alabama Univ., Dept. of Electrical and Computer Engineering, Huntsville, AL USA
Applying Parallel Processing Techniques to Tether Dynamics Simulation
Wells, B. Earl, Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The focus of this research has been to determine the effectiveness of applying parallel processing techniques to a sizable real-world problem, the simulation of the dynamics associated with a tether which connects two objects in low earth orbit, and to explore the degree to which the parallelization process can be automated through the creation of new software tools. The goal has been to utilize this specific application problem as a base to develop more generally applicable techniques.
Author
Parallel Processing (Computers); Tethering; Software Development Tools; Dynamic Models; Predictor-Corrector Methods; Dynamical Systems

19980206276 Los Alamos National Lab., NM USA
Performance characterization and validation of ASCI applications: A memory centric view
Lubeck, O. M., Los Alamos National Lab., USA; Luo, Y., Los Alamos National Lab., USA; Wasserman, H., Los Alamos National Lab., USA; Bassetti, F., Los Alamos National Lab., USA; [1997]; 5p; In English; Paid '97, 1 Jun. 1997, Denver, CO, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1807; CONF-9706144-1; DE97-008195; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Performance and scalability of high performance scientific applications on large scale parallel machines are more dependent on the hierarchical memory subsystems of these machines than the peak instruction rate of the processors employed. The dependence is likely to increase in the future. While single-processor performance may double every eighteen months, memory bandwidth increases by only 15% during the same period. In addition, distributed shared memory (DSM) architectures are now being implemented which extend the concept of single-processor cache hierarchies across an entire physically-distributed multi-processor machine. Machines which will be available to the Department of Energy's Accelerated Strategic Computing Initiative (ASCI) can have as many as 128 processors in a single DSM. Scalability of these machines to large numbers of processors is ultimately tied to issues of memory hierarchy performance, which includes data migration policies and distributed cache coherence protocols. Investigations of the performance improvements of applications over time and across new generations of machines must explicitly account for the effects of memory performance. In this paper, the authors characterize application performance with a memory-centric view. The applications are a representative part of the ASCI workload. Using a simple Mean Value Analysis (MVA) strategy and observed performance data, they infer the contribution of each level in the memory system to the application's overall performance in cycles per instruction (CPI). Their empirical model accounts for the overlap of processor execution with memory accesses.
DOE
Architecture (Computers); Parallel Processing (Computers); Distributed Memory; Memory (Computers)

19980206307 Sandia National Labs., Albuquerque, NM USA
Nonisothermal multiphase subsurface transport on parallel computers
Martinez, M. J., Sandia National Labs., USA; Hopkins, P. L., Sandia National Labs., USA; Shadid, J. N., Sandia National Labs., USA; 1997; 11p; In English; International Mechanical Engineering Congress and Exposition, 16 - 21 Nov. 1997, Dallas, TX, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2016C; CONF-971115; DE98-000330; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We present a numerical method for nonisothermal, multiphase subsurface transport in heterogeneous porous media. 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 distributed memory parallel computers. An illustrative application is shown to demonstrate capabilities and performance.
DOE
Finite Element Method; Mathematical Models; Two Phase Flow; Nonlinear Equations; Porous Materials; Galerkin Method; Fluid Flow; Parallel Processing (Computers)

63
CYBERNETICS

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

19980203265 North Carolina Univ., Chapel Hill, NC USA
Dynamic Simulation and Path Planning for Virtual Environments ***Final Report***
Lin, Ming, North Carolina Univ., USA; Apr. 1998; 4p; In English
Contract(s)/Grant(s): DAAH04-93-D-0001
Report No.(s): AD-A344364; ARO-36449.1-MA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The PI and his students have developed novel algorithms for collision detection, 3D polyhedral morphing and view frustrum culling. These include use of noval hierarchical data structures and geometric techniques for interactive occlusion culling, general 3D mapping algorithm and efficient collision detection between general polygonal models. The resulting algorithms and systems have been applied to a number of applications and the technology has been transferred to a number of research labs and academic institutes, as well as commercial vendors.
DTIC
Computerized Simulation; Virtual Reality; Algorithms; Collision Parameters; Detection; Trajectory Planning

19980203280 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Linear Reconstruction of Non-Stationary Image Ensembles Incorporating Blur and Noise Models
Ford, Stephen D., Air Force Inst. of Tech., USA; Mar. 1998; 160p; In English
Report No.(s): AD-A344310; AFIT/DS/ENG-98-06; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Two new linear reconstruction techniques are developed to improve the resolution of images collected by ground-based telescopes imaging through atmospheric turbulence. The classical approach involves the application of Constrained Least Squares (CLS) to the Deconvolution from WaveFront Sensing (DWFS) technique. The new algorithm incorporates blur and noise models to select the appropriate regularization constant automatically. In all cases examined, the Newton-Raphson minimization converged to a solution in less than 10 iterations. The non-iterative Bayesian approach involves the development of a new vector Wiener filter which is optimal with respect to Mean Square Error (MSE) for a non-stationary object class degraded by atmospheric turbulence and measurement noise. This research involves the first extension of the Wiener filter to account properly for shot noise and an unknown, random optical transfer function (OTF). The vector Wiener filter provides superior reconstructions when compared to the traditional scalar Wiener filter for a non-stationary object class. In addition, the new filter can provide a superresolution capability when the object's Fourier domain statistics are known for spatial frequencies beyond the OTF cutoff. A generalized performance and robustness study of the vector Wiener filter showed that MSE performance is fundamentally limited by object signal-to-noise ratio (SNR) and correlation between object pixels.
DTIC
Adaptive Optics; Procedures; Image Reconstruction; Imaging Techniques; Image Filters

19980203283 Nottingham Univ., UK
Proceedings of the Second European Conference on Cognitive Modelling
Ritter, Frank E., Editor, Nottingham Univ., UK; Young, Richard M., Editor, Nottingham Univ., UK; Apr. 04, 1998; 218p; In English; 2nd; Cognitive Modelling, 104 Apr. 1998, Nottingham, UK
Contract(s)/Grant(s): F61775-98-WE003
Report No.(s): AD-A344313; ECCM-98; EOARD-CSP-98-1046; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This interdisciplinary conference covered all areas of cognitive modeling. including artificial intelligence programming; classification; problem solving; reasoning; inference; learning; language processing; human computer interaction; symbolic and

connectionist models; evolutionary computation; artificial neural networks; grammatical inferences; reinforcement learning; and data sets designed to test models.
DTIC
Conferences; Neural Nets; Cognition; Human Factors Engineering

19980203284 California Univ., Berkeley, CA USA
Modal Logics for Continuous Dynamics
Davoren, Jennifer M., California Univ., USA; Nov. 1997; 143p; In English
Contract(s)/Grant(s): DAAH04-96-1-0341
Report No.(s): AD-A344316; TR-97-09; ARO-35873.76-MA-MUR; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This work is a formal investigation of a number of bimodal and polymodal logics built on a base of propositional S4, and is a contribution to the theory of hybrid control systems. It is the first stage of a larger project of developing logics for the design and verification of such systems.
DTIC
Proving; Adaptive Control; Computer Systems Programs; Hybrid Structures

19980203348 Institute for the Study of Learning and Expertise, Palo Alto, CA USA
MAGELLAN: An Integrated Adaptive Architecture for Mobile Robotics ***Final Report, 1 Mar. 1994 - 28 Feb. 1997***
Yamauchi, Brian, Institute for the Study of Learning and Expertise, USA; Langley, Pat, Institute for the Study of Learning and Expertise, USA; Schultz, Alan C., Institute for the Study of Learning and Expertise, USA; Grefenstette, John, Institute for the Study of Learning and Expertise, USA; Adams, William, Institute for the Study of Learning and Expertise, USA; May 01, 1998; 21p; In English
Contract(s)/Grant(s): N00014-94-1-0505
Report No.(s): AD-A343712; ISLE-98-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we describe MAGELLAN, an integrated architecture for mobile robotics. The system represents its spatial knowledge in terms of a topological network that connects a set of distinct places, each represented by evidence grids that contain probabilistic descriptions of occupancy. MAGELLAN includes a module for place recognition that determines its initial location and when it has reached a goal, a module for continuous localization that maintains accurate estimates of the robot's position, and a module for navigation that generates path plans and executes them using reactive behaviors. Experiments in two laboratories with different characteristics suggest that the system can operate robustly across a range of environments, including ones that involve dynamic changes.
DTIC
Robotics; Robots; Architecture (Computers); Adaptive Control; Computer Programs; Machine Learning

19980203420 Energia Nucleare e Delle Energie Alternative, Dipt. Innovazione, Rome, Italy
Training data representation in a neural based robot position estimation system
Taraglio, S., Energia Nucleare e Delle Energie Alternative, Italy; Di Fonzo, F., La Sapienza Univ., Italy; Burrascano, P., La Sapienza Univ., Italy; Mar. 1997; ISSN 1120-5571; 8p; In English
Report No.(s): ENEA-RT-INN-97-01; RT/INN-97-1; DE97-765452; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The vision subsystem of an autonomous vehicle is studies. It is based on a multi layer perceptron that uses TV images to estimate the position of the vehicle. A comparative study of the effects of output data representation and input data processing is presented and discussed.
DOE
Neural Nets; Robots; Artificial Intelligence; Machine Learning; Computer Vision; Image Processing

19980203429 Energia Nucleare e Delle Energie Alternative, Dipt. Innovazione, Rome, Italy
Cellular neural networks for the stereo matching problem
Taraglio, S., Energia Nucleare e Delle Energie Alternative, Italy; Zanela, A., La Sapienza Univ., Italy; Mar. 1997; ISSN 1120-5571; 9p; In English
Report No.(s): ENEA-RT-INN-97-04; RT/INN-97-4; DE97-765451; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

The applicability of the Cellular Neural Network (CNN) paradigm to the problem of recovering information on the tridimensional structure of the environment is investigated. The approach proposed is the stereo matching of video images. The starting point of this work is the Zhou-Chellappa neural network implementation for the same problem. The CNN based system we present here yields the same results as the previous approach, but without the many existing drawbacks.
DOE
Neural Nets; Artificial Intelligence; Computer Vision; Pattern Recognition; Parallel Processing (Computers); Image Processing

19980203430 Energia Nucleare e Delle Energie Alternative, Dipt. Innovazione, Rome, Italy
Cellular Neural Networks: A genetic algorithm for parameters optimization in artificial vision applications
Taraglio, S., Energia Nucleare e Delle Energie Alternative, Italy; Zanela, A., La Sapienza Univ., Italy; Mar. 1997; ISSN 1120-5571; 9p; In English
Report No.(s): ENEA-RT-INN-97-03; RT/INN-97-3; DE97-765450; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

An optimization method for some of the CNN's (Cellular Neural Network) parameters, based on evolutionary strategies, is proposed. The new class of feedback template found is more effective in extracting features from the images that an autonomous vehicle acquires, than in the previous CNN's literature.
DOE
Neural Nets; Computer Vision; Genetic Algorithms; Pattern Recognition; Artificial Intelligence

19980203442 Auburn Univ., AL USA
Superresolution of Passive Millimeter-Wave Imaging ***Final Report***
Reeves, Stanley J., Auburn Univ., USA; Apr. 28, 1998; 6p; In English
Contract(s)/Grant(s): F49620-95-1-0328
Report No.(s): AD-A343682; AFRL-SR-BL-TR-98-0436; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In standard intensity imaging, the resolution is limited by the width of the aperture. The region of support of the autocorrelation of the pupil function is the measured spatial frequency bandwidth of the imaging system and thus determines the resolution limit. This relationship between the size of the pupil function and the resolution limit is generally taken to describe a fundamental limit for resolution. Contrary to conventional wisdom, the resolution is actually limited only for fields with zero higher-order cumulants. For fields with non-vanishing higher-order cumulants, higher resolution can be obtained by integrating higher powers of instantaneous intensity in the image plane and combining these images appropriately. The result is that resolution is limited only by the time required for the integral of the higher power of intensity to approximate the expected value. We demonstrate these claims and analyze the variance of the integrated intensity-squared image as a function of the temporal spectrum and integration time. Furthermore, various image restoration strategies are proposed to estimate the superresolved intensity image from the various measurements. Our simulations show imaging of spatial frequency information outside the support of the pupil function autocorrelation for non-Gaussian fields.
DTIC
Millimeter Waves; High Resolution; Microwave Imagery; Imaging Techniques; Pupils

19980203465 California Univ., Sponsored Projects Office, Berkeley, CA USA
Automation Comparison Procedure for Verification of Hybrid Systems
Kohn, W., California Univ., USA; Remmel, J. B., California Univ., USA; Nerode, A., California Univ., USA; Nov. 1997; 9p; In English
Contract(s)/Grant(s): DAAH04-96-1-0341
Report No.(s): AD-A344450; TR-97-11; ARO-35873.79-MA-MUR; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes ongoing research on a procedure for the verification of hybrid system controllers implemented via HyBrithms' Multiple Agent Hybrid Control Architecture which executes the Kohn Nerode procedure for the on-line extraction of real time controls. It is an automated static verification technique based on the construction of an Intersection Unification Automaton. We discuss an essential step of this verification technique, namely, a procedure to verify that the controller design generated by an agent in MAHCA meets the requirements established for that agent The paper describes the functionality of the procedure and illustrates it with an example.
DTIC
Linear Systems; Control Theory; Procedures; Proving; Program Verification (Computers); Adaptive Control

19980203514 Stanford Univ., Dept. of Computer Science, Stanford, CA USA

Basic Research in Knowledge Representation ***Final Report, 1 Jun. 1994 - 31 Dec. 1997***

McCarthy, John, Stanford Univ., USA; Talcott, Carolyn, Stanford Univ., USA; May 01, 1998; 7p; In English

Contract(s)/Grant(s): ARPA ORDER-A991

Report No.(s): AD-A344511; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This project concerned developing new logical formalisms for representing information. New formalisms allow us to represent information that we previously could not capture. New reasoning methods allow us to integrate more information and can yield conclusions that were previously unavailable. One basic method that was developed involves introducing contexts as mathematical objects and developing formal language for describing the relations between sentences true in different contexts. This allows information that arose from different sources to be integrated, taking account of the differences in collection methodologies, uncertainties, differing languages and ontologies, and potential inconsistencies. The other main thrust was to describe the processes that underly the changes that occur when new information arrives. The representation of counterfactuals, change, and defeasible reasoning was studied. Each of these allow us to capture how new information should make us adjust our current view of the world.

DTIC

Artificial Intelligence; Procedures; Information Management; Research; Formalism

19980203529 Oak Ridge National Lab., TN USA

Future applications of simulators in process control

Ruppel, F., Oak Ridge National Lab., USA; Wysor, W., Oak Ridge National Lab., USA; Mar. 21, 1997; 11p; In English; Isa-tech 1997, 7 Oct. 1997, Anaheim, CA, USA

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

Report No.(s): CONF-971038-1; DE97-005131; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Future applications of simulators in process control will see activities with high return on investment in areas such as concurrent engineering, hardware-in-the-loop controller testing, process fault detection, and Internet-retrievable simulation models and tools. These applications are based on advancing technology in the field of simulation technology. In this paper, the advancing technology will be reviewed, and projections to future uses of simulators in process control will be made.

DOE

Computerized Simulation; Concurrent Engineering

19980203769 California Univ., San Diego, La Jolla, CA USA

VR/Multimedia Synthesis, Phase 2 ***Annual Report, 1 Oct. 1996 - 30 Sep. 1997***

Hoffman, Helene M., California Univ., San Diego, USA; Oct. 1997; 9p; In English

Contract(s)/Grant(s): DAMD17-94-J-4487

Report No.(s): AD-A343370; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The University of California, San Diego (UCSD) School of Medicine's (SOM) Learning Resources Center (LRC) is developing a virtual world to provide a compelling learning environment and a valuable paradigm for navigating through medical knowledge. It combines 3-D anatomic models (based on the Visible Human dataset) with supporting 2-D media (e.g., diagnostic imagery, surgical videos, etc.) to establish a dynamic learning environment that integrates spatial knowledge (VR) with extant multimedia (MM) resources. Case based scenarios promote exploration, discovery, and active learning by enabling users to dissect 3-D anatomic models while accessing supporting resource elements. Exercises are organized in a 3-D Study Guide that supplies: (1) an interactive Table of Contents for flexible non-sequential access to the case material; (2) descriptive text which provides an organized presentation of key concepts; and (3) suggested exercises and exploratory actions. The LRC is also evaluating the VR-MM environment in order to optimize learning outcomes, training transfer, and cost effectiveness. These experiments are being designed to evaluate important VE system design issues including degree of immersion and affect on users' perception of depth in virtual space as indexed by perceptual motor task performance.

DTIC

Virtual Reality; Transfer of Training; Three Dimensional Models; Systems Engineering; Psychomotor Performance; Human Performance; Cost Effectiveness

19980203896 Cornell Univ., Center for Foundations of Intelligent Systems, Ithaca, NY USA

Modal Logics and Topological Semantics for Hybrid Systems

Artemov, Sergei N., Cornell Univ., USA; Davoren, Jennifer M., Cornell Univ., USA; Nerode, A., Cornell Univ., USA; Jun. 1997; 40p; In English

Contract(s)/Grant(s): DAAH04-96-1-0341

Report No.(s): AD-A344355; TR-97-02; ARO-35873.77-MA-MUR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper introduces the logic of a control action S4F and the logic of a continuous control action S4C on the state space of a dynamical system. The state space is represented by a topological space (X, T) and the control action by a function f from X to X. We present an intended topological semantics and a Kripke semantics, give both a Hilbert style axiomatization and Gentzen style sequent calculus for S4F and S4C, and prove completeness with respect to both semantics a cut elimination for the sequent calculi, and decidability of the logics.

DTIC

Topology; Logic Programming; Modal Response; Semantics

19980204997 Michigan Univ., Dept. of Electrical Engineering and Computer Science, Ann Arbor, MI USA

Control and Identification of Uncertain Systems ***Final Report***

Khargonekar, Pramod P., Michigan Univ., USA; Mar. 1998; 16p; In English

Contract(s)/Grant(s): DAAH04-93-G-0012

Report No.(s): AD-A344186; ARO-30650.10-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The design and analysis of robust feedback systems were summarized. This research is broadly concerned with robust control and identification theory and applications. We have obtained significant new theoretical results and efficient computational algorithms for: H2, H-infinity, and H2/H-infinity control synthesis, multiobjective robust control, robust identification, and gain-scheduled control. The proposed methods are demonstrated in several engineering applications.

DTIC

Systems Analysis; Control Theory; Nonlinear Systems

19980205001 Chicago Univ., Dept. of Statistics, Chicago, IL USA

A Computational Model for Visual Selection

Amit, Yali, Chicago Univ., USA; Geman, Donald, Massachusetts Univ., USA; Apr. 1998; 36p; In English

Contract(s)/Grant(s): DAAL03-92-G-0322; DAAH04-96-1-0061

Report No.(s): AD-A344220; TR-469; ARO-30167.17-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We propose a computational model for detecting and localizing instances from an object class in static grey level images. We divide detection into visual selection and final classification, concentrating on the former: (1) Drastically reducing the number of candidate regions which require further, (2) usually more intensive, (3) processing, (4) but with a minimum of computation, and (5) missed detections. Bottom-up processing is based on local groupings of edge fragments constrained by loose geometrical relationships. They have no a priori semantic or geometric interpretation. The role of training is to select special groupings which are moderately likely at certain places on the object but rare in the background. We show that the statistics in both populations are stable. The candidate regions are those which contain global arrangements of several local groupings. Whereas our model was not conceived to explain brain functions, it does cohere with evidence about the functions of neurons in V1 and V2, such as responses to coarse or incomplete patterns (e.g., ”illusory contours”) and to scale and translation invariance in IT. Finally, the algorithm is applied to face and symbol detection.

DTIC

Mathematical Models; Image Processing; Computer Vision

19980205008 Houston Univ., Dept. of Electrical and Computer Engineering, TX USA

Robust Optimal Digital Control of Uncertain Multi-Rate Sampled-Data Systems ***Final Report, 1 Jun. 1994 - 31 Jan. 1998***

Shieh, Leang-San, Houston Univ., USA; Chen, Guanrong, Houston Univ., USA; Jan. 31, 1998; 16p; In English

Contract(s)/Grant(s): DAAH04-94-G-0227

Report No.(s): AD-A344559; ARO-32438.36-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents a new digital redesign method for robust control of a sampled data uncertain system using an observer based digital controller. The multiple segment trapezoidal rule together with interval arithmetic is utilized to find a digital interval model of the original continuous time uncertain system. A dual concept of the digital interval modeling which captures the inter-sample states of the original continuous time uncertain system is used to discretize a predesigned continuous time state feedback

robust controller so that the states of the digitally controlled continuous time uncertain system closely match those of the original analogously controlled continuous time uncertain system. A discrete time observer is constructed from the original continuous time observer such that the estimated states of the redesigned discrete time observer match those of the original continuous time observer at the sampling instants. Using the newly digitally redesigned observer based controllers, the resulting dynamic states of the digitally controlled sampled data uncertain systems are able to closely match those of the original analogously controlled continuous time uncertain systems.
DTIC
Digital Systems; Control Theory; Robustness (Mathematics); Data Systems; Control Systems Design; Time Functions

19980205010 California Univ., Berkeley, CA USA
Hybrid System Extraction of Control Automata with Small Topologies
Nerode, A., California Univ., USA; Remmel, J. B., California Univ., USA; Yakhnis, A., California Univ., USA; Jun. 1997; 46p; In English
Contract(s)/Grant(s): DAAH04-96-1-0341
Report No.(s): AD-A344578; TR-97-03; ARO-35873.81-MA-MUR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We propose a game framework for analyzing, extracting and verifying digital control programs for continuous plants by regarding such programs as finite state winning strategies in associated games. We call such interacting systems of digital control programs and continuous plants hybrid systems and model them as networks of interacting concurrent digital programs or automata. This extends to hybrid systems the paradigm introduced by Nerode, Yakhnis and Yakhnis for analysing concurrent digital programs meeting program specifications as winning finite state strategies in associated two person games.
DTIC
Control Theory; Automata Theory; Procedures; Computer Programs

19980205604 Los Alamos National Lab., NM USA
Limited weights neural networks: Very tight entropy based bounds
Beiiu, V., Los Alamos National Lab., USA; Draghici, S., Wayne State Univ., USA; 1997; 4p; In English; 2nd; Soco '97: International Symposium on Soft Computing, Fuzzy Logic, Artificial Neural Networks, and Genetic Algorithms, 17 - 19 Sep. 1997, Nimes, France
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-UR-97-294; CONF-970939-1; DE97-004781; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Being given a set of m examples (i.e., data-set) from IR(sup n) belonging to k different classes, the problem is to compute the required number-of-bits (i.e., entropy) for correctly classifying the data-set. Very tight upper and lower bounds for a dichotomy (i.e., k = 2) will be presented, but they are valid for the general case.
DOE
Neural Nets; Entropy; Dichotomies

19980205715 Lockheed Martin Tactical Defense Systems, Saint Paul, MN USA
Information Theory Analysis for Data Fusion ***Final Report, 1 Jul. 1994 - 30 Nov. 1997***
Mahler, Ronald P. S., Lockheed Martin Tactical Defense Systems, USA; Jan. 16, 1998; 45p; In English
Contract(s)/Grant(s): DAAH04-94-C-0011
Report No.(s): AD-A344545; ARO-32628.12-EL; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Complete theoretical development of random set unified data fusion, and place under theoretically solid information theory foundation suitable for publication. Findings: (1) Showed that optimal sensor allocation (redirection of the reallocatable sensors in a sensor suite) can be subsumed within the random set approach to information fusion, via generalization of nonlinear optimal control theory. (2) Showed that random set theory and information theory provides a common basis for performance evaluation in information fusion. Showed that parameters (e.g. target I.D. performance) can be measured in terms of information, and likewise for user defined constraints (e.g. subjective or multiple definitions of information). (3) Showed that both precise and ambiguous observations can be fused by generalizing Bayesian measurement models and the standard Bayesian recursive nonlinear filtering equations. (4) Seven chapters were completed and submitted for a book published in 1997 by Kluwer. (5) Organized a joint ONR/ARO scientific workshop on Applications and Theory of Random Sets.
DTIC
Control Theory; Information Theory; Numerical Analysis; Evaluation; Multisensor Fusion

19980205809 Los Alamos National Lab., NM USA

On sparsely connected optimal neural networks

Beiu, V., Los Alamos National Lab., USA; Draghici, S., Wayne State Univ., USA; [1997]; 9p; In English; Microelectronics for Neural Networks, Evolution and Fuzzy Systems, 24 - 26 Sep. 1997, Dresden, Germany

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

Report No.(s): LA-UR-97-1567; CONF-970984-1; DE97-008308; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper uses two different approaches to show that VLSI- and size-optimal discrete neural networks are obtained for small fan-in values. These have applications to hardware implementations of neural networks, but also reveal an intrinsic limitation of digital VLSI technology: its inability to cope with highly connected structures. The first approach is based on implementing F(sub n,m) functions. The authors show that this class of functions can be implemented in VLSI-optimal (i.e., minimizing AT(sup 2)) neural networks of small constant fan-ins. In order to estimate the area (A) and the delay (T) of such networks, the following cost functions will be used: (i) the connectivity and the number-of-bits for representing the weights and thresholds--for good estimates of the area; and (ii) the fan-ins and the length of the wires--for good approximates of the delay. The second approach is based on implementing Boolean functions for which the classical Shannon's decomposition can be used. Such a solution has already been used to prove bounds on the size of fan-in 2 neural networks. They will generalize the result presented there to arbitrary fan-in, and prove that the size is minimized by small fan-in values. Finally, a size-optimal neural network of small constant fan-ins will be suggested for F(sub n,m) functions.

DOE

Neural Nets; Boolean Functions; Very Large Scale Integration

19980206033 NASA Lewis Research Center, Cleveland, OH USA

Vibrational Analysis of Engine Components Using Neural-Net Processing and Electronic Holography

Decker, Arthur J., NASA Lewis Research Center, USA; Fite, E. Brian, NASA Lewis Research Center, USA; Mehmed, Oral, NASA Lewis Research Center, USA; Thorp, Scott A., NASA Lewis Research Center, USA; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The use of computational-model trained artificial neural networks to acquire damage specific information from electronic holograms is discussed. A neural network is trained to transform two time-average holograms into a pattern related to the bending-induced-strain distribution of the vibrating component. The bending distribution is very sensitive to component damage unlike the characteristic fringe pattern or the displacement amplitude distribution. The neural network processor is fast for real-time visualization of damage. The two-hologram limit makes the processor more robust to speckle pattern decorrelation. Undamaged and cracked cantilever plates serve as effective objects for testing the combination of electronic holography and neural-net processing. The requirements are discussed for using finite-element-model trained neural networks for field inspections of engine components. The paper specifically discusses neural-network fringe pattern analysis in the presence of the laser speckle effect and the performances of two limiting cases of the neural-net architecture.

Author

Neural Nets; Structural Vibration; Engine Parts; Holography; Damage Assessment; Real Time Operation; Inspection; Mathematical Models; Artificial Intelligence

19980206091 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Decentralized Robust Stabilization for Uncertain Interconnected Systems

Cheng, Cheng-Fa, Nankai Junior Coll. of Technology and Commerce, Taiwan, Province of China; Wang, Wen-June, Nankai Junior Coll. of Technology and Commerce, Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 199-211; In English

Contract(s)/Grant(s): NSC86-2213-E-252-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

This paper is concerned with the decentralized stabilization of an uncertain interconnected system by using local state feedback control. The considered interconnected system consists of several subsystems, each of which contains bounded uncertainties and structured interactions. A complete solution to the quadratically decentralized stabilization problem for this uncertain interconnected system is given and it will be shown that the solution is equivalent to solving a set of algebraic Riccati equations contain-

ing some free parameters. Subsequently, the relationship between these robust stabilization problems and H-infinity control theory is explored.
Author
Stabilization; Control Theory; Feedback Control; H-Infinity Control; Theorem Proving; Mathematical Models; Linear Quadratic Gaussian Control

19980206133 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Variable Structure Controllers Design for Discrete-Time Model-Following Systems
Lee, Rong-Chyang, National Central Univ., Taiwan, Province of China; Wang, Wen-June, National Central Univ., Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 171-176; In English
Contract(s)/Grant(s): NSC83-0404-E008-040; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

This paper proposes a design technique for the variable structure control (VSC) to stabilize the discrete-time model-following systems. That is, for a given model with ideal response characteristics, a VSC is designed so that the error between the plant's state and the model's state is forced to exhibit a sliding mode behavior, then the output of the plant faithfully follows that of the model. This VSC includes two portions, one is the "sliding control" which depends on the determination of the matrix G for the sliding surface such that the sliding mode is stable; the other is the reaching control which is designed to force the error state approaching the sliding surface. It is also shown that in this controlled system the sliding surface is extended to a sliding region which is determined by a diagonalizing transformation matrix. Furthermore, the designed reaching control gain is a simple vector with the same elements. This may make the practical controller easily implemented.
Author
Controllers; Nonlinear Systems; Control Systems Design; Model Reference Adaptive Control; Mathematical Models

64
NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19980203394 University of Southern California, Center for Applied Mathematical Sciences, Los Angeles, CA USA
Nonlinear Filtering Stochastic Analysis and Numerical Methods ***Final Report, 1 Apr. 1995 - 31 Mar. 1998***
Rozovskii, B. L., University of Southern California, USA; LeGland, F., University of Southern California, USA; Mar. 31, 1998; 31p; In English
Contract(s)/Grant(s): DAAH04-95-1-0164
Report No.(s): AD-A344383; ARO-32332.13-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The final report contains the outline of the research that was done during the period 1995-98. The main objective was to develop effective numerical algorithms of optimal nonlinear filtering and prediction and (more generally), state and parameter estimation in partially observed stochastic dynamical systems. During the course of the project a number of fundamental results were obtained, such as: development of a Wiener type optimal nonlinear filter (complete solution of "the last Wiener problem"); development of the spectral based approach to nonlinear filtering, which have led to the spectral separating scheme (separation of parameters and observations in optimal nonlinear filter) and other effective numerical approximations for the optimal nonlinear filter that include projection filter and assumed density filters. The results have been applied to specific "difficult" problems in target tracking, particularly, to the angle only tracking in EO and IR search and track systems and track-before-detect of resolved or sub-resolved low SNR targets. Extensive simulation showed that the proposed approach allows us to obtain much better performance as compared to the conventional expended Kalman filter in a number of important practical situations.
DTIC
Stochastic Processes; Algorithms; Numerical Analysis; Nonlinear Equations; Numerical Integration

19980203395 Wisconsin Univ., Madison, WI USA
Bootstrap Calibration, Model Selection and Tree-Structured Methods ***Final Report, 1 Apr. 1994 - 31 Mar. 1998***
Wei-Yin, Loh, Wisconsin Univ., USA; Apr. 06, 1998; 7p; In English
Contract(s)/Grant(s): DAAH04-94-G-0042
Report No.(s): AD-A344443; ARO-32330.13-MA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several problems in variable selection and decision trees were solved. In the case of linear regression models with increasing number of covariates, a method based on ordering the covariates in terms of their t-statistics is shown to be asymptotically consis-

tent as the sample size increases. This result holds for the fixed design situation as well as that of random covariates. A new unbiased method of split selection for classification trees was developed and implemented into computer software. The method is unbiased in the sense that when all the covariates are unrelated to the response variable, each covariate has an equal chance of being selected to split a node. No previous algorithm has this property. Bootstrap calibration plays a critical role in the algorithm. Empirical evaluations of the algorithm show that it is as accurate as the best classifiers from the statistical and computer science literature. It has the additional benefit of being one of the fastest algorithms.
DTIC
Selection; Trees (Mathematics); Models; Algorithms; Linear Equations

19980203408 Los Alamos National Lab., NM USA
Random subgraphs of Cayley graphs over P-groups
Reidys, C. M., Los Alamos National Lab., USA; 1997; 13p; In English; European Journal of Combinatories, 28 May 1997, Paris, France
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1913; CONF-9705152-1; DE97-008151; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In this paper the author studies the largest component of random induced subgraphs of Cayley graphs X(sub n) over a certain class of p-groups P(sub n). Here P(sub n) consists of p-groups, G(sub n), that have the properties: (i) G(sub n)/(Phi)(G(sub n)) (congruent) F(sub p)(sup n), where (Phi)(G(sub n)) is the Frattini subgroup and (ii) (vert bar)G(sub n)(vert bar) (le)n(sup Kn), K greater than 0. The author then takes minimal Cayley graphs X(sub n) = (Gamma)(G(sub n),S(prime)(sub n)), where S(prime)(sub n) = S(sub n) (union) S(sub n)(sup (minus)1), and S(sub n) is a minimal G(sub n)-generating set. The random induced subgraphs, (Gamma)(sub n) of X(sub n) are produced by selecting G(sub n)-elements with independent probability (lambda)(sub n). The subject of this paper is the analysis of the largest component of random induced subgraphs (Gamma)(sub n) less than X(sub n). The author's main result is, that there exists a positive constant c greater than 0 such that for (lambda)(sub n) = c ln ((vert bar)S(prime)(sub n)(vert bar))/(vert bar)S(prime)(sub n)(vert bar) the largest component of random subgraphs of X(sub n) contains almost all vertices.
DOE
Probability Theory; Apexes; Graph Theory

19980203545 Tromsoe Univ., Norway
Formulae and Bounds Connected to Optimal Design and Homogenization of Partial Differential Operators and Integral Functionals
Lukkassen, D., Tromsoe Univ., Norway; 1996; 147p; In English
Report No.(s): NEI-NO-857; DE98-701803; ISBN 82-90487-87-8; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

When partial differential equations are set up to model physical processes in strongly heterogeneous materials, effective parameters for heat transfer, electric conductivity etc. are usually required. Averaging methods often lead to convergence problems and in homogenization theory one is therefore led to study how certain integral functionals behave asymptotically. This mathematical doctoral thesis discusses (1) means and bounds connected to homogenization of integral functionals, (2) reiterated homogenization of integral functionals, (3) bounds and homogenization of some particular partial differential operators, and (4) applications and further results.
DOE
Partial Differential Equations; Operators (Mathematics); Functionals; Problem Solving; Homogenizing

19980203582 Rutherford Appleton Lab., Chilton, UK
Numerical Analysis Group *Progress Report, Jan. 1996 - Dec. 1997*
Duff, Iain S., Editor, Rutherford Appleton Lab., UK; Mar. 1998; ISSN 1358-6254; 56p; In English
Report No.(s): RAL-TR-98-028; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK); US Sales Only, Hardcopy, Microfiche

We discuss the research activities of the Numerical Analysis Group in the Department for Computation and Information at the Rutherford Appleton Laboratory for the period January 1996 to December 1997. Keywords: sparse matrices, numerical linear algebra, large-scale optimization, FORTRAN, Harwell Subroutine Library,
Author
Numerical Analysis; Matrices (Mathematics); Algebra

19980203718 Utah State Univ., Dept. of Mathematics and Statistics, Logan, UT USA

Iterative Methods for Large Scale Nonlinear and Linear Systems ***Final Report, 1994-1996***

Walker, H. F., Utah State Univ., USA; [1997]; 9p; In English

Contract(s)/Grant(s): DE-FG03-94ER-25221

Report No.(s): DOE/ER/25221-1; DE97-009203; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The major goal of this research has been to develop improved numerical methods for the solution of large-scale systems of linear and nonlinear equations, such as occur almost ubiquitously in the computational modeling of physical phenomena. The numerical methods of central interest have been Krylov subspace methods for linear systems, which have enjoyed great success in many large-scale applications, and newton-Krylov methods for nonlinear problems, which use Krylov subspace methods to solve approximately the linear systems that characterize Newton steps. Krylov subspace methods have undergone a remarkable development over the last decade or so and are now very widely used for the iterative solution of large-scale linear systems, particularly those that arise in the discretization of partial differential equations (PDEs) that occur in computational modeling. Newton-Krylov methods have enjoyed parallel success and are currently used in many nonlinear applications of great scientific and industrial importance. In addition to their effectiveness on important problems, Newton-Krylov methods also offer a nonlinear framework within which to transfer to the nonlinear setting any advances in Krylov subspace methods or preconditioning techniques, or new algorithms that exploit advanced machine architectures. This research has resulted in a number of improved Krylov and Newton-Krylov algorithms together with applications of these to important linear and nonlinear problems.

DOE

Iterative Solution; Linear Systems; Nonlinear Systems; Newton Methods; Numerical Analysis

19980203726 Los Alamos National Lab., NM USA

Lie group applications to the solution of differential equations

Cranfill, C. W., Los Alamos National Lab., USA; Coggeshall, S. V., Los Alamos National Lab., USA; Knapp, C. E., Los Alamos National Lab., USA; Smitherman, D. P., Los Alamos National Lab., USA; Caramana, E. J., Los Alamos National Lab., USA; Axford, R. A., Illinois Univ., USA; [1997]; 6p; In English

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

Report No.(s): LA-UR-97-2567; DE97-008684; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), 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 applied Lie group techniques to the solution of differential equations (DEs) describing physical systems important to LANL's scientific mission. There were two main objectives: (1) to construct analytic or quasianalytic solutions for use as benchmark test problems; and (2) to develop improved numerical solution algorithms that possess the same symmetries (e.g. rotational, translational, and scaling invariance) as the DEs. Significant progress was achieved on both these objectives.

DOE

Differential Equations; Lie Groups; Analysis (Mathematics)

19980203823 Los Alamos National Lab., NM USA

Mimetic difference approximations of partial differential equations

Hyman, J. M., Los Alamos National Lab., USA; Shashkov, M., Los Alamos National Lab., USA; Staley, M., Los Alamos National Lab., USA; Kerr, S., Los Alamos National Lab., USA; Steinberg, S., New Mexico Univ., USA; Castillo, J., San Diego State Univ., USA; [1997]; 8p; In English

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

Report No.(s): LA-UR-97-2174; DE97-008578; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The goal was to construct local high-order difference approximations of differential operators on nonuniform grids that mimic the symmetry properties of the continuum differential operators. Partial differential equations solved with these mimetic difference approximations automatically satisfy discrete versions of conservation laws and analogies to Stoke's theorem that are true in the continuum and therefore more likely to produce physically faithful results. These symmetries are easily preserved by local discrete high-order approximations on uniform grids, but are difficult to retain in high-order approximations on nonuniform grids. We also desire local approximations and use only function values at nearby points in the computational grid; these methods are especially efficient on computers with distributed memory. We have derived new mimetic fourth-order local finite-difference discretizations of the divergence, gradient, and Laplacian on nonuniform grids. The discrete divergence is the negative of the

adjoint of the discrete gradient, and, consequently, the Laplacian is a symmetric negative operator. The new methods derived are local, accurate, reliable, and efficient difference methods that mimic symmetry, conservation, stability, the duality relations and the identities between the gradient, curl, and divergence operators on nonuniform grids. These methods are especially powerful on coarse nonuniform grids and in calculations where the mesh moves to track interfaces or shocks.
DOE
Partial Differential Equations; Operators (Mathematics); Finite Difference Theory; Computational Grids; Conservation Laws; Nonlinear Equations

19980203850 Wisconsin Univ., Madison, WI USA
Planning Under Uncertainity: Methods and Applications ***Final Report, 1 Apr. - 31 Dec. 1997***
Robinson, Stephen M., Wisconsin Univ., USA; Mar. 28, 1998; 6p; In English
Contract(s)/Grant(s): F49620-97-1-0283
Report No.(s): AD-A343351; AFRL-SR-BL-TR-98-0333; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This grant was for research in methods for optimizing parameters in complex simulation models. The principal method investigated was that of sample-path optimization (SPO) During the period of the grant, progress was achieved in extending SPO to the solution of stochastic variational inequalities, and in supporting areas. Results were documented in two papers prepared for publication and in one completed Ph.D. dissertation.
DTIC
Optimization; Procedures; Stochastic Processes; Trajectory Optimization

19980203876 Brookhaven National Lab., Upton, NY USA
Deadtime effects in coincidence counting: A new model
Lu, Ming-Shih, Brookhaven National Lab., USA; Teichmann, T., Teichmann (T.), Austria; [1997]; 4p; In English; International Safeguards, 13-17 Oct. 1997, Vienna, Austria
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-64037-Rev; CONF-971031-2-Rev; DE97-004578; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche
This paper described a model for correcting deadtime effects in coincidence counting. The correction is based on waiting time distribution for the detection of particles. The waiting time distribution is expressed as integrals of correlation functions, using SRatonivich's theory of random set of points. The correlation functions are solved from the basic equation governing the probability.
DOE
Coincidence Circuits; Time; Mathematical Models; Procedures; Counting Circuits

19980203917 Rutgers - The State Univ., New Brunswick, NJ USA
Numerical Methods for Linear and Nonlinear Optimization ***Final Report***
Shanno, David, Rutgers - The State Univ., USA; Mar. 30, 1998; 6p; In English
Contract(s)/Grant(s): F49620-95-1-0110
Report No.(s): AD-A343437; AFRL-SR-BL-TR-98-0334; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
New higher order methods for linear programming have been developed that have led to significant improvement in performance.
DTIC
Numerical Analysis; Nonlinearity; Procedures

19980203919 Rutgers - The State Univ., New Brunswick, NJ USA
Mathematical Theory of Neural Networks ***Final Report***
Sontag, Eduardo, Rutgers - The State Univ., USA; Sussmann, Hector, Rutgers - The State Univ., USA; Aug. 01, 1997; 46p; In English
Contract(s)/Grant(s): F49620-94-1-0293
Report No.(s): AD-A343441; AFRL-SR-BL-TR-98-0328; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report focuses on fundamental theoretical issues relevant to the capabilities, performance, and limitations of artificial neural networks. For static (feedforward) networks, subjects of investigation included the study of error surfaces for least squares fitting, VC and other learning dimensions, representability questions. and function approximation. For dynamic (recurrent) nets,

covered are questions dealing with parameter identification and modeling, realizability and other systems theoretic issues, theoretical computational capabilities, and learning-theoretic issues.
DTIC
Neural Nets; Mathematical Models; Computer Techniques

19980203953 NASA Lewis Research Center, Cleveland, OH USA
A Formulation of Asymptotic and Exact Boundary Conditions Using Local Operators
Hagstrom, T., New Mexico Univ., USA; Hariharan, S. I., Akron Univ., USA; Jun. 1998; 20p; In English
Contract(s)/Grant(s): NCC3-494; NAG3-2014; NSF DMS-96-00146; RTOP 538-03-11
Report No.(s): NASA/CR-1998-207935; NAS 1.26:207935; ICOMP-98-03; E-11225; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we describe a systematic approach for constructing asymptotic boundary conditions for isotropic wave-like equations using local operators. The conditions take a recursive form with increasing order of accuracy. In three dimensions the recursion terminates and the resulting conditions are exact for solutions which are described by finite combinations of angular spherical harmonics. First, we develop the expansion for the two-dimensional wave equation and construct a sequence of easily implementable boundary conditions. We show that in three dimensions and analogous conditions are again easily implementable in addition to being exact. Also, we provide extensions of these ideas to hyperbolic systems. Namely, Maxwell's equations for TM waves are used to demonstrate the construction. Finally, we provide numerical examples to demonstrate the effectiveness of these conditions for a model problem governed by the wave equation.
Author
Boundary Conditions; Asymptotic Properties; Hyperbolic Functions; Wave Equations

19980203970 Los Alamos National Lab., NM USA
Modeling mesoscopic phenomena in extended dynamical systems
Bishop, A., Los Alamos National Lab., USA; Lomdahl, P., Los Alamos National Lab., USA; Jensen, N. G., Los Alamos National Lab., USA; Cai, D. S., Los Alamos National Lab., USA; Mertenz, F., Bayreuth Univ., Germany; Konno, Hidetoshi, Tsukuba Univ., Japan; Salkola, M., Stanford Univ., USA; [1997]; 11p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2173; DE97-008579; 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 project at the Los Alamos National Laboratory (LANL). We have obtained classes of nonlinear solutions on curved geometries that demonstrate a novel interplay between topology and geometric frustration relevant for nanoscale systems. We have analyzed the nature and stability of localized oscillatory nonlinear excitations (multi-phonon bound states) on discrete nonlinear chains, including demonstrations of successful perturbation theories, existence of quasiperiodic excitations, response to external statistical time-dependent fields and point impurities, robustness in the presence of quantum fluctuations, and effects of boundary conditions. We have demonstrated multi-time-scale effects for nonlinear Schroedinger descriptions and shown the success of memory function approaches for going beyond these approximations. In addition we have developed a generalized rate-equation framework that allows analysis of the important creation/annihilation processes in driven nonlinear, nonequilibium systems.
DOE
Partial Differential Equations; Nonlinear Equations; Perturbation Theory; Nonlinear Systems; Robustness (Mathematics); Annihilation Reactions; Mathematical Models

19980204726 Rutherford Appleton Lab., Atlas Centre, Oxford, UK
Modified Absolute-Value Factorization Norm for Trust-Region Minimization
Gould, N. I. M., Rutherford Appleton Lab., UK; Nocedal, J., Rutherford Appleton Lab., UK; Dec. 17, 1997; ISSN 1358-6254; 24p; In English
Report No.(s): PB98-142730; RAL-TR-97-071; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A trust-region method for unconstrained minimization, using a trust-region norm based upon a modified absolute-value factorization of the model Hessian, is proposed. It is shown that resulting trust-region subproblem may be solved using a single factorization. In the convex case, the method reduces to a backtracking Newton linesearch procedure. The resulting software package

is available as HSL-VF06 within the Harwell Subroutine Library. Numerical evidence shows that the approach is effective in the nonconvex case.
NTIS
Applications Programs (Computers); Subroutine Libraries (Computers); Factorization

19980205628 Rutherford Appleton Lab., Chilton, UK
Implicit Scaling of Linear Least Squares Problems
Reid, J. K., Rutherford Appleton Lab., UK; Mar. 1998; ISSN 1358-6254; 38p; In English
Report No.(s): PB98-142664; RAL-TR-98-027; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
The consider the solution of weighted linear least squares problems by Householder transformations with implicit scaling, that is, with the weights stored separately. by holding inverse weights, the constrained case can be accommodated. The error analysis of the weighted and unconstrained case is readily extended and the authors show that iterative refinement may be applied.
NTIS
Algorithms; Linear Systems; Least Squares Method

19980205667 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Parameterised Higher-Order Algebraic Specifications
Steggles, L. J., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 40p; In English
Report No.(s): PB98-147960; TRS-603; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
Motivated by the need to address the issue of specification in the large and the problems of specifying a full function space, the authors consider extending the theory of parameterized algebraic specifications to the higher-order case. The authors develop the notion of a higher-order abstract parameterized data type and a parameterized higher-order equational specification. The authors present a concrete construction of a functor which the authors take to be the semantics of a parameterized higher-order equational specification. The authors demonstrate the theory they develop by considering a detailed specification case study of a second-order abstract parameterized data type for convolution.
NTIS
Algebra; Operators (Mathematics); Independent Variables; Abstracts; Parameterization

19980206089 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Computer Vision for Geometric Model Construction and Pose Determination of 3-D Curved Objects
Chia, Tsorng-Lin, Chung Cheng Inst. of Tech., Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 223-234; In English
Contract(s)/Grant(s): NSC-84-0408-E014-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only
In this paper a new vision based method for 3-D geometric model construction and pose determination of a curved object is proposed. The key concept in the proposed method is to derive the 3-D object information using some planar patch passing through the object stripe junctions or silhouette edges. This patch will be referred to as a virtual plane. We can define the virtual plane to obtain the 3-D object stripe junctions or the 3-D silhouette edges of some specific primitive curved objects. Based on the derived 3-D object information, we propose two methods to estimate the shape parameters of primitive objects. The shape parameters completely specify the geometric model of the primitive object. The shape parameters also reflect the pose information (location and orientation) of the object. Experimental results indicate that our method for determining the 3-D surface points and shape parameters of primitive objects are accurate and fast.
Author
Computer Vision; Image Reconstruction; Shapes; Least Squares Method; Surface Properties; Edge Detection; Three Dimensional Models

19980206090 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Optimal 2-D Separable-Denominator Approximants for 2-D Transfer Functions
Guo, Tong-Yi, National Kaohsiung Inst. of Tech., Taiwan, Province of China; Guo, Jia-Chyu, National Cheng Kung Univ., Taiwan, Province of China; Journal of the Chinese Inst. of Engineers; Mar. 1997; ISSN 0253-3839; Volume 20, No. 2, pp. 213-221; In English
Contract(s)/Grant(s): NSC85-2241-E151-001; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

This paper is concerned with the optimal approximation of a general 2-D transfer function by a separable-denominator with stability preservation. To preserve the stability, the two one-variable denominator polynomials of the reduced model are both represented in their bilinear Routh continued-fraction expansions. The bilinear Routh gamma parameters of the two one-variable denominator polynomials and the coefficients of the two-variable numerator polynomial are then determined such that a frequency-domain L(sub 2)-norm is minimized. The main advantage of searching bilinear Routh gamma parameters instead of denominator coefficients is that the stability constraints on the new decision parameters are simple bounds. to facilitate using a gradient-based algorithm, an effective numerical algorithm is also provided for computing the performance index and its gradients with respect to the decision variables.
Author
Transfer Functions; Approximation; Optimization; Discrete Functions; Two Dimensional Models

19980206102 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France
Noncommutative Geometry and Matrix Theory: Compactification on Tori
Connes, A., Institut des Hautes Etudes Scientifiques, France; Douglas, M. R., Institut des Hautes Etudes Scientifiques, France; Schwarz, A., Institut des Hautes Etudes Scientifiques, France; Dec. 1997; 46p; In English; Figures in this document may not be legible in mic
Report No.(s): PB98-151988; IHES/P/97/82; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The authors study toroidal compactification of Matrix theory, using ideas and results of noncommutative geometry. The authors generalize this to compactification on the noncommutative torus, explain the classification of these backgrounds, and argue that they correspond in supergravity to tori with constant background three-form tensor field. The paper includes an introduction for mathematicians to the IKKT formulation of Matrix theory and its relation to the BFSS Matrix theory.
NTIS
Matrix Theory; Toruses; Supergravity; Void Ratio

19980206421 Helsinki Univ., Helsinki, Finland
Pairs of Symmetries of Riemann Surfaces
Singerman, David, Southampton Univ., UK; Izquierdo, Milagros, Maelardalen Univ., Sweden; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 3-24; In English; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14, FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

Let F(sub g) be a compact Riemann surface of genus g. A symmetry S of F(sub g) is an anticonformal involution acting on F(sub g). The fixed-point set of a symmetry is a collection of disjoint simple closed curves, called the mirrors of the symmetry. The number of mirrors of a symmetry of a surface of genus g can be any integer k with k, between 0 and g+1. However, if a Riemann surface F(sub g) admits a symmetry S(sub 1) with k mirrors then work of Bujalance and Costa and Natanzon on symmetries with g + 1 mirrors suggest that there may possibly be restrictions on the number of mirrors of another symmetry S(sub 2) of F(sub g). In the first three sections of this work we show that the number of such restrictions is few and only occur if one of the symmetries has g+1 or 0 mirrors. The main result of Sections 1-3 is Theorem 1.1. In Section 4 we study a finer classification than the number of mirrors, namely the species of a symmetry. The k mirrors of a symmetry S may or may not separate the surface F(sub g) into two non-empty components. If the mirrors do separate, then we say that S has species +k, and if the mirrors do not separate then we say that the species is -k. The species of S determines S up to topological conjugacy. In Section 4 we investigate which pairs of species can occur for two symmetries S(sub 1), S(sub 2) of F(sub g). There are many more restrictions than when we just ask for the number of mirrors.
Author
Symmetry; Riemann Manifold; Theorem Proving

19980206422 Helsinki Univ., Helsinki, Finland
A Note on Isolated Points in the Branch Locus of the Moduli Space of Compact Riemann Surfaces
Bujalance, Emilio, Universidad Nacional de Educacion a Distancia, Spain; Costa, Antonio F., Universidad Nacional de Educacion a Distancia, Spain; Izquierdo, Milagros, Maelardalen Univ., Sweden; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 25-32; In English; Sponsored in part by the Spanish Government
Contract(s)/Grant(s): CEE-CHRX-CT93-0408-A; DGICYT-PB-95-0017; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14, FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

Let g be an integer > or equal to 3 and let B(sub g) = {X belonging to M(sub g) such that Aut X does not equal e} where M(sub g) denotes the moduli space of a compact Riemann surface. The geometric structure of B(sub g) is of substantial interest because B(sub g) corresponds to the singularities of the action of the modular group on the Teichmuller space of surfaces of genus g. Sur-

prisingly R. S. Kulkarni has found isolated points in B(sub g). He showed that they appear if and only if 2g + 1 is an odd prime distinct from 7. The aims of this paper is to find a geometrical explanation of this phenomenon using the fact that the isolated points are given by surfaces admitting anticonformal involutions(symmetries). The points in the Teichmuller space corresponding to groups uniformizing surfaces with a symmetry is a (non disjoint) union of submanifolds. We shall obtain that the isolated intersections of such submanifolds give us the isolated points in the branch loci. Also we prove that there are no isolated points in the moduli space of Klein surfaces which are not Riemann surfaces.
Author
Riemann Manifold; Symmetry; Group Theory; Branching (Mathematics); Theorem Proving

19980206423 Helsinki Univ., Helsinki, Finland
Perturbation of Non-Linear Harmonic Spaces ***Perturbations et Espaces Harmoniques Non Lineaires***
Rhouma, Nadra Bel Hadj, Institut Preparatoire aux Etudes d'Ingenieurs, Tunisia; Boukricha, Abderrahman, Faculte des Sciences de Tunis, Tunisia; Mosbah, Mahel, Faculte des Sciences de Bizerte, Tunisia; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 33-58; In French; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14, FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

Similar to the work done by F Y. Maeda and F. van Gool, we consider a more general semi linear perturbation of linear harmonic spaces, studying the solvability (existence and uniqueness of solutions) of the non-linear Dirichlet problem. We then prove that this perturbation leads to a more general non-linear harmonic Bauer space introduced by the authors. In the last sections of the paper we show that the majority of properties in the linear case has an analogue in this non-linear setting.
Author
Dirichlet Problem; Perturbation; Nonlinear Systems; Potential Theory; Theorem Proving

19980206424 Helsinki Univ., Helsinki, Finland
Polarization, Conformal Invariants, and Brownian Motion
Betsakos, Dimitrios, Washington Univ., USA; Annals of the Finnish Academy of Sciences : Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 59-82; In English; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14, FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

The polarization P(A) of a closed or open set A belonging to C is defined as follows: If z, z bar belongs to A then z, z bar belongs to P(A). If neither z, z bar belongs to A then neither z, z bar belongs to P(A). If exactly one of z = x + iy, z bar belongs to A then x + i(absolute value of y) belongs to P(A) and x - i(absolute value of y) belongs to P(A). We prove theorems that describe the behavior of harmonic measure, Green function, Robin function, Brownian motion and extremal length under polarization. These theorems, combined with an approximation technique due to Dubinin, lead to a new proof of symmetrization results of Baernstein.
Author
Harmonic Functions; Theorem Proving; Potential; Polarization; Set Theory

19980206425 Helsinki Univ., Helsinki, Finland
On the Dynamics of Pseudo-Anosov Homeomorphisms on Representation Varieties of Surface Groups
Kapovich, Michael, Utah Univ., USA; Annals of the Finnish Academy of Sciences : Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 83-100; In English; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14, FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

We study the action of pseudo-Anosov homeomorphisms f: R acting on R on the character varieties of SL(2,C) -representations of the fundamental groups pi(sub 1)(R) of closed orientable hyperbolic surfaces R. We prove that the representation pi(sub 1)(R) acting on SL(2,C) corresponding to the holonomy representation of the hyperbolic structure on the mapping torus of f is a hyperbolic fixed point for the action of f on the character variety X(pi(sub 1)(R)).
Author
Homomorphisms; Manifolds (Mathematics); Fixed Points (Mathematics)

19980206426 Helsinki Univ., Helsinki, Finland
General Univalence Criteria in the Disk: Extensions and Extremal Function
Chuaqui, M., Catholic Univ., Chile; Osgood, B., Stanford Univ., USA; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 101-132; In English
Contract(s)/Grant(s): FONDECYT-1940690; FONDECYT-1971055; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

Many classical univalence criteria depending on the Schwarzian derivative are special cases of a result, involving both conformal mappings and conformal metrics. The classical theorems for analytic functions on the disk emerge by choosing appropriate conformal metrics and computing a generalized Schwarzian. The results in this paper address questions of extending functions which satisfy the general univalence criterion; continuous extensions to the closure of the disk, and homeomorphic and quasiconformal extensions to the sphere. The main tool is the convexity of an associated function along geodesics of the metric. The other important aspect of this study is an extremal function associated with a given criterion, along with its associated extremal geodesics. An extremal function for a criterion is one whose image is not a Jordan domain. An extremal geodesic joins points on the boundary which map to the same point in the image. We show that, for the general criterion, the image of an extremal geodesic under an extremal function is a euclidean circle.
Author
Conformal Mapping; Analytic Geometry; Analytic Functions; Theorem Proving; Disks (Shapes); Spheres

19980206427 Helsinki Univ., Helsinki, Finland
On the Fixpoints, Multipliers and Value Distribution of Certain Classes of Meromorphic Functions
Langley, J. K., Nottingham Univ., UK; Zheng, J. H., Tsinghua Univ., China; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 133-150; In English; Partially sponsored by a Royal Society K. C. Wong fellowship; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

We consider the frequency of fixpoints of meromorphic functions for which the set of finite singular values of the inverse function is bounded, and we prove fairly sharp estimates for the multipliers of these fixpoints. We go on to consider the critical values of, and linear differential polynomials in, composite meromorphic functions.
Author
Meromorphic Functions; Fixed Points (Mathematics); Multipliers; Theorem Proving

19980206428 Helsinki Univ., Helsinki, Finland
Quasisymmetrically Thick Sets
Staples, Susan G., Texas Christian Univ., USA; Ward, Lesley A., Rice Univ., USA; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 151-168; In English; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

A subset of the real line is called quasisymmetrically thick if all its images under quasisymmetric self-mappings of the real line have positive Lebesgue measure. We establish two sufficient conditions for a set to be quasisymmetrically thick, give an example distinguishing the conditions, and show that one of these conditions, which applies to sets with a Cantor-type structure, is sharp. We give the analogues of these conditions for sets all of whose K-quasisymmetric images have positive measure, for fixed K. These results are related to Wu's work on sets all of whose quasisymmetric images have measure zero. We also prove a result about when a Cantor set of positive measure cannot be mapped quasisymmetrically to a set of zero measure; for instance, a middle-interval Cantor set of positive measure, constructed in the usual way, cannot be mapped quasisymmetrically to the ternary Cantor set.
Author
Set Theory; Lebesgue Theorem; Conformal Mapping; Theorem Proving

19980206429 Helsinki Univ., Helsinki, Finland
A Note on Interpolation and Higher Integrability
Milman, Mario, Florida Atlantic Univ., USA; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 169-180; In English; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

Using interpolation theory we give a new proof and an extension of higher integrability results by Reshetnyak-Gurev, Iwaniec, and others. We show that interpolation theory provides a general context to formulate and prove classical higher integrability theorems.
Author
Interpolation; Function Space; Theorem Proving; Measure and Integration

19980206430 Helsinki Univ., Helsinki, Finland
Rational Solutions of First-Order Differential Equations
Ermenko, A., Purdue Univ., USA; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 181-190; In English

Contract(s)/Grant(s): NSF DMS-95-00636; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

We prove that degrees of rational solutions of an algebraic differential equation F(dw/dz,w,z)= O are bounded. For given F an upper bound for degrees can be determined explicitly. This implies that one can find all rational solutions by solving algebraic equations.

Author

Algebra; Differential Equations; Theorem Proving; Differential Calculus

19980206431 Helsinki Univ., Helsinki, Finland

On the Noncompactness of David Classes

Potyemkin, V., Academy of Sciences of the Ukraine, Ukraine; Ryazanov, V., Academy of Sciences of the Ukraine, Ukraine; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 191-204; In English; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

Certain classes of plane homeomorphisms with general measure-theoretic restrictions on the local dilatation are considered. The noncompactness of such classes is proved. In particular, the noncompactness of all David's classes with exponential bounding functions is obtained from this. It is also established that the closure of such a class cannot be a class of the same type.

Author

Homomorphisms; Exponential Functions; Theorem Proving

19980206432 Helsinki Univ., Helsinki, Finland

The Quasihyperbolic Metric, Growth, and John Domains

Langmeyer, Navah, National Security Agency, USA; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 205-224; In English; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

A result of Hardy and Littlewood relates Hoelder continuity of analytic functions in the unit disk with a bound on the derivative. Gehring and Martio extended this result to the class of uniform domains. We further extend this result to the class of John domains.

Author

Analytic Functions; Conformal Mapping; Theorem Proving; Metric Space

19980206433 Helsinki Univ., Helsinki, Finland

Dynamics of Transcendental Meromorphic Functions

Dominguez, P., Imperial Coll. of Science Technology and Medicine, UK; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 225-230; In English; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

The paper examines some properties of the dynamics of entire functions which extend to general meromorphic functions and also some properties which do not. For a transcendental meromorphic function f(z) whose Fatou set F(f) has a component of connectivity at least three, it is shown that singleton components are dense in the Julia set J(f). Some problems remain open if all components are simply or doubly connected. Let I(f) denote the set of points whose forward orbits tend to infinity but never land at infinity . For a transcendental meromorphic function f(z) we have J(f) = partial derivative(I(f)), the intersection of I(f) and J(f) not equal to the null set. However, in contrast to the entire case, the components of I(f) need not be unbounded, even if f(z) has only one pole. If f(z) has finitely many poles then, as in the entire case, F(f) has at most one completely invariant component.

Author

Entire Functions; Meromorphic Functions; Transcendental Functions; Set Theory; Theorem Proving

19980206434 Helsinki Univ., Helsinki, Finland

New Poincare Inequalities from Old

Buckley, Stephen M., National Univ. of Ireland, Ireland; Koskela, Pekka, Jyvaskyla Univ., Finland; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 251-260; In English; Partially sponsored by Forbairt

Contract(s)/Grant(s): NSF DMS-93-05742; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

We discuss a geometric method, which we refer to as Coning, for generating new Poincare type inequalities from old ones. In particular, we derive weighted Poincare inequalities for star-shaped domains and variant Trudinger inequalities for another class of domains.
Author
Inequalities; Theorem Proving; Sobolev Space

19980206435 Helsinki Univ., Helsinki, Finland
A Remark on the Uniqueness of Quasi Continuous Functions
Kilpelaeinen, Tero, Jyvaskyla Univ., Finland; Annals of the Finnish Academy of Sciences: Mathematics; 1998; ISSN 1239-629X; Volume 23, No. 1, pp. 261-262; In English; Copyright; Avail: Issuing Activity (Bookstore Tiedekirja, Kirkkokatu 14 FIN-00170 Helsinki, Finland), Hardcopy, Microfiche

We give a simple argument showing that two quasi continuous functions that agree almost everywhere coincide in fact quasi everywhere.
Author
Uniqueness; Continuity (Mathematics); Potential Theory

65
STATISTICS AND PROBABILITY

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

19980203225 Boston Univ., Dept. of Electrical and Computer Engineering, Boston, MA USA
Analysis, Synthesis, and Estimation of Fractal-Rate Stochastic Point Process ***Final Report, 1 Jan. - 31 Dec. 1997***
Teich, Malvin C., Boston Univ., USA; Dec. 31, 1997; 8p; In English
Contract(s)/Grant(s): N00014-97-1-0059
Report No.(s): AD-A339241; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Fractal and fractal-rate stochastic point processes (FSPPs and FRSPPs) provide useful models for describing a broad range of diverse phenomena, including electron transport in amorphous semiconductors, computer network traffic, and sequences of neuronal action potentials. A particularly useful statistic of these processes is the fractal exponent a, which may be estimated for any FSPP or FRSPP by using a variety of statistical methods. Simulated FSPPs and FRSPPs consistently exhibit bias in this fractal exponent, however, rendering the study and analysis of these processes non-trivial. We have examined the synthesis and estimation of FRSPPs by carrying out a systematic series of simulations for several different types of FRSPP over a range of design values for alpha. The discrepancy between the desired and achieved values of alpha is shown to arise from finite data size and from the character of the point-process generation mechanism. In the context of point-process simulation, reduction of this discrepancy requires generating data sets with either a large number of points, or with low jitter in the generation of the points. In the context of fractal data analysis, the results presented here suggest caution when interpreting fractal exponents estimated from experimental data sets.
DTIC
Amorphous Semiconductors; Electron Transfer

19980203666 National Academy of Sciences - National Research Council, Board on Mathematical Sciences, Washington, DC USA
Statistical Software Engineering ***Final Report, 18 Mar. 1993 - 6 Mar 1996***
Tucker, John R., National Academy of Sciences - National Research Council, USA; Apr. 13, 1998; 82p; In English
Contract(s)/Grant(s): DAAH04-93-G-0032
Report No.(s): AD-A344440; ISBN 0-309-05344-7; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report spotlights problem areas in software engineering to which the application of modern statistical methodology can be fruitfully applied. It was produced by an expert cross-disciplinary National Research Council panel. The panel deliberated, discussed, and made recommendations based upon their experience and on information gathered at a two-day public forum at which there were presentations by 12 software and industrial engineers, scientists, and statisticians. The most important findings are: What is needed to address the challenge of cost-effectively building huge high quality software systems is productive interactions between software engineers and statisticians. Essential catalysts for this interactions include: Following a collaborative model that partners statisticians, software engineers and a REAL software process or product; following a model for data collection and analysis that ensures availability of high quality data for statistical approaches to software engineering issues; and paying

attention to relevant issues in education, such as in the areas of designed experiments, exploratory data analysis, modeling, risk analysis, attitudes toward assumptions, visualization, and statistical computing tools.
DTIC
Software Engineering; Problem Solving; Statistical Analysis; Computer Programming

19980204872 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A New Sequential Goodness of Fit Test for the Three-Parameter Weibull Distribution with Known Shape Based on Skewness and Kurtosis
Clough, Jonathan C., Air Force Inst. of Tech., USA; Mar. 1998; 314p; In English
Report No.(s): AD-A341199; AFIT/GOA/ENC/98M-01; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The Weibull distribution finds wide applicability across a broad spectrum of disciplines and is very prevalent in reliability theory. Consequently, numerous statistical tests have been developed to determine whether sample data can be adequately modeled with this distribution. Unfortunately, the majority of these goodness-of-fit tests involve a substantial degree of computational complexity. The study presented here develops and evaluates a new sequential goodness-of-fit test for the three-parameter Weibull distribution with a known shape that delivers power comparable to popular procedures while dramatically reducing computational requirements. The new procedure consists of two distinct tests, using only the sample skewness and sample kurtosis as test statistics. Critical values are derived using large Monte Carlo simulations for known shapes k=0.5(0.5)4 and sample sizes n=5(5)50. Attained significance levels for all combinations of the two tests between alpha=0.01(0.01)0.20 are also are approximated with Monte Carlo simulations and presented in a useful contour plot format. Extensive power studies against numerous alternate distributions demonstrate the test's excellent performance compared to popular EDF test statistics such as the Anderson-Darling and Cramer-von Mises tests. Recommendations are included on techniques to choose significance levels of the two component tests in a manner that should optimize power while maintaining the overall significance level.
DTIC
Monte Carlo Method; Weibull Density Functions; Skewness; Kurtosis; Goodness of Fit

19980205535 General Sciences Corp., Laurel, MD USA
An Overview of the Physical-Space Statistical Analysis System Development at the Data Assimilation Office
Guo, Jing, General Sciences Corp., USA; Larson, Jay W., Maryland Univ., USA; Lyster, P. M., Maryland Univ., USA; Second International Workshop on Software Engineering and Code Design in Parallel Meteorological and Oceanographic Applications; Jun. 1998, pp. 153; In English; Also announced as 19980205520; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

Atmospheric data assimilation is a contemporary scientific discipline for studying the state of the atmosphere. Its object is to produce an optimal and physically consistent four dimensional estimate of the state of the atmosphere using observations from highly diverse sources available irregularly in space and time. Typical methodologies of data assimilation use numerical prediction models, such as General Circulation Models (GCM), and objective analysis systems, such as the Physical-space Statistical Analysis System (PSAS). PSAS is one of the central components of the Data Assimilation System being developed at the Data Assimilation Office (DAO), NASA/Goddard Space Flight Center, for NASA's Earth Observing System (EOS). It has been designed to replace the traditional analysis scheme used in the earlier version of the DAO's Data Assimilation System with a state-of-art global statistical analysis scheme capable of handling a huge and diverse observational data flow operationally, and to provide the basic computational infrastructure for the DAO research activities using advanced error covariance models. to realize its scientific goals, PSAS is being designed to overcome several computational obstacles, including the computational complexity of solving the statistical analysis equations for error covariance matrices typically of order 100,000 x 100,000, and the software complexity of supporting advanced error covariance models accessing a heterogeneous array of information resources. At the same time, we are also actively exploring the path of implementing the technology of distributed parallel computing to PSAS in an operational environment. Implementing a message passing parallel computing paradigm into an existing yet developing computational system as complex as PSAS is in many ways a nontrivial problem. The technical challenges include issues such as reassessing the system's computational and operational requirements with appropriate solutions, planning and managing a gradual system development path with parallel software development efforts, and particularly, designing software structures supporting planned but often unspecified future scientific extensions.
Author
Atmospheric General Circulation Models; Assimilation; Data Systems; Earth Observing System (EOS); Information Management; Parallel Processing (Computers); Systems Engineering

19980205791 Oak Ridge National Lab., TN USA

Determination of the multiplication factor and its bias by the Cf-252-source technique: A method for code benchmarking with subcritical configurations

Perez, R. B., Oak Ridge National Lab., USA; Valentine, T. E., Oak Ridge National Lab., USA; Mihalczo, J. T., Oak Ridge National Lab., USA; Mattingly, J. K., Oak Ridge National Lab., USA; 1997; 12p; In English; Joint International Conference on Mathematical Methods and Supercomputing In Nuclear Applications, 6 - 10 Oct. 1997, Saratoga Springs, NY, USA

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

Report No.(s): CONF-971005-18; DE97-007707; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

A brief discussion of the Cf-252 source driven method for subcritical measurements serves as an introduction to the concept and use of the spectral ratio, (Gamma). It has also been shown that the Monte Carlo calculation of spectral densities and effective multiplication factors have as a common denominator the transport propagator. This commonality follows from the fact that the Neumann series expansion of the propagator lends itself to the Monte Carlo method. On this basis a linear relationship between the spectral ratio and the effective multiplication factor has been shown. This relationship demonstrates the ability of subcritical measurements of the ratio of spectral densities to validate transport theory methods and cross sections.

DOE

Multiplication; Californium Isotopes; Procedures; Density Measurement

19980205811 Sandia National Labs., Albuquerque, NM USA

Improved safety analysis through enhanced mathematical structures

Cooper, J. A., Sandia National Labs., USA; Ross, T. J., New Mexico Univ., USA; [1997]; 7p; In English; IEEE International Conference on Systems, Man and Cybernetics, 12 - 15 Oct. 1997, Orlando, FL, USA

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

Report No.(s): SAND-97-1813C; CONF-971068-3; DE97-007954; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

In probabilistic safety analyses, the input data and logical combinations of the data can involve considerable subjectivity. It is important that mathematical processing be done in as meaningful a manner as possible, especially for assessing the safety of high consequence operations. The authors have begun an investigation of some innovative mathematical structures that are potentially useful in such safety analyses, and have developed some practical illustrations of the utility of the approaches. They have addressed active and passive safety systems, independent and dependent inputs, fault trees and event trees, and crisp and distributed logic. The long-range intent is to provide analysts with a comprehensive selection of mathematically based tools, so that the best match possible is available for a particular system or portions of systems. Some of the mathematical structures investigated are based on various logical norms, Ordered Weighted Averaging, implication operations, Gamma operators, sigmoid operators, inference networks, failure race comparators, min/max ordinate logic, threshold logic conditional possibility, and Frechet-based dependence operators.

DOE

Failure Analysis; Threshold Logic; Fault Trees

19980205842 Westinghouse Electric Corp., West Mifflin, PA USA

Neutron transport calculations using Quasi-Monte Carlo methods

Moskowitz, B. S., Westinghouse Electric Corp., USA; 1997; 11p; In English; Mathematical Methods and Supercomputing In Nuclear Applications, 6-10 Oct. 1997, Saratoga Springs, NY, USA

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

Report No.(s): WAPD-T-3158; CONF-971005-17; DE97-006637; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This paper examines the use of quasirandom sequences of points in place of pseudorandom points in Monte Carlo neutron transport calculations. For two simple demonstration problems, the root mean square error, computed over a set of repeated runs, is found to be significantly less when quasirandom sequences are used (”Quasi-Monte Carlo Method”) than when a standard Monte Carlo calculation is performed using only pseudorandom points.

DOE

Computer Programs; Neutrons; Monte Carlo Method; Transport Theory

19980206081 Los Alamos National Lab., Technology and Safety Assessment Div., NM USA

Structural model uncertainty in stochastic simulation

McKay, M. D., Los Alamos National Lab., USA; Morrison, J. D., Los Alamos National Lab., USA; [1997]; 7p; In English; 29th; Computing Science and Statistics, 4 - 17 May 1997, El Paso, TX, USA; Sponsored by Association for Computing Machinery, USA

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

Report No.(s): LA-UR-97-2508; CONF-970599-2; DE97-009111; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Prediction uncertainty in stochastic simulation models can be described by a hierarchy of components: stochastic variability at the lowest level, input and parameter uncertainty at a higher level, and structural model uncertainty at the top. It is argued that a usual paradigm for analysis of input uncertainty is not suitable for application to structural model uncertainty. An approach more likely to produce an acceptable methodology for analyzing structural model uncertainty is one that uses characteristics specific to the particular family of models.

DOE

Stochastic Processes; Mathematical Models; Structural Analysis

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19980203236 Michigan Univ., Ann Arbor, MI USA

State Space Identification and Active Structural Control for the ACTEX Experiment ***Final Report, 1 Oct. 1994 - 29 Jul. 1997***

Bernstein, Dennis S., Michigan Univ., USA; Jul. 29, 1997; 8p; In English

Contract(s)/Grant(s): F49620-94-1-0409

Report No.(s): AD-A343681; AFRL-SR-BL-TR-98-0327; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of this work was to develop a stronger theoretical foundation for the Juan-Pappas eigensystem realization algorithm. This technique is a widely used method from impulse response data. Details and references are included in the report.

DTIC

Algorithms; Systems Analysis; Structural Stability; Impulses

19980203269 Arizona State Univ., Dept. of Electrical and Comuter Engineering, Tempe, AZ USA

Convex Bayes Decision Networks ***Final Report, 5 Oct. 1993 - 5 Sep. 1997***

Morrell, Darryl, Arizona State Univ., USA; Apr. 16, 1998; 6p; In English

Contract(s)/Grant(s): DAAH04-93-G-0218

Report No.(s): AD-A344385; TRC-SP-DRM-98-01; ARO-30739.3-EL; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This final report describes the results of a project to study the use of Bayesian networks to implement Levi's epistemic utility decision theory. The results of this project can be roughly categorized as falling into one of three areas: (1) implementation of Levi's theory using Bayesian networks, (2) development of Bayesian network updating algorithms for continuous valued network nodes, and (3) application of continuous Bayesian networks to stochastic filtering problems. We found that although Bayesian networks do not preserve the convexity of sets of distributions, Levi's decision theory can still be implemented by computing extremely points in these sets. Also, we developed a method of implementing Bayesian networks containing continuous valued nodes using Gaussian sum approximations; this method is applicable in any context in which a Bayesian network may be applied and, in particular, is not restricted to networks used to implement Levi's theory. Finally we investigated the application of Bayesian networks to stochastic filtering problems and demonstrated this application through a simple angle-only target tracking problem. This report provides an overview of these results, which are fully documented in the PhD dissertation and papers referenced in Section 3.

DTIC

Networks; Decision Theory; Bayes Theorem; Tracking Problem

19980203277 Army War Coll., Carlisle Barracks, PA USA

The State of the US Army and Space Operations

Allison, Avery V., Jr., Army War Coll., USA; Apr. 15, 1998; 51p; In English

Report No.(s): AD-A344303; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

At the end of Operations Desert Shield/Storm, many in the U.S. Department of Defense (DoD) and elsewhere declared the U.S. had won ”the first Space War”. This study will demonstrate the Gulf War represents an important benchmark for the role of U.S. space systems in support of warfighters. This study will show that while the Gulf War demonstrated the promise of fully integrating space systems into the U.S. joint doctrine and operations, lessons learned in the Gulf War identified shortfalls in planning, doctrine, experience and operations which remain to be addressed. This study explores the importance of space support to U.S. ground warfighters. U.S. military planners have made efforts to develop space policy and doctrine reflecting the end of the Cold War and emerging space systems technology. The study includes a brief synopsis of the emerging doctrine. Since the Gulf War U.S. space force structure modifications and technological developments have progressed. This study will evaluate if these changes successfully overcome Gulf War deficiencies. This study will assess the changing space environment in order to determine if the U.S. is better prepared to employ space plans, doctrine, force structure, experience and systems to support U.S. ground command in likely future conflicts.

DTIC

Tactics; Warfare; Military Operations; Aerospace Systems; Defense Program

19980203282 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Modified Multiple Model Adaptive Estimation (M(exp 3)AE) for Simultaneous Parameter and State Estimation

Miller, Mikel M., Air Force Inst. of Tech., USA; Mar. 1998; 243p; In English

Report No.(s): AD-A344312; AFIT/DS/ENG/98-02; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

In many estimation problems, it is desired to estimate system states and parameters simultaneously. However, inherent to traditional estimation architectures of the past, the designer has had to make a trade-off decision between designs intended for accurate state estimation versus designs concerned with accurate parameter estimation. This research develops one solution to this trade-off decision by proposing a new architecture based on Kalman Filtering (KF) and Multiple Model Adaptive Estimation (MMAE) techniques. This new architecture, the Modified-MMAE (M3AE), exploits the benefits of an MMAE designed for accurate parameter estimation, and yet performs at least as well in state estimation as an MMAE designed for accurate state estimation. The M3AE accomplishes the simultaneous estimation task by providing accurate state estimates from a single KF designed to accept accurate parameter estimates from the MMAE. Additionally, an M3AE approximate covariance analysis capability is developed, giving the designer a valuable design tool for analyzing and predicting M3AE performance before actually implementing the M3AE and conducting a time-consuming full-scale Monte Carlo performance analysis. Finally, the M3AE architecture is applied to two existing research examples to demonstrate the performance improvement over that of conventional MMAEs. The first example involves a simple second-order mechanical translational system, in which the system’s natural frequency is the uncertain parameter. The second example involves a 13-state nonlinear integrated Global Positioning System/Inertial Navigation System (GPS/INS) system, in which the variance of the measurement noise affecting the GPS outputs, is the uncertain parameter.

DTIC

Systems Analysis; Estimating; State Estimation; Resonant Frequencies; Kalman Filters; Revisions

19980203285 California Univ., Berkeley, CA USA

Compositional Modeling with DPNs

Zweig, Geoffrey, California Univ., USA; Russell, Stuart, California Univ., USA; Mar. 31, 1998; 11p; In English

Contract(s)/Grant(s): DAAH04-96-1-0341

Report No.(s): AD-A344321; ARO-35873.70-MA-MUR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dynamic probabilistic networks (DPNs) are a powerful and efficient method for encoding stochastic temporal models. In the past, however, their use has been largely confined to the description of uniform temporal processes. In this paper we show how to combine specialized DPN models to represent inhomogeneous processes that progress through a sequence of different stages. We develop a method that takes a set of DPN submodels and a stochastic finite state automaton that defines a legal set of submodel concatenations, and constructs a composite DPN. The composite. DPN is shown to represent correctly the intended probability distribution over possible histories of the temporal process. The use of DPNs allows us to take advantage of efficient, general-purpose inference and learning algorithms and can confer significant advantages over HMMs in terms of statistical efficiency and representational flexibility. We illustrate these advantages in the context of speech recognition.

DTIC

Mathematical Models; Stochastic Processes; Networks; Probability Theory

19980203774 Naval Research Lab., Washington, DC USA

Comparing Simplification Procedures for Decision Trees on an Economics Classification ***Final Report***

Aha, David W., Naval Research Lab., USA; Breslow, Leonard A., Naval Research Lab., USA; May 11, 1998; 22p; In English

Report No.(s): AD-A343305; NRL/FR/5510-98-9881; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several commercial case-based reasoning (CBR) shells now use decision trees to index cases, including ReMind (Cognitive Systems, Inc.), Kate (AcknoSoft), and The Easy Reasoner (The Haley Enterprise). These trees serve to expedite case retrieval and to generate comprehensible explanations of case retrieval behavior. Unfortunately, induced trees are often large and complex, reducing their explanatory power. to combat this problem, some commercial systems contain an option for simplifying decision trees. However, while many methods for simplifying decision trees exist, they have not been systematically compared and most have not been applied to case retrieval. This report builds on our previous survey and initial empirical comparison of tree simplification procedures. In this report, we compare them on a specific, challenging task that is the focus of an existing CBR effort. We examine which tree simplification procedures are useful for this task and suggest which ones should be included in a commercial CBR tool.

DTIC

Decision Theory; Classifications; Economics; Trees (Mathematics)

19980203914 Massachusetts Inst. of Tech., Lab. of Electronics, Cambridge, MA USA

Numerical and Symbolic Algorithms for Application Specific Signal Processing ***Final Report, 1 May 1993 - 31 Dec. 1997***

Oppenheim, Alan V., Massachusetts Inst. of Tech., USA; May 01, 1998; 17p; In English

Contract(s)/Grant(s): N00014-93-1-0686

Report No.(s): AD-A343353; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our research under the RASSP program focussed on the development of new signal processing algorithms to exploit the advantages and opportunities of rapid prototyping for signal processing systems. Our work was carried out in the Research Laboratory of Electronics at MIT with close collaboration and interaction with industrial partners including Lockheed Sanders. Our primary accomplishments were in several categories. We developed and explored new classes of signals and algorithms related to chaotic behavior in nonlinear systems. We also developed and explored the use of fractal signals for communications. A third new nonlinear signal class that we explored exploits the solution behavior of certain nonlinear wave equations. A significant part of our effort was directed at the exploration of algorithm-based fault tolerant architectures for signal processing and for the use of approximate processing techniques which can be exploited in the contexts of low-power signal processing architectures and in other aspects of processor resource management. We also explored opportunities to exploit multirate signal processing. In the following section we briefly summarize our results in each of these areas. Section 3 contains a bibliography of the journal articles, book chapters, and conference papers in which the details of our work is presented.

DTIC

Algorithms; Signal Processing; Architecture (Computers); Communication Networks

19980205005 California Univ., Berkeley, CA USA

Scalable Data and Sensor Fusion via Multiple-Agent Hybrid Systems

Kohn, W., California Univ., USA; Remmel, J. B., California Univ., USA; Nerode, A., California Univ., USA; Mar. 31, 1998; 38p; In English

Contract(s)/Grant(s): DAAH04-96-01-0341

Report No.(s): AD-A344362; ARO-35873.82-MA-MUR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We address the problem of finding an unbiased estimate of the plant state given that the data available is dynamic, noisy, and given in a multiplicity of representations. The approach proposed in the study is unique because it does not attempt to transform the data to a common representation. Rather we establish a framework, which we call the Multiple Agent Hybrid Estimation Architecture, in which we allow heterogeneous data to flow between individual agents in the network to improve their individual estimates of the current plant state.

DTIC

Data Processing; Numerical Analysis; Multisensor Fusion; Scale (Ratio)

19980205720 Naval Postgraduate School, Monterey, CA USA

A Monthly Sortie Scheduling Model for Improved EA-6B Prowler Combat Readiness

Swords, Scott H., Naval Postgraduate School, USA; Mar. 1998; 78p; In English

Report No.(s): AD-A344558; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

EA-6B Prowler crews conduct a variety of missions and are required to fly and train with sufficient regularity to maintain combat proficiency. These crews maintain this proficiency by completing regularly scheduled training qualifications. Squadrons determine their readiness level based on the percentage completion of these qualifications. Squadrons currently use an ad hoc method for scheduling training. This thesis develops a mixed integer program to plan monthly sorties, as a decision aid for squadron operations officers. The goal is to maximize squadron combat readiness by minimizing the number of aviators not fully combat-ready, subject to the number of flights available. The model is programmed in the GAMS language and uses a spreadsheet interface for both input and output. It is typically solved in 10 minutes on a Pentium 120 MHz PC with the OSL solver. The output is a matrix of pilots to flight assignments and aircrew to flight and seat assignments. This approach immediately yields a 10% improvement in average monthly readiness as compared to the ad hoc method and should be implemented as a methodology for scheduling monthly sorties.

DTIC

Flight Crews; Scheduling; Mathematical Models; Computer Graphics; Project Planning

19980206099 Air Force Materials Lab., Wright-Patterson AFB, OH USA

1997 Air Force Materiel Command, Annual Report, 1997 ***Annual Report, 1997***

Jan. 1998; 26p; In English

Report No.(s): AD-A345476; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The AFMC Studies and Analyses Office (AFMC SAO/XPS) conducts and sponsors studies and research of significant materiel issues. We use, modify, and develop new or improved methods, models, and tools to manage materiel resources. Our goal is to quantify the relationships between alternative materiel resources and the resultant aircraft availability and sustainability so that AFMC can prioritize and justify its investments in those resources. We work toward this goal by performing studies for our customers and by pursuing a few internally developed projects that have significant potential for providing valuable insights into these relationships. The Command is headed toward a renewed focus on customer support while operating in a business-like manner with solid financial planning and control. Everyone in SAO is working hard in helping this happen.

DTIC

Research Management; Planning; Procedures; Military Technology; Military Operations; Resources Management

19980206274 Naval Postgraduate School, Dept. of Operations Research, Monterey, CA USA

Assessing and Controlling the Availability of Failure-Degraded Service Agents

Gaver, Donald P., Naval Postgraduate School, USA; Jacobs, Patricia A., Naval Postgraduate School, USA; May 1998; 27p; In English

Report No.(s): AD-A345968; NPS-0R-98-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Military items such as airborne surveillance systems (UAVs, JSTARs, helicopters, etc.) or combat vehicles (tanks, APCs, ships) may have high effectiveness when available on station, but require occasional restoration (refueling, re-arming, scheduled maintenance) and repair after unscheduled failures of certain subsystems. This requirement takes them off station, where delays occur that are affected by the numbers and types of support resources and the philosophy of scheduling those resources. This paper considers the effect of decision choices on long-run item availability on station when items can be in several levels of capability/effectiveness when on station. The model is used to show that a simple binary decision rule (that depends on ratios of endurance, failure, and restoration and repair rates) guides the decision as to whether a failed item should be completely repaired to its highest level, or returned to duty at an incompletely-capable state. View this as an indicator of the types of rules anticipated to apply in realistic generality. These will be the subject of additional research.

DTIC

Aerial Reconnaissance; Failure; Maintenance; Decision Theory

67
THEORETICAL MATHEMATICS

Includes topology and number theory.

19980203240 California Univ., Sponsored Projects Office, Berkeley, CA USA
Proof Polynomials vs. lambda-terms
Artemov, S. N., California Univ., USA; Mar. 31, 1998; 21p; In English
Contract(s)/Grant(s): DAAH04-96-1-0341
Report No.(s): AD-A344395; ARO-35873.72-MA-MUR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Logic of Proofs provides a basic framework for the formalization of reasoning about proofs. It incorporates proof terms into the propositional language, using labeled logical operators ”t:” with the intended reading of t:F being ”T is a proof of F”. In the current paper we demonstrate how the typed lambda calculus and the modal lambda-calculus can be realized in the Logic of Proofs.
DTIC
Mathematical Logic; Calculus

19980203278 California Univ., Berkeley, CA USA
On Proof Realization of Intuitionistic Logic
Artemov, S. N., California Univ., USA; Oct. 1997; 20p; In English
Contract(s)/Grant(s): DAAH04-96-1-0341
Report No.(s): AD-A344305; TR-97-08; ARO-35873.74-MA-MWR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1933 Godel Introduced an axiomatic system, currently known as S4, for a logic of an absolute provability. The problem of finding a fair probability model for S4 was left open. In the current paper we demonstrate how the Intuitionistic propositional logic (Int) can be directly realized by proof polynomials. It is shown that Int is complete with respect to this proof realizability.
DTIC
Mathematical Logic; Polynomials; Calculus

19980203405 Argonne National Lab., IL USA
Dynamics of the Ginzburg-Landau equations of superconductivity
Fleckinger-Pelle, J., Toulouse Univ., France; Kaper, H. G., Argonne National Lab., USA; Takac, P., Rostock Univ., German Democratic Republic; [1997]; 26p; In English
Contract(s)/Grant(s): W-31109-ENG-38; ERBCHRXCT930409; DMS-9401418
Report No.(s): ANL/MCS/PP-89260; DE97-008270; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This article is concerned with the dynamical properties of solutions of the time-dependent Ginzburg-Landau (TDGL) equations of superconductivity. It is shown that the TDGL equations define a dynamical process when the applied magnetic field varies with time, and a dynamical system when the applied magnetic field is stationary. The dynamical system describes the large-time asymptotic behavior: Every solution of the TDGL equations is attracted to a set of stationary solutions, which are divergence free. These results are obtained in the (open quotes)(phi) = -(omega)((gradient)(center dot)A)(close quotes) gauge, which reduces to the standard (close quotes)(phi) = -(gradient)(center dot)A(close quotes) gauge if (omega) = 1 and to the zero-electric potential gauge if (omega) = 0; the treatment captures both in a unified framework. This gauge forces the London gauge, (gradient)(center dot)A = 0, for any stationary solution of the TDGL equations.
DOE
Superconductivity; Asymptotic Properties; Magnetic Fields

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.

19980203235 Virginia Polytechnic Inst. and State Univ., Dept. of Mathematics, Blacksburg, VA USA
Pulse Propagation in Random Media ***Final Report, 1 Feb. 1995 - 31 Jan. 1998***
Kohler, Werner E., Virginia Polytechnic Inst. and State Univ., USA; Mar. 30, 1998; 31p; In English
Contract(s)/Grant(s): F49620-95-1-0137
Report No.(s): AD-A343680; AFRL-SR-BL-TR-98-0332; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

(1) Multiple scattering of electromagnetic waves in randomly layered dissipative media. The magnetotelluric (MT) problem considered has lent itself to modeling within the 'weak noise' or Gauss Markov regime. In addition to considering propagation per se, the issue of the detection of anomalous layers has been addressed. Details are presented in the enclosed preprint, 'Random Scattering in Magnetotellurics,' by Benjamin White, Werner Kohler, and Leonard SRnka, which has been submitted for publication to Geophysics. (2) Extension of the ideas mentioned above to the case of an undulating (locally layered) medium. The theory developed for layered media is shown to be robust. (3) Incorporation of the above analysis into an inversion strategy.
DTIC
Geomagnetism; Electromagnetic Scattering; Pulses; Propagation; Media; Electromagnetic Radiation

19980203268 Carnegie-Mellon Inst. of Research, Pittsburgh, PA USA
New and Improved High Energy Magnets ***Final Report***
Wallace, W. E., Carnegie-Mellon Inst. of Research, USA; Huang, M. Q., Carnegie-Mellon Inst. of Research, USA; Mar. 1998; 12p; In English
Contract(s)/Grant(s): DAAH04-94-G-0319
Report No.(s): AD-A344379; ARO-32362.9-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fe16N2, SmCo(7-x)Zr(x), RCo(13-x)Si(x), and RFe(13-x)Si(x) (R is a rare earth) have been studied as high temperature, high performance permanent magnet materials. Each of them systems has the intrinsic properties needed: (1) large magnetization, (2) high T(c), and (3) uniaxial structure. However, the latter features are found only for certain values in RCo(13-x)Si(x) and RFe(13-x)Si(x). In no case, with the possible exception of SmCo(7-x)Zr(x), have all three of the desired intrinsic properties been present in a single compound. Fe-57 NMR work on Fe16N2 confirms that the Fe moment is significantly enhanced compared to the moment of elemental Fe. SmCo(7-x)Zr(x) has intrinsic properties which make it deserve attention as a high energy permanent magnet material. LaCo13 has large magnetization and high T(c). Unfortunately, it is cubic and hence lacks anisotropy. It can be made uniaxial but then it loses its large Ms and T(c). It has been studied as a soft magnet material in regard to which it shows promise.
DTIC
Permanent Magnets; Rare Earth Elements; Magnetic Materials

19980203326 Florida Univ., Dept. of Electrical and Computer Engineering, Gainesville, FL USA
Ground Conductivity Estimated from Wideband dE/dt Waveshapes of Distant Lightning Sources Near Ground ***Final Report***
Schueler, Jim, Florida Univ., USA; Thomson, Ewen M., Florida Univ., USA; Nov. 21, 1997; 27p; In English
Contract(s)/Grant(s): F49620-94-1-0256
Report No.(s): AD-A341013; AFRL-SR-BL-TR-98-0298; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An electric field propagating as a ground wave over finitely conducting ground suffers Ohmic loss, which increases with frequency. This loss is a function of the ground constants (conductivity and dielectric constant) and source height. Ground conductivities were estimated from waveshape differences in dE/dt pulses arising from different propagation distances. The data were wideband dE/dt signals recorded from five measurement sites stations at Kennedy Space Center. A model was used to introduce additional loss into the closer station waveshape so that it matched the more distant station waveshape. up to four conductivities per dE/dt pulse were estimated via pairwise matches with the furthest station waveshape. The waveshapes were matched by using a gradient method to minimize the sum of the squares of the measurement residuals. The geometric mean of 96 ground conductivity estimates was 0.0042 S/m and the geometric standard deviation was 2.0. Both of these values are in line with published values. Errors arising from uncertainties in distance, height, and dielectric constant accounted for only 8% of this standard deviation. However, it was not clear whether the two times spread was caused by system noise or an actual variation in conductivity. System

noise was reduced for a handful of pulses by estimating a single conductivity per pulse via the pairwise matching of station data all possible pairs.
DTIC
Computation; Lightning; Data Acquisition; Estimating; Distance; Broadband; Electrical Resistivity

19980203469 Naval Postgraduate School, Monterey, CA USA
Performance Analysis of Noncoherent DPSK with Various Diversity Combining Techniques Over a Rician Fading Channel
Sendogan, Maruf, Naval Postgraduate School, USA; Jun. 1998; 76p; In English
Report No.(s): AD-A344647; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The error probability analysis of a Differential Phase Shift Keyed (DPSK) receiver employing diversity combining techniques is performed. It is assumed that the system operates over a frequency non-selective, slowly fading Rician channel. This thesis analyzes Equal Gain Combining (EGC), Selection Combining (SC) and Post Detection Selection Combining (PDSC). The first two diversity combining techniques are widely used in communication systems, while Post Detection Selection Combining is a new technique. Previous analysis of the EGC and the SC techniques shows that the EGC technique has a better performance than the SC technique in a Rayleigh fading channel. In this thesis, the effect on the performance of a noncoherent DPSK receiver using the diversity combining techniques for Rician fading is examined. It is shown that the PDSC technique provides a performance that is better than the SC but worse than the EGC technique. The PDSC technique allows a relatively simple receiver structure independent of the number of diversity branches.
DTIC
Error Analysis; Fading; Procedures; Reliability Analysis; Frequencies; Phase Shift Keying

19980203479 Massachusetts Inst. of Tech., Research Lab. of Electronics, Cambridge, MA USA
Basic and Applied Research in the Field of Electronics and Communications ***Final Report, 1 Nov. 1994 - 31 Oct. 1997***
Allen, Jonathan, Massachusetts Inst. of Tech., USA; Feb. 18, 1998; 38p; In English
Contract(s)/Grant(s): DAAH04-95-1-0038
Report No.(s): AD-A344877; ARO-33035.85-EL-JSEP; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Massachusetts Institute of Technology (MIT) Research Laboratory of Electronics' Joint Services Program comprises seventeen work units (see below) that span a broad array of topics in high speed optics, surface and phase transitions, submicron structures and quantum effect devices, the electrical behavior of interconnect structures, and atomic and molecular physics. The work units include: (1) InGaAlAs Quantum Heterostructures for High Performance Devices; (2) Chemical Beam Epitaxy of II-VI/III-V Quantum Wells; (3) Physics of InAlAs/InGaAs Heterostructure Field Effect Transistors; (4) Sub-100-Nanometer Structures: Technology, Electronics, and Optics; (5) Single Electron Electronics, (6) Quantum Transport in Mesoscopic Systems; (7) Statistical Mechanics of Quantum Dots; (8) Single Electron Microscopy; (9) Femtosecond Quantum Optics; (10) Ultrafast Optical and Electronic Processes; (11) Excitations, Ground State Properties, and Phase Transitions of Surfaces; (12) Synchrotron X-ray Studies of Semiconductor Surface Disordering; (13) Step Structures and Epitaxy on Semiconductor Surfaces; (14) Optical Frequency Metrology; (15) Precision Physical Measurements; (16) Ultracold Atoms; and (17) Electromagnetic Waves in Complex Media.
DTIC
Quantum Electronics; Solid State Physics; Quantum Optics; Phase Transformations; Atomic Physics; Statistical Mechanics; Electromagnetic Radiation; Excitation; Synchrotrons; Frequencies; Metrology; Electron Microscopy; Ground State

19980203515 Houston Univ., TX USA
Materials Development and Characterization for Trapped Field Magnets ***Final Report, 1 Jan. 1984 - 30 Nov. 1997***
Weinstein, Roy, Houston Univ., USA; Jan. 31, 1998; 19p; In English
Contract(s)/Grant(s): DAAH04-94-G-0310
Report No.(s): AD-A344454; ARO-32603.4-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pinning centers have been studied in the high temperature superconductor (HTS) YBa2Cu3O(7-delta), using damage centers created by neutrons, protons, high Z ions, and Uranium fission. The aim of this study was to increase the critical current, J(sub c), decrease the creep, and decrease the anisotropy while reducing cost and residual radioactivity. Such material could immediately be applied to make superior trapped field magnets, and may be applied to many other devices. Results are that J(sub c)=J(sub c)(T, BA) has been increased by factors of 10 to 42, depending on the operating values of temperature, T, and applied field. The resultant material also has the lowest cost, by a factor of 5-100, and has also the lowest radioactivity, by a factor of 5. The increases in J(sub c) are maintained at high field (e.g., 14 Tesla). The effects on creep and T(sub c) are small. In other work a method was developed

to, practically, eliminate creep by use of post activation cooling. In addition, the theory of cracking under magnetic pressure has been corrected, and experimentally confirmed.
DTIC
High Temperature Superconductors; YBCO Superconductors; Magnets; Anisotropy; Pinning

19980203682 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil
Gauging N=2 supersymmetric non-linear (sigma)-models in the Atiyah-Ward space-time
Carvalho, M., Centro Brasileiro de Pesquisas Fisicas, Brazil; deOliveira, M. W., Centro Brasileiro de Pesquisas Fisicas, Brazil; Nov. 1996; ISSN 0029-3865; 15p; In English
Report No.(s): CBPF-NF-073/96; DE97-636847; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

It was built up a class of N=2 supersymmetric non-linear (sigma)-models in an N=1 superspace based on the Atiyah-Ward space-time of (2+2)-signature metric. Is also discussed the gauging of isometries of the associated hyper-Kaehlerian target spaces and present the resulting gauge-covariant supersymmetric action functional.
DOE
Measuring Instruments; Supersymmetry; Signatures

19980203745 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil
Quantum dynamics of an electric charge in an oscillating pulsed magnetic field
Oliveira, I. S., Centro Brasileiro de Pesquisas Fisicas, Brazil; Guimaraes, A. P., Centro Brasileiro de Pesquisas Fisicas, Brazil; daSilva, X. A., Centro Brasileiro de Pesquisas Fisicas, Brazil; Nov. 1996; ISSN 0029-3865; 11p; In English
Report No.(s): CBPF-NF-077/96; DE97-636833; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The motion of a charged particle under the action of a time-dependent oscillating magnetic field has been investigated. For one and two magnetic pulses were obtained analytical expressions for the free current decay and current echo in agreement with a recently proposed classical description of electrical current in fields E and B. When the resonance condition is achieved, the axis of quantization is turned over by 90 degrees. The results suggest a magnetic pulsed resonant method to separate charged particles in a beam.
DOE
Charged Particles; Electric Charge; Time Dependence; Electric Fields

19980203746 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil
A rotating quantum vacuum
deLorenci, V. A., Centro Brasileiro de Pesquisas Fisicas, Brazil; Svaiter, N. F., Centro Brasileiro de Pesquisas Fisicas, Brazil; Nov. 1996; ISSN 0029-3865; 31p; In English
Report No.(s): CBPF-NF-069/96; DE97-636832; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS));US Sales Only, Hardcopy, Microfiche

It was investigated which mapping has to be used to compare measurements made in a rotating frame to those made in an inertial frame. Using a non-Galilean coordinate transformation, the creation-annihilation operators of a massive scalar field in the rotating frame are not the same as those of an inertial observer. This leads to a new vacuum state(a rotating vacuum) which is a superposition of positive and negative frequency Minkowski particles. Polarization effects in circular accelerators in the proper frame of the electron making a connection with the inertial frame point of view were analysed.
DOE
Coordinate Transformations; Scalars; Annihilation Reactions; Frequencies

19980203830 Los Alamos National Lab., NM USA
The VNIIEF magnetic bubble approach to an x-ray source
Kirkpatrick, R. C., 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-97-2358; CONF-9706113-15; DE97-008675; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Both analytic and cursory numerical investigations indicate that the All-Russian Scientific Institute for Experimental Physics (VNIIEF) approach to x-ray generation has potential advantages. An experimental test of this concept was conducted at VNIIEF

in Sarov, Russia, in the spring of 1994. We present only the analytic and numerical investigations, which clearly demonstrate the potential advantages of this approach.
DOE
X Ray Sources; Implosions; Feasibility Analysis

19980205598 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Materials Research, Cologne, Germany
International Conference on Thermoelectrics(16th), Proceedings
May 08, 1998; 802p; In English, 26-29 Aug. 1997, Dresden, Germany; Sponsored by Fraunhofer-Inst. fuer Chemische Technologie, Germany
Contract(s)/Grant(s): F61708-97-W-0097
Report No.(s): AD-A344532; EOARD-CSP-97-1042; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

The Final Proceedings for XVI International Conference on Thermoelectrics, 26 August 1997 - 29 August 1997 Thermoelectric Materials: bulk materials, thin films, heterostructures; preparation & processing techniques; characteristics of structure and transport properties; modeling.
DTIC
Thermoelectricity; Conferences; Thermoelectric Materials

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ACOUSTICS

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

19980203443 Naval Postgraduate School, Monterey, CA USA
Geoacoustic Inversion Using Direct Methods on Ambient Noise and Explosive Acoustic Data in a Shallow Water Waveguide
Rojas, Jose G., Naval Postgraduate School, USA; Mar. 1998; 43p; In English
Report No.(s): AD-A343684; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The fundamental goal of this thesis is to determine the geoacoustic parameters of a shallow water seabed using direct analysis methods on ambient noise and broadband explosive acoustic data. All data considered are from the Mid-Atlantic Bight shelf break experiment that was conducted from 19 July to 9 August 1996. Simple, theoretical treatments of acoustic propagation in a shallow water waveguide are applied to specific, measurable quantities in the data which can be inverted directly to produce estimates of bottom compressional sound speed, density, and attenuation. Shear influences are neglected throughout. Specifically, vertical coherence of the ambient noise is used to determine the sound speed contrast at the water bottom interface, mode travel times extracted from spectrograms of explosive data are used to estimate bottom density based on the concept of an ideal waveguide effective depth, and mode attenuation as a function of range extracted from similar spectrograms are employed to estimate attenuation. These direct inversion methods are less accurate than sophisticated matched field processing techniques or direct core measurements, but they do provide a relatively simple means of obtaining reasonable estimates of ocean bottom parameters from minimal information.
DTIC
Shallow Water; Acoustic Propagation; Ambience; Noise (Sound); Waveguides

19980203456 Scripps Institution of Oceanography, La Jolla, CA USA
Establishment of Acoustic Reverberation Special Research Program (ARSRP) Data Archive ***Final Report, 30 Sep. 1992 - 30 Sep 1996***
Orcutt, John A., Scripps Institution of Oceanography, USA; May 11, 1998; 5p; In English
Contract(s)/Grant(s): N00014-92-J-4079
Report No.(s): AD-A343741; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have developed a database containing digital data collected during the Office of Naval Research Bottom Subbottom Acoustic Reverberation Special Research Program. The data entered into the database include the acoustic data from the 1991 Acoustic Reverberation Special Research Program, the bottom bathymetry, side scan data, and seismic reflection data from the 1992 Large Scale Geophysics Cruise, the digital data collected during the 1993 Small Scale Geophysics Cruise, and the acoustic data collected on the R/V Cory Chouest, the RV Knorr, and the R/V Alliance during the 1993 Acoustics Experiment. The data is accessible by scientific investigators through the Internet or through copies to Exabyte and/or DAT tapes or magnetooptical

disks at IGPP. The system provides an essentially permanent archive of the ARSRP data which as been collected at great expense and encourages the thorough analysis of this acoustic data.
DTIC
Data Bases; Reverberation; Research and Development; Acoustic Scattering; Digital Data

19980203481 Woods Hole Oceanographic Inst., Dept. of Applied Ocean Physics and Engineering, MA USA
Measurement and Inversion of Acoustic Emission from Ice: Mechanical Processes in the Arctic ***Final Report***
VonDerHeydt, Keith, Woods Hole Oceanographic Inst., USA; Scheer, Edward K., Woods Hole Oceanographic Inst., USA; Apr. 30, 1998; 3p; In English
Contract(s)/Grant(s): N00014-91-J-1296
Report No.(s): AD-A343245; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The project was part of the Sea Ice Mechanics Initiative. Our focus was on the development of instrumentation and techniques for making seismo-acoustic measurements of ice crack events in the Arctic pack ice. Specialized autonomous data acquisition equipment with an emphasis on dynamic range and radio LAN telemetry was designed and manufactured. There was special emphasis on developing realtime beamforming and graphical display software for use in the field. WHOI personnel participated in two extensive field programs, one in the Fall of 1993 and another the following Spring. Data acquired during these experiments was subsequently the focus of processing and analysis efforts through the end of the grant period.
DTIC
Acoustic Emission; Arctic Regions; Ice; Acoustic Measurement

19980203839 Attila Jozsef Univ., Dept. of Experimental Physics, Szedged, Hungary
Proceedings of the First International Conference on Unsolved Prolems of Noise in Physics, Biology, Electronic Technology and Information Technology
Doering, Ch. R., Michigan Univ., USA; Kiss, L. B., Uppsala Univ., Sweden; Shelsinger, M. F., Office of Naval Research, USA; Jan. 1997; 345p; In English; Sponsored in part by the Institute of Physics, EDS, European Lab. for Electronic Noise, and OMFB
Contract(s)/Grant(s): N00014-96-1-0016
Report No.(s): AD-A343666; ISBN 981-02-3199-7; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

Before turning to the unsolved problems of noise presented in this book, I would like to take your attention to the probably most important unsolved problem of nowadays science, because this problem is also relevant to noise phenomena. We, noise researchers all know that a finite duration time record of a noise does not have any meaning. Either, the record duration has to be infinite or we should have finite records from an infinite number of analogous physical systems to use the terms of nowadays science: distribution functions, noise spectra, etc. We are interested in the general properties, and we are unable to accurately predict details of single events. Scientists of classical physics believed that this is due to our limited knowledge and by solving the set of equations describing a complex system, we, in principle, could be able to predict even a single sequence of events accurately. Quantum physics has proved that it is not the case: the nature is fundamentally 'noisy': the single event is basically unpredictable; the wavefunction provides only a probability distribution for the elementary processes.
DTIC
Classical Mechanics; Complex Systems; Conferences; Distribution Functions; Electronics; Information Systems; Noise Spectra

19980205716 Naval Postgraduate School, Monterey, CA USA
Transient Localization in Shallow Water Environments
Brune, Joachim, Naval Postgraduate School, USA; Mar. 1998; 85p; In English
Report No.(s): AD-A344546; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In this work, the robustness of a simple, Bartlett-type processor based on matching broadband signal autocorrelation functions is investigated. Measures of robustness to be examined include the size of the localization footprint on the ambiguity surface and the peak-to-sidelobe levels in the presence of environmental mismatch and noise. A full-wave PE model is used to produce broadband replicas. Both model-generated synthetic signals, which provide baseline results, and measured pulses in a shallow water environment are analyzed. This work suggests that environmental mismatch has a more significant effect on the localization performance than noise. It also suggests that, as long as the noise level is not higher than the signal level, the localization performance will not be significantly affected. This is to be expected, since for white noise the majority of the influence on the autocorrelation function occurs at zero lag which has been removed in the localization algorithms. It is also shown that the autocorrelation match-

ing in the time-domain is generally more useful for smaller bandwidths at low frequencies, which has been observed in previous work, whereas the autocorrelation matching in the frequency-domain is better suited for larger bandwidths and higher frequencies.
DTIC
Signal Processing; Autocorrelation; Shallow Water; Robustness (Mathematics); Acoustic Sounding; Mathematical Models

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19980203246 Johns Hopkins Univ., Dept. of Chemistry, Baltimore, MD USA
Collisional and Dissociative Processes Involving Molecular Free Radicals
Dagdigian, Paul J., Johns Hopkins Univ., USA; Jan. 14, 1998; 16p; In English
Report No.(s): AD-A344458; ARO-33503.9-CH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A number of experimental studies of the dynamics of bimolecular and unimolecular collisional processes and spectroscopic studies involving molecular free radicals of importance in combustion and atmospheric chemistry have been carried out. These include study of the reaction of Cl atoms with small hydrocarbons, the formation of NCO in the CN + O2 reaction, predissociation of electronically excited NCO, and photodissociation of vibrationally excited halomethanes. The interaction of the HCO radical with Ar was probed through electronic spectroscopy of the weakly bound Ar-HCO complex. A search for the laser fluorescence excitation of the FCO radical was unsuccessful, and bands previously attributed by other workers to this species were definitively assigned to the CH2CFO radical.
DTIC
Free Radicals; Collisions; Atmospheric Chemistry; Combustion Chemistry; Spectroscopic Analysis; Dissociation

19980203410 Oak Ridge National Lab., TN USA
The n-particle picture and the calculation of the electronic structure of atoms, molecules, and solids
Gonis, A., Lawrence Livermore National Lab., USA; Turchi, P. E. A., Lawrence Livermore National Lab., USA; Schulthess, T. C., Oak Ridge National Lab., USA; Ek, J. van, Tulane Univ., USA; 1997; 20p; In English; 213th, 13 - 17 Apr. 1997, San Francisco, CA, USA; Sponsored by American Chemical Society, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-970443-24; DE97-007779; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The works referred to above indicate the usefulness of viewing an N-particle system from a higher-dimensional perspective. In doing so, one should attempt to strike a balance between conceptual clarity and computational efficiency, which mitigates against considering calculations in 3n-dimensional space except for rather small values of n. It appears that such a procedure may be profitably employed if a system of N particles were to be considered as consisting of a collection of units or sets, (I(sub k)), each containing n(sub k) particles so that (Sigma)(sub k) n(sub k) = N. The resulting problem associated with these sets of particles that interact with one another is obviously formally identical to the original one. However, it possesses the formal advantage of allowing, in principle, the systematic approach to an exact solution by treating the entire system as a single unit. The operative words here are in principle, as practical applications do not seem to be possible but for the smallest number of particles in a unit, say n = 2 or n = 3. However, in such an implementation, the interparticle correlation is treated directly and explicitly within a unit, resulting in a more accurate treatment of the system the larger the number of particle in a unit.
DOE
Atomic Structure; Molecules; Electric Energy Storage; Hamiltonian Functions

19980203434 Los Alamos National Lab., NM USA
Developing electron beam bunching technology for improving light sources
Carlsten, B. E., Los Alamos National Lab., USA; Chan, K. C. D., Los Alamos National Lab., USA; Feldman, D. W., Los Alamos National Lab., USA; [1997]; 15p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1477; DE97-008338; 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 goal of this project was to develop a new electron bunch compression technology, experimen-

tally demonstrate subpicosecond compression of bunches with charges on the order of 1 nC, and to theoretically investigate fundamental limitations to electron bunch compression. All of these goals were achieved, and in addition, the compression system built for this project was used to generate 22 nm light in a plasma-radiator light source.
DOE
Electron Beams; Electron Bunching; Light Sources

19980203553 Princeton Univ., NJ USA
Energetic Particle Physics Issues for ITER
Cheng, C. Z., Princeton Univ., USA; Budny, R., Princeton Univ., USA; Fu, G. Y., Princeton Univ., USA; 1996; 10p; In English; 16th; Plasma Physics and Controlled Nuclear Fusion Research, 7-11 Oct. 1996, Montreal, Canada; Sponsored by International Atomic Energy Agency, Austria
Contract(s)/Grant(s): DE-AC02-76CH-03073
Report No.(s): PPPL-CFP--3643; IAEA-CN--64/F:-23; CONF-961005--25; DE97-005299; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper summarizes our present understanding of the following energetic/alpha particle physics issues for the 21 MA, 20 TF coil ITER Interim Design configuration and operational scenarios: (a) toroidal field ripple effects on alpha particle confinement, (b) energetic particle interaction with low frequency MHD modes, (c) energetic particle excitation of toroidal Alfven eigenmodes, and (d) energetic particle transport due to MHD modes.
DOE
Magnetohydrodynamic Waves; Magnetohydrodynamics; Particle Interactions; Alpha Particles; Energetic Particles

19980203643 Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD USA
Nuclear Magnetic Resonance (NMR) Procedures for the Characterization of Products from the VX/NaOH Demilitarization Process ***Final Report, Nov. 1995 - Dec. 1997***
Sxafraniec, Linda L., Edgewood Research Development and Engineering Center, USA; Beaudry, William T., Edgewood Research Development and Engineering Center, USA; Mar. 1998; 58p; In English
Report No.(s): AD-A343564; ERDEC-TR-481; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Taking advantage of the unique capabilities of nuclear magnetic resonance (NMR). spectroscopy, methods were developed to characterize the two phase samples resulting from the hydrolysis of VX (S-2-DIISOPROPYL AMINOethyl O-ethyl methylphosphonothio ate) in aqueous solutions of NaOH. Methods were developed to determine the mole ratios of the major compounds present (greater than 0.1 mole%) and to evaluate the product for residual VX in the upper organic layer and for residual EA 2192 (S-2-DIISOPROPYL- AMINOethyl methylphosphonothioic acid) in the lower aqueous layer. Under the proper conditions, a detection limit of 20 microg/mL for either VX or EA 2192 can be realized in a 1 hr experiment using a 5-mm probe at a field strength of 9.4 T (162 MHz). Longer accumulation times (greater than 16 hr) on each layer can lower the detection limit to 5 microg/mL or less. This report documents the step-by-step procedures for characterizing VX/caustic products using NMR spectroscopy and describes, in detail, the analyses of typical samples. Interpreted P-31 and C-13 spectra are included as well as a list of representative NMR parameters for compounds typically present in the hydrolysates.
DTIC
Nuclear Magnetic Resonance; Spectroscopy; Ethyl Compounds; Alkalies; Sodium Hydroxides

19980203644 Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD USA
Nuclear Magnetic Resonance (NMR) Procedure for the Characterization of HD Hydrolyates ***Final Report, Sep. 1995 - Oct. 1997***
Szafraniec, Linda L., Edgewood Research Development and Engineering Center, USA; Beaudry, William T., Edgewood Research Development and Engineering Center, USA; Mar. 1998; 39p; In English
Report No.(s): AD-A343542; ERDEC-TR-480; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A useful and facile Nuclear Magnetic Resonance (NMR) method for characterizing hydrolysates of HD (2,2'- dichlorodiethyl sulfide) has been developed. The method uses both H-1 and C-13 NMR to identify the major components (greater than 0.1 mole%) in the hydrolysate and to determine the mole ratios of these compounds in solution. This NMR method is especially useful since no sample preparation is required, and all soluble compounds, including the polar and ionic hydrolysis products of HD, are easily observed This report outlines a step-by-step procedure for characterizing HD hydrolysates using NMR spectroscopy and

describes, in detail, the analysis of a typical hydrolysate sample. Interpreted H-1 and C-13 spectra and reproducibility data are included as well as a list of representative NMR parameters for compounds typically present in the hydrolysates.
DTIC
Nuclear Magnetic Resonance; Spectroscopy; Spectra; Hydrolysis

19980203696 Instituto de Fisica Teorica, Sao Paulo, Brazil
Tunneling time through a barrier using the tempus operator
Kobe, Donald H., Instituto de Fisica Teorica, Brazil; Aguilera-Navarro, Valdir C., University of North Texas, USA; Nov. 1996; 22p; In English
Report No.(s): IFT-P-047/96; DE97-636834; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The time a particle spends in a classically forbidden region of a potential barrier is expressed as an expectation value of the time operator in that region. Classically, time is canonically conjugate to the energy and is equal to the time a conservative system. The tunneling time is calculated by this approach for a rectangular barrier, which gives a complex time. The imaginary part of the time is non negative, so it is interpreted as a tunneling time. The real part gives a negative value for some values of the parameters, and is therefore rejected because it violates causality. This tunneling time is compared with other tunneling times that have been suggested by also calculating them for the rectangular barrier.
DOE
Schroedinger Equation; Quantum Theory; Time Measurement

19980203698 Paul Scherrer Inst., Villigen, Switzerland
The 1996 Radon Intercomparison Exercise at PSI ***Die Vergleichsmessung 1996 fuer Radongasmessgeraete am PSI***
Schuler, C., Paul Scherrer Inst., Switzerland; Butterweck-Dempewolf, G., Paul Scherrer Inst., Switzerland; May 1997; ISSN 1019-0643; 30p; In German
Report No.(s): PSI-97-05; DE97-636281; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The 1996 Radon Intercomparison Exercise at PSI was organized by the PSI Reference Laboratory for Radon Gas Activity Concentration Measurements. A total of 14 laboratories, companies and institutions participated with radon gas detectors and measuring instruments. The detectors and instruments were exposed in the PSI radon chamber during seven days in a reference atmosphere with an average radon gas concentration of about 6000 Bqm(exp -3). Comparison of the results of electret ionization chambers, track etch detectors and measuring instruments with the PSI target value showed the criteria for traceability and reproducibility demanded by the Federal Office for Health for the acknowledgement of Swiss Radon Gas Measurement Laboratories to be fulfilled for all participants. Exposure of track etch detectors stored for more than one year demonstrated that this detector type can suffer sensitivity loss by a too long storage period.
DOE
Gas Composition; Reference Atmospheres; Gas Analysis; Radon; Measuring Instruments; Compressed Gas

19980203727 Moscow State Univ., Russia
Ultrashort Pulses in Multicomponent Media and Photonic Bandgap Structures ***Interim Report, Nov. 1997 - Feb. 1998***
Andreev, Anatoli V., Moscow State Univ., Russia; Feb. 17, 1998; 11p; In English
Contract(s)/Grant(s): N68171-97-M-5698
Report No.(s): AD-A341082; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the reporting period we have developed the mathematical algorithms and programs for the study of the femtosecond pulse propagation in an extended medium of the two-level atoms. The regime of the inversionless superradiance in the two component superradiance medium has been investigated. It has been described the spatio-temporal nonlinear dynamics of coherent field in periodic resonant structures with arbitrary modulation of atomic density and gain gratings.
DTIC
Pulses; Photonics; Energy Gaps (Solid State); Frequencies

19980203743 Instituto de Fisica Teorica, Sao Paulo, Brazil
Fundamental fermion masses from deformed SU(sub q)(2) triplets
Palladino, B. E., Instituto de Fisica Teorica, Brazil; Ferreira, P. L., Instituto de Fisica Teorica, Brazil; Oct. 1996; 15p; In English
Report No.(s): IFT-P-038/96; DE97-636846; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A spectrum generating q-algebra, within the framework of SU(sub q)(2), is studied in order to describe the mass spectrum of three generations of quarks and leptons. The SU(sub q)(2) quantum group is a q-deformed extension of SU(2), where q=exp(alpha) (with (alpha) real) is the deformation parameter. In this letter, the essential use of inequivalent representations of SU(sub q)(2) is introduced. A formula for the fermion masses is derived. As an example, a possible scheme which corresponds to two triplets associated to up and down quarks is presented here in some detail.
DOE
Algebra; Mass Spectra; Quarks; Fermions

19980203744 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil
Motions of charged particles in Goedel-type spacetimes
Figueiredo, Bartolomeu D. B., Centro Brasileiro de Pesquisas Fisicas, Brazil; Oct. 1996; ISSN 0029-3865; 19p; In English
Report No.(s): CBPF-NF-065/96; DE97-636845; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Goedel-type spacetimes in Hehl's non propagating torsion theory are reconsidered by supposing that the curvature source is a Weyssenhoff-Raab fluid and an electromagnetic field. The electromagnetic field implies space time homogeneity and admits a dual interpretation. From the trajectories of the test particles, it is shown that there is a class of such spacetimes for which charged particles can reach regions inaccessible to neutral particles or even photons.
DOE
Charged Particles; Electromagnetic Fields; Neutral Particles; Photons

19980203822 Los Alamos National Lab., NM USA
Nonperturbative estimates of the Standard Model parameters
Gupta, R., Los Alamos National Lab., USA; Bhattacharya, T., Los Alamos National Lab., USA; Tamayo, P., Los Alamos National Lab., USA; Grandy, T., Lawrence Livermore National Lab., USA; Kilcup, G., Ohio State Univ., USA; Sharpe, S., Washington Univ., USA; [1997]; 7p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2175; DE97-008577; 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 objectives were (1) to develop highly optimized codes for the simulation of lattice Quantum Chromodynamics (QCD) on the Connection Machine CM-5, (2) to use these codes to carry out a comprehensive analysis of Standard Model phenomenology using a large statistical sample, and (3) to combine the results of numerical simulations with experimental data to estimate the unknown parameters of the Standard Model. We were successful in achieving all these goals. Our highly optimized codes were used to debug both the hardware and software of the CM-5. We carried out a comprehensive study of the hadron spectrum, decay constants for mesons, semi- leptonic form factors, form-factors for the rare decay B (r arrow) K(*) gamma, pi-pi scattering amplitude, and matrix elements of a variety of 4-fermion weak operators. From these observables we were able to predict the masses of light quarks, m(sub u) + m(sub d) and m(sub s), matrix elements of the Cabibbo-Kobayashi-Maskawa mixing matrix, and the CP violating parameters epsilon and epsilon'. Our new estimates of light-quark masses are roughly half of commonly believed values, and we predict a much larger value for epsilon'/epsilon, which will be tested experimentally over the next few years.
DOE
Quantum Chromodynamics; Computer Programs; Meson-Meson Interactions; Particle Decay; Weak Interactions (Field Theory); Standard Model (Particle Physics); Mesons

19980203859 Florida Univ., Dept. of Physics, Gainesville, FL USA
Magnetic excitations in (VO)HPO(sub 4)(center dot)(1/2)H(sub 2)O
Garrett, A. W., Florida Univ., USA; Nagler, S. E., Florida Univ., USA; Tennant, D. A., Florida Univ., USA; Jul. 11, 1997; 7p; In English; Neutron Scattering, 17 - 21 Aug. 1997, Toronto, Canada
Contract(s)/Grant(s): DE-FG05-86ER-45280; DE-AC05-96OR-22464
Report No.(s): CONF-970814-9; DE97-008438; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The magnetic excitations of an antiferromagnetic spin dimer system, (VO)HPO(sub 4)(center dot)(1/2)H(sub 2)O, are examined using inelastic neutron scattering. A dispersionless mode is found, consistent with expectations for a dimer excitation.

The intensity variation of the mode reveals a V(sup 4+) - V(sup 4+) dimer separation of 4.43(angstrom), almost 50% larger than the originally expected length.
DOE
Inelastic Scattering; Antiferromagnetism; Excitation

19980203867 Stanford Linear Accelerator Center, Menlo Park, CA USA
The light-cone Fock state expansion and hadron physics phenomenology
Brodsky, S. J., Stanford Linear Accelerator Center, USA; Jun. 1997; 12p; In English; New Nonperturbative Methods and Quantization on the Light Cone, 24 Feb. - 7 Mar. 1997, Les Houches, France
Contract(s)/Grant(s): DE-AC03-76SF-00515
Report No.(s): SLAC-PUB-7542; CONF-970291-1; DE97-007251; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The light-cone Fock expansion is defined in the following way: one first constructs the light-cone time evolution operator and the invariant mass operator in light-cone gauge from the QCD Lagrangian. The total longitudinal momentum and transverse momenta are conserved, i.e. are independent of the interactions. The matrix elements of the invariant mass operator on the complete orthonormal basis of the free theory can then be constructed. The matrix elements connect Fock states differing by 0, 1, or 2 quark or gluon quanta, and they include the instantaneous quark and gluon contributions imposed by eliminating dependent degrees of freedom in light-cone gauge. Applications of light-cone methods to QCD phenomenology are briefly described.
DOE
Light-Cone Expansion; Hadrons; Hartree Approximation

19980203966 Stanford Linear Accelerator Center, Menlo Park, CA USA
Strong coupling electroweak symmetry breaking
Barklow, T. L., Stanford Linear Accelerator Center, USA; Burdman, G., Wisconsin Univ., USA; Chivukula, R. S., Boston Univ., USA; Apr. 1997; 28p; In English; New Directions for High Energy Physics, 25 Jun. - 12 Jul. 1996, Snowmass, CO, USA
Contract(s)/Grant(s): DE-AC03-76SF-00515; NSF PHY-93-10754; NSF PHY-95-14797; NSF PHY-95-14950
Report No.(s): SLAC-PUB-7397; CLNS-97/1473; CONF-9606243-68; DE97-006831; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The authors review models of electroweak symmetry breaking due to new strong interactions at the TeV energy scale and discuss the prospects for their experimental tests. They emphasize the direct observation of the new interactions through high-energy scattering of vector bosons. They also discuss indirect probes of the new interactions and exotic particles predicted by specific theoretical models.
DOE
Broken Symmetry; Electroweak Interactions (Field Theory); Mathematical Models; Coupling; Vector Analysis; Experiment Design

19980203967 Stanford Linear Accelerator Center, Menlo Park, CA USA
CP and B Physics: Progress and prospects
Bjorken, J. D., Stanford Linear Accelerator Center, USA; Jun. 1997; 20p; In English; B Physics and CP Violation, 24-27 Mar. 1997, Honolulu, HI, USA
Contract(s)/Grant(s): DE-AC03-76SF-00515
Report No.(s): SLAC-PUB-7521; CONF-970352-2; DE97-007259; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This summary of the 2nd International Conference on B Physics and CP Violation (Honolulu, 24-27 March, 1997) contains, in addition to what is implied in the title, some extended remarks on the limitations of theory as well as speculations regarding nonperturbative enhancement of decay modes of the class b (yields) s+ charmless hadrons.
DOE
Conferences; Hadrons; Augmentation; Particle Decay; Weak Energy Interactions; Quantum Chromodynamics

19980204687 Florida Univ., Gainesville, FL USA
Minimum entropy production of neutrino radiation in the steady state
Essex, C., Florida Univ., USA; Kennedy, D. C., Florida Univ., USA; Aug. 1997; 18p; In English
Contract(s)/Grant(s): DE-FG05-86ER-40272
Report No.(s): DOE/ER/40272-280; UFIFT-HEP-97-7; DE98-000025; No Copyright; Avail: Issuing Activity (Natl Technical

Information Service (NTIS)), Hardcopy, Microfiche

A thermodynamical minimum principle valid for photon radiation is shown to hold for arbitrary geometries. It is successfully extended to neutrinos, in the zero mass and chemical potential case, following a parallel development of photon and neutrino statistics. This minimum principle stems more from that of Planck than that of classical Onsager-Prigogine irreversible thermodynamics. Its extension from bosons to fermions suggests that it may have a still wider validity.

DOE

Bosons; Neutrinos; Onsager Relationship; Photons; Minimum Entropy Method

19980204688 Florida Univ., Dept. of Physics, Gainesville, FL USA

Relativistic charged particle in magnetic dipole-spherical geometry, 3, Local three-dimensional states

Gopinath, K. S., Florida Univ., USA; Kennedy, D. C., Florida Univ., USA; Gelb, J. M., Texas Univ., USA; Jul. 1997; 38p; In English

Contract(s)/Grant(s): DE-FG05-86ER-40272

Report No.(s): DOE/ER/40272-281; UFIFT-HEP-97-11; DE98-000024; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Following two previous papers, we examine single- and many-body states of relativistic charged particles in an intense, rotating magnetic dipole field. Single-body orbits are derived classically and semiclassically, and then applied to the many-body case via the Thomas-Fermi approximation. Examples of electrons in a realistic neutron star crust are considered with both fixed density profiles and constant Fermi energy. In the first case, the varying magnetic field and Coriolis correction lead to a varying Fermi energy and macroscopic currents; in the second, the electron density is redistributed by the magnetic field. Further questions are outlined.

DOE

Relativistic Particles; Many Body Problem; Magnetic Fields; Magnetic Dipoles; Charged Particles; Electron Density (Concentration); Thomas-Fermi Model

19980205601 Stanford Linear Accelerator Center, Menlo Park, CA USA

Proceedings of the Summer institute on particle physics: The top quark and the electroweak interaction

Burke, D., Stanford Linear Accelerator Center, USA; Dixon, L., Stanford Linear Accelerator Center, USA; Leith, D. W. G. S., Stanford Linear Accelerator Center, USA; Jan. 1997; 602p; In English; Summer Institute on Particle Physics Conference on Top Quark of the Electroweak Interaction, 10 - 21 Jul. 1995, Stanford, CA, USA

Contract(s)/Grant(s): DE-AC03-76SF-00515

Report No.(s): SLAC-R-494; CONF-9507258-; DE97-006538; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The XXIII SLAC Summer Institute on Particle Physics addressed the physics of the recently discovered top quark, and its connection to the electroweak interaction and to physics beyond the Standard Model. The seven-day school portion of the Institute covered many avenues for studying the top quark, from its direct production at hadron colliders and at future electron-positron colliders, to its virtual effects in precision electroweak quantities, in heavy flavor physics, and in the renormalization of supersymmetric theories, Vertex detectors - critical for identifying the b quark decay products of the top - and Cherenkov techniques for particle identification were also reviewed. The Institute concluded with a three-day topical conference covering recent developments in theory and experiment; this year, the highlights were the CDF and D0 top quark discovery. Also featured were updated precision electroweak measurements from SLC, LEP, and the Tevatron, heavy quark results from these facilities as well as CLEO, and new photoproduction and deep-inelastic scattering data from HERA. Separate abstracts have been submitted to the energy database for articles from this proceedings.

DOE

Electroweak Interactions (Field Theory); Quarks; Particle Production; Nuclear Reactions

19980205605 Sandia National Labs., Albuquerque, NM USA

Multidimensional electron-photon transport with standard discrete ordinates codes

Drumm, C. R., Sandia National Labs., USA; 1997; 12p; In English; Joint International Conference on Mathematical Methods and Supercomputing In Nuclear Applications, 6 - 10 Oct. 1997, Saratoga Springs, NY, USA

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

Report No.(s): SAND-97-0792C; CONF-971005-3; DE97-004443; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

A method is described for generating electron cross sections that are comparable with standard discrete ordinates codes without modification. There are many advantages of using an established discrete ordinates solver, e.g. immediately available adjoint capability. Coupled electron-photon transport capability is needed for many applications, including the modeling of the response of electronics components to space and man-made radiation environments. The cross sections have been successfully used in the DORT, TWODANT and TORT discrete ordinates codes. The cross sections are shown to provide accurate and efficient solutions to certain multidimensional electron-photon transport problems. The key to the method is a simultaneous solution of the continuous-slowing-down (CSD) portion and elastic-scattering portion of the scattering source by the Goudsmit-Saunderson theory. The resulting multigroup-Legendre cross sections are much smaller than the true scattering cross sections that they represent. Under certain conditions, the cross sections are guaranteed positive and converge with a low-order Legendre expansion.
DOE
Photons; Boltzmann Transport Equation; Charged Particles; Transport Properties; Electron Transfer; Scattering Cross Sections; Fokker-Planck Equation

19980205703 Fermi National Accelerator Lab., Batavia, IL USA
W', Z', leptoquarks and bump hunting at the Tevatron
Valls, J. A., Rutgers - The State 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-97/135-E; CONF-970393-3; DE97-053125; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This paper summarizes recent results on non-SUSY searches at the Fermilab Tevatron p(bar p) collider. All the analysis are based on the complete data samples recorded by both the CDF and D0 collaborations during the 1992-1995 running period (Run 1), and correspond to (approx) 100 pb(sup -1). Searches for new neutral heavy vector bosons, leptoquarks, dijet mass resonances, and associated production of new heavy scalars together with vector bosons show no evidence for new physics. Consequently, the results have been interpreted in terms of 95% confidence level limits on production cross sections and new particle masses.
DOE
Particle Mass; Bosons; Resonance Scattering; Vector Spaces; Particle Accelerators; Radiation Measuring Instruments

19980205785 Los Alamos National Lab., NM USA
Status of electron transport in MCNP(trademark)
Hughes, H. G., Los Alamos National Lab., USA; [1997]; 11p; In English; Supercomputing In Nuclear Applications, 6 - 10 Oct. 1997, Saratoga Springs, NY, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2454; CONF-971005-19; DE97-009115; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The latest version of MCNP, the Los Alamos Monte Carlo transport code, has now been officially released. MCNP4B has been sent to the Radiation Safety Information Computational Center (RSICC), in Oak Ridge, Tennessee, which is responsible for the further distribution of the code within the US. International distribution of MCNP is done by the Nuclear Energy Agency (ECD/NEA), in Paris, France. Readers with access to the World-Wide-Web should consult the MCNP distribution site http://www-xdiv.lanl.gov/XTM/mcnp/about.html for specific information about contacting RSICC and OECD/NEA. A variety of new features are available in MCNP4B. Among these are differential operator perturbations, cross-section plotting capabilities, enhanced diagnostics for transport in repeated structures and lattices, improved efficiency in distributed-memory multiprocessing, corrected particle lifetime and lifespan estimators, and expanded software quality assurance procedures and testing, including testing of the multigroup Boltzmann-Fokker-Planck capability. New and improved cross section sets in the form of ENDF/B-VI evaluations have also been recently released and can be used in MCNP4B. Perhaps most significant for the interests of this special session, the electron transport algorithm has been improved, especially in the collisional energy-loss straggling and the angular-deflection treatments. In this paper, the author concentrates on a fairly complete documentation of the current status of the electron transport methods in MCNP.
DOE
Electron Transfer; Computer Programs; Operators (Mathematics); Multiprocessing (Computers); Random Vibration; Data Bases; Computation

19980205786 Los Alamos National Lab., NM USA

Spallation-neutron sources

Michaudon, A., Los Alamos National Lab., USA; [1997]; 6p; In English; Nuclear Data for Science and Technology, 20 - 24 May 1997, Trieste, Italy

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

Report No.(s): LA-UR-97-2583; CONF-970512-19; DE97-009109; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Of particular interest for neutron-physics studies are spallation-neutron sources (SNSs) using intense proton beams with energies in the GeV range. Some SNSs already provide average fluxes of thermal and cold neutrons comparable with those of high-flux reactors. Most SNSs are pulsed with high peak fluxes that can be used with the powerful time-of-flight (TOF) method. Also, SNSs could be developed to much higher performance.

DOE

Neutron Sources; Spallation; Thermal Neutrons; Proton Beams

19980205790 Los Alamos National Lab., NM USA

The Los Alamos Intense Neutron Source

Nebel, R. A., Los Alamos National Lab., USA; Barnes, D. C., Los Alamos National Lab., USA; Bollman, R., Los Alamos National Lab., USA; Eden, G., Los Alamos National Lab., USA; Morrison, L., Los Alamos National Lab., USA; Pickrell, M. M., Los Alamos National Lab., USA; Reass, W., Los Alamos National Lab., USA; [1997]; 23p; In English; Symposium on 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-97-1512; CONF-9703109-1; DE97-007736; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The Intense Neutron Source (INS) is an Inertial Electrostatic Confinement (IEC) fusion device presently under construction at Los Alamos National Laboratory. It is designed to produce 10(exp 11) neutrons per second steady-state using D-T fuel. Phase 1 operation of this device will be as a standard three grid IEC ion focus device. Expected performance has been predicted by scaling from a previous IEC device. Phase 2 operation of this device will utilize a new operating scheme, the Periodically Oscillating Plasma Sphere (POPS). This scheme is related to both the Spherical Reflect Diode and the Oscillating Penning Trap. With this type of operation the authors hope to improve plasma neutron production to about 10(sup 13) neutrons/second.

DOE

Neutron Sources; Design Analysis; Performance Prediction; Inertial Confinement Fusion

19980205807 Stanford Linear Accelerator Center, Menlo Park, CA USA

BFKL scattering at LEP2 and a next e(+)e(-) collider

Brodsky, S. J., Stanford Linear Accelerator Center, USA; Hautmann, F., Stanford Linear Accelerator Center, USA; Soper, D. E., Stanford Linear Accelerator Center, USA; Jul. 1997; 8p; In English; Deep Inelastic Scattering and Qcd, 14 - 18 Apr. 1997, Chicago, IL, USA

Contract(s)/Grant(s): DE-AC03-76SF-00515

Report No.(s): SLAC-PUB-7601; OITS-635; HEP-PH-9707444; CONF-970463-1; DE97-008411; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We discuss virtual photon scattering in the region dominated by BFKL exchange, and report for the cross sections at present and future e(+)e(-) colliders.

DOE

Photons; Inelastic Scattering; Quantum Chromodynamics

19980205813 Florida Univ., Inst. for Fundamental Theory, Gainesville, FL USA

Transverse spin dependent Drell Yan in QCD to O((alpha)(sub s)(sup 2)) at large p(sub (Tau)), 1, Virtual corrections and methods for the real emissions

Chang, S., Florida Univ., USA; Coriano, C., Jefferson (Thomas) National Accelerator Facility, USA; Elwood, J. K., Kent State Univ., USA; [1997]; 48p; In English

Contract(s)/Grant(s): DE-FG05-86ER-40272

Report No.(s): DOE/ER/40272-286; JLAB-THY-97-39; UFIFT-HEP-97-25; DE98-000710; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors investigate the role of the transverse spin dependence in Drell Yan lepton pair production to NLO in QCD at parton level. In the analysis the authors deal with the large p(sub (Tau)) distributions. They give very compact expressions for the virtual O((alpha)(sub s)(sup 2)) corrections to the cross section and show that the singularities factorize. The study is performed in the (ovr MS) scheme in Dimensional Regularization, and with the t'Hooft-Veltman prescription for (gamma)(sub 5). A discussion of the structure of the real emissions is included, and detailed methods for the study of these contributions are formulated.
DOE
Models; Pair Production; Partons; Leptons; Transverse Oscillation

19980205824 Rutherford Appleton Lab., Chilton, UK
Features of Quark and Lepton Mixing from Differential Geometry of Curves on Surfaces
Bordes, Jose, Valencia Univ., Spain; Chan, H. M., Rutherford Appleton Lab., UK; Pfaudler, J., Oxford Univ., UK; Tsou, S. T., Oxford Univ., UK; Feb. 1998; ISSN 1358-6254; 18p; In English
Report No.(s): PB98-142748; RAL-TR-98-022; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
No abstract available.
NTIS
Differential Geometry; Surface Geometry

19980205839 Florida Univ., Inst. for Fundamental Theory, Gainesville, FL USA
M-theory model-building and proton stability
Ellis, J., European Organization for Nuclear Research, Switzerland; Faraggi, A. E., Florida Univ., USA; Nanopoulos, D. V., Texas A&M Univ., USA; Sep. 1997; 14p; In English
Contract(s)/Grant(s): DE-FG05-86ER-40272
Report No.(s): DOE/ER/40272-285; CERN-TH-97/237; CPT-TAMU-36/97; ACT-14/97; UFIFT-HEP-97-24; HEP-TH-9709049; DE98-000709; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche
The authors study the problem of baryon stability in M theory, starting from realistic four-dimensional string models constructed using the free-fermion formulation of the weakly-coupled heterotic string. Suitable variants of these models manifest an enhanced custodial gauge symmetry that forbids to all orders the appearance of dangerous dimension-five baryon-decay operators. The authors exhibit the underlying geometric (bosonic) interpretation of these models, which have a Z(sub 2) x Z(sub 2) orbifold structure similar, but not identical, to the class of Calabi-Yau threefold compactifications of M and F theory investigated by Voisin and Borcea. A related generalization of their work may provide a solution to the problem of proton stability in M theory.
DOE
Stability; Protons; Measuring Instruments; Baryons; Gauge Invariance; Perturbation Theory

19980206079 Sandia National Labs., Albuquerque, NM USA
Navigating nuclear science: Enhancing analysis through visualization
Irwin, N. H., Sandia National Labs., USA; Berkel, J. van, Sandia National Labs., USA; Johnson, D. K., Sandia National Labs., USA; Wylie, B. N., Sandia National Labs., USA; Sep. 1997; 32p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2218; DE98-000051; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche
Data visualization is an emerging technology with high potential for addressing the information overload problem. This project extends the data visualization work of the Navigating Science project by coupling it with more traditional information retrieval methods. A citation-derived landscape was augmented with documents using a text-based similarity measure to show viability of extension into datasets where citation lists do not exist. Landscapes, showing hills where clusters of similar documents occur, can be navigated, manipulated and queried in this environment. The capabilities of this tool provide users with an intuitive explore-by-navigation method not currently available in today's retrieval systems.
DOE
Information Retrieval; Scientific Visualization; Navigation; Data Bases

19980206140 Los Alamos National Lab., NM USA
Nucleon-nucleon data
McNaughton, M. W., Los Alamos National Lab., USA; Gulmez, E., California Univ., USA; Whitten, C. A., California Univ., USA; [1997]; 7p; In English

Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-3415; DE98-000092; 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). This work completes the determination of the nucleon-nucleon (NN) scattering amplitudes from 485 to 800 MeV. The data set is completed by the publication of two papers. These new data have a precision better than 1% and an absolute accuracy about 1%, which is generally an order of magnitude better than previous data. The NN data set is now complete and consistent. The set of spin-dependent NN-scattering amplitudes is now well determined up to 800 MeV.
DOE
Nucleon-Nucleon Scattering; Scattering Cross Sections; Data Acquisition

19980206262 Colorado Univ., Center for Astrophysics and Space Astronomy, Boulder, CO USA
[PAH Cations as Viable Carriers of DIBs] ***Final Report***
Snow, Ted, Colorado Univ., USA; May 28, 1998; 4p; In English
Contract(s)/Grant(s): NAG5-4184
Report No.(s): NASA/CR-1998-208058; NAS 1.26:208058; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report is intended to fill in the blanks in NASA's file system for our lab astro study of molecular ions of astrophysical interest. In order to give NASA what it needs for its files, I attach below the text of the section from our recent proposal to continue this work, in which we describe progress to date, including a large number of publications. Our initial studies were focused on PAH cations, which appear to be viable candidates as the carriers of the DIBs, an idea that has been supported by laboratory spectroscopy of PAH cations in inert matrices. Beginning with the simplest aromatic (benzene; C6H6) and moving progressively to larger species (naphthalene, C10OH8; pyrene, C16H10; and most recently chrysene, C18H12), we have been able to derive rate coefficients for reactions with neutral spices that are abundant in the diffuse interstellar medium.
Derived from text
Molecular Ions; Astrophysics; Cations; Organic Compounds

19980206269 Phillips Lab., Propulsion Directorate, Edwards AFB, CA USA
Velocity Selection of Fast Laser Ablated Metal Atoms by a Novel Nonmechanical Technique: Temporally and Spatially Specific Photoionization (TASSPI) ***Final Report, Mar. 1992 - Mar 1997***
Fajardo, Mario E., Phillips Lab., USA; Feb. 1998; 71p; In English
Contract(s)/Grant(s): AF Proj. 1R2N; AF Proj. 1R2R; AF Proj. RA51; AF Proj. RD52
Report No.(s): AD-A345419; PL-TR-97-3051; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the in-house research effort that led to the development of a novel, nonmechanical technique for performing velocity selection of fast laser ablated atoms. The technique is named "TASSPI" for Temporally and Spatially Specific Photo-Ionization as ablated metal atoms moving either too slowly or too quickly to be hidden behind an opaque mask are photoionized by a second pulsed laser and then deflected from the main atomic beam by a magnetic field. This report includes previously unpublished and supplementary materials which candidly summarize the present status of this technology. The four peer-reviewed publications and the U.S. Patent that have resulted from this effort are included herein as appendices.
DTIC
Velocity; Ablation; Atoms; Metals; Pulsed Lasers; Photoionization; Atomic Beams

19980206280 Los Alamos National Lab., NM USA
Small angle neutron scattering studies of vesicle stability
Mang, J. T., Los Alamos National Lab., USA; Hjelm, R. P., Los Alamos National Lab., USA; [1997]; 18p; 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-97-1904; CONF-970629-1; DE97-008153; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

Small angle neutron scattering (SANS) was used to investigate the structure of mixed colloids of egg yolk phosphatidylcholine (EYPC) with the bile salt, cholylglycine (CG), in D2O as a function of pressure (P) and temperature (T). At atmospheric pressure, the system forms an isotropic phase of mixed, single bilayer vesicles (SLV's). Increasing the external hydrostatic pressure brought about significant changes in particle morphology. At T = 25 C, application of a pressure of 3.5 MPa resulted in the collapse of the SLV's. Further increase of P, up to 51.8 MPa, resulted in a transition from a phase of ordered (stacked), collapsed vesicles

to one of stacked, ribbon-like particles. A similar collapse of the vesicles was observed at higher temperature (T = 37 C) with increasing P, but at this temperature, no ribbon phase was found at the highest pressure explored.
DOE
Neutron Scattering; Colloids; Microstructure; Hydrostatic Pressure; Body Fluids

19980206281 Los Alamos National Lab., NM USA
The effect of the new nucleon-nucleus elastic scattering data in LAHET(trademark) Version 2.8 on neutron displacement cross section calculations
Pitcher, E. J., Los Alamos National Lab., USA; Ferguson, P. D., Los Alamos National Lab., USA; Russell, G. J., Los Alamos National Lab., USA; Prael, R.E., Los Alamos National Lab., USA; Madland, D. G., Los Alamos National Lab., USA; Court, J. D., Los Alamos National Lab., USA; Daemen, L. L., Los Alamos National Lab., USA; Wechsler, M. S., North Carolina State Univ., USA; [1997]; 9p; In English; Symposium on Materials for Spallation Neutron Sources, Sep. 1997, Orlando, FL, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1905; CONF-970983-1; DE97-008152; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The latest release of the medium-energy Monte Carlo transport code LAHET includes a new nucleon-nucleus elastic scattering treatment based on a global medium-energy phenomenological optical-model potential. Implementation of this new model in LAHET allows nuclear elastic scattering for neutrons with energies greater than 15 MeV and for protons with energies greater than 50 MeV. Previous investigations on the impact of the new elastic scattering data revealed that the addition of the proton elastic scattering channel can lead to a significant increase in the calculated damage energy under certain conditions. The authors report here results on the impact of the new elastic scattering data on calculated displacement cross sections in various elements for neutrons with energies in the range 16 to 3,160 MeV. Calculated displacement cross sections at 20 MeV in low-mass materials are in better agreement with SPECTER-calculated cross sections.
DOE
Elastic Scattering; Monte Carlo Method; Neutron Cross Sections; Nucleons; Neutrons; Elementary Particle Interactions

19980206286 Sandia National Labs., Albuquerque, NM USA
Modeling and characterization of molecular structures in self assembled and Langmuir-Blodgett films for controlled fabrication
Cesarano, J., III, Sandia National Labs., USA; Oct. 1997; 42p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000; NSF HRD-94-50475
Report No.(s): SAND-97-2395; DE98-001274; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Self Assembled (SA) thin films and Langmuir-Blodgett (LB) thin films are emerging technologies for the development of chemical and bio-chemical sensors, electrooptic films, second harmonic generators (frequency doublers), templates for biomimetic growth etc. One of the goals of this project was to extend Sandia's characterization techniques and molecular modeling capabilities for these complex two-dimensional geometries with the objective of improving the control of the fabrication of these structures for specific applications. Achieving this requires understanding both the structure throughout the thickness of the films and the in-plane lattice of the amphiphilic molecules. To meet these objectives they used atomic force microscopy (AFM), X-ray reflectivity, and molecular modeling. While developing these capabilities, three different materials systems were fabricated and characterized: (1) Self Assembled Monolayers (SAMs) of octadecyltrichlorosilane (OTS) and LB films of arachidic acid on silicon wafers; (2) SAMs on PZT substrates; and (3) electrochemical deposition of CdS on LB film templates.
DOE
Atomic Force Microscopy; Biochemistry; Electro-Optics; Harmonic Generators; Langmuir-Blodgett Films; Molecular Structure; X Rays; Wafers

19980206296 Los Alamos National Lab., NM USA
Post-scission fission theory: Neutron emission in fission
Madland, D. G., Los Alamos National Lab., USA; [1997]; 11p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2657; DE98-001086; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A survey of theoretical representations of two of the observables in neutron emission in fission is given, namely, the prompt fission neutron spectrum N (E) and the average prompt neutron multiplicity (bar (nu))(sub p). Early representations of the two

observables are presented and their deficiencies are discussed. This is followed by summaries and examples of recent theoretical models for the calculation of these quantities. Emphasis is placed upon the predictability and accuracy of the recent models. In particular, the dependencies of N (E) and (bar (nu))(sub p) upon the fissioning nucleus and its excitation energy are treated. Recent work in the calculation of the prompt fission neutron spectrum matrix N (E, E(sub n)), where E(sub n) is the energy of the neutron inducing fission, is then discussed. Concluding remarks address the current status of our ability to calculate these observables with confidence, the direction of future theoretical efforts, and limitations to current (and future) approaches.
DOE
Mathematical Models; Matrices (Mathematics); Neutron Emission; Neutron Spectra; Neutrons

19980206299 Florida Univ., Inst. for Fundamental Theory, Gainesville, FL USA
Rapidity correlations and Delta(G) from prompt photon plus jet production in polarized pp collisions
Chang, S., Florida Univ., USA; Coriano, C., Jefferson (Thomas) National Accelerator Facility, USA; Gordon, L. E., Argonne National Lab., USA; [1997]; 27p; In English
Contract(s)/Grant(s): DE-FG05-86ER-40272; W-31-109-ENG-38
Report No.(s): DOE/ER/40272-284; UFIFT-HEP-97-12; JLAB-THY-97-40; ANL-HEP-PR-97-21; DE98-000708; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A study of prompt photon plus associated jet production is performed at next-to-leading order (O((alpha)(alpha)(sub s)(sup 2))) in QCD at radical-S = 200--500 GeV, appropriate for the RHIC polarized (rvec p)(rvec p) collider experiment. Momentum correlations between the jet and photon are examined and the utility of the process as a method for constraining the size and shape of the polarized gluon density of the proton Delta(G) is examined.
DOE
Particle Collisions; Particle Production; Proton-Proton Reactions; Quantum Chromodynamics; Photons; Gluons

19980206311 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Xi-Omega production in Pb + Pb collisions at 158 GeV/c
Odyniec, G., California Univ., Lawrence Berkeley Lab., USA; Cooper, G. E., California Univ., Lawrence Berkeley Lab., USA; Jacobs, P., California Univ., Lawrence Berkeley Lab., USA; Jun. 1997; 15p; In English; Strangeness In Quark Matter, 14 - 18 Apr. 1997, Santorini, Greece
Contract(s)/Grant(s): DE-AC03-76SF-00098
Report No.(s): LBNL-40422; CONF-9704163; DE97-008866; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Using the NA49 main TPC, the central production of ((Xi) + (bar (Xi))) hyperons has been measured in CERN SPS Pb on Pb collisions at 158 GeV/c. The preliminary (Xi + (bar-Xi))/ (Lambda + (bar-Lambda)) ratio, studied at 2.0 <y 4)% (systematic error only). It is compatible, within errors, with the previously obtained ratios for central S+S, S+W, and S+Au collisions. The fit to the transferse momentum distribution resulted in an inverse slope parameter T of 297 MeV. At this level of statistics we do not see any noticeable enhancement of hyperon production with the increased volume (and, possibly, degree of equilibration) of the system from S+S to Pb+Pb. This result is unexpected and counter intuitive, and should be further investigated. If confirmed, it will have a significant impact on our understanding of mechanisms leading to the enhanced strangeness production in heavy ion collisions.
DOE
Ionic Collisions; Xi Hyperons; Particle Production; Particle Decay; Omegatrons

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NUCLEAR AND HIGH-ENERGY PHYSICS

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

19980203409 Sandia National Labs., Albuquerque, NM USA
Application of reactors for testing neutron-induced upsets in commercial SRAMs
Griffin, P. J., Sandia National Labs., USA; Luera, T. F., Sandia National Labs., USA; Sexton, F. W., Sandia National Labs., USA; Cooper, P. J., Sandia National Labs., USA; Karr, S. G., Sandia National Labs., USA; Hash, G. L., Sandia National Labs., USA; Fuller, E., Novus Technologies, Inc., USA; [1997]; 9p; In English; 34th; Nuclear and Space Radiation Effects Conference, 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-97-1778C; CONF-970711-18; DE97-007906; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Reactor neutron environments can be used to test/screen the sensitivity of unhardened commercial SRAMs to low-LET neutron-induced upset. Tests indicate both thermal/epithermal (less than 1 keV) and fast neutrons can cause upsets in unhardened parts. Measured upset rates in reactor environments can be used to model the upset rate for arbitrary neutron spectra.
DOE
Fast Neutrons; Neutron Spectra; Neutrons

19980203428 Stanford Linear Accelerator Center, Menlo Park, CA USA
Particle trapping with an rf cavity
Chao, A., Stanford Linear Accelerator Center, USA; Nov. 1995; 7p; In English; 31st; Eloisatron Workshop on Crystalline Beams and Related Issues, 11-21 Nov. 1995, Erice, Italy
Contract(s)/Grant(s): DE-AC03-76SF-00515
Report No.(s): SLAC-PUB-7072; CONF-9511174-5; DE97-008416; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

It is in principle possible to trap charged particles in an rf cavity. In this note the authors calculate the trapping mechanism of the field pattern given by (1). The trapping occurs for either sign of the charge of the particles. The mode pattern (1) traps particles around the node point (0,0,0). Such a trapping mechanism is of course considered favorable for a particle trap. On the other hand, it may also happen that undesirable stray particles are trapped at nodes of an rf device, which then perturbs the normal operation of an accelerator. Such trappings are then undesirable and are to be avoided.
DOE
Accelerators; Beam Interactions; Beam Plasma Amplifiers; Cavity Resonators

19980203433 Stanford Linear Accelerator Center, Menlo Park, CA USA
Observation and analysis of static deflections from transverse long-range wakefields in the SLC
Assmann, R. W., Stanford Linear Accelerator Center, USA; Decker, F. J., Stanford Linear Accelerator Center, USA; Raimondi, P., Stanford Linear Accelerator Center, USA; Raubenheimer, T. O., Stanford Linear Accelerator Center, USA; Jul. 1997; 5p; In English; 17th; Particle Accelerator Conference, 12 -16 May 1997, Vancouver, Canada; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-76SF-00515
Report No.(s): SLAC-PUB-7580; CONF-970503-206; DE97-008413; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In the SLC main linac a train of three bunches is accelerated. The leading positron bunch is followed by two bunches of electrons. When the positron bunch passes off-axis through the Rf structures, it excites dipole modes in the structures, for example long-range transverse wakefields which deflect the subsequent electron bunches. Although the magnitude of the deflections is small one can infer the deflections by measuring the trajectory differences while changing the spacing between the positron and electron bunches. Knowing the positron trajectory the misalignments of the accelerating RF structures with respect to the BPM's can be calculated. The authors present measurements from the SLC linac and discuss the data analysis and errors.
DOE
Electron Bunching; Positrons; Velocity Modulation; Traveling Wave Tubes; Klystrons

19980203552 Stanford Linear Accelerator Center, Menlo Park, CA USA
Saw-tooth instability studies in the Stanford Linear Collider damping rings
Podobedov, B. V., Stanford Linear Accelerator Center, USA; Siemann, R. H., Stanford Linear Accelerator Center, USA; May 1997; 4p; In English; 17th; Particle Accelerator Conference, 12 - 16 May 1997, Vancouver, Canada; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): DE-AC03-76SF-00515
Report No.(s): SLAC-PUB-7533; CONF-970503-146; DE97-007086; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Experimental results of the instability studies are being reported. The system built gives a BPM-derived single bunch 'instability signal'. The signal was recorded simultaneously with the longitudinal density bunch profiles obtained from the synchrotron

light with the high resolution Hamamatsu streak camera. Correlation of the instability signal with the streak camera profiles has been found. For the strongly developed instability state the dominant mode structure was obtained.
DOE
Streak Cameras; Synchrotrons

19980203900 Defense Intelligence Agency, Washington, DC USA
Identification of Radiation Sources in a Peacetime Environment
Apr. 1998; 37p; In English
Report No.(s): AD-A344473; DIA-1811-2-98; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this handbook is to aid individuals who may encounter radioactive materials in unfamiliar forms, in facilities damaged by natural catastrophe, or as a result of war in foreign countries. Individuals may encounter radioactive materials used in situations or in a manner that is not only unfamiliar but also potentially hazardous. Individuals may be required to perform peacekeeping or humanitarian operations in areas where radiation warning placards, signs, and instructions may he posted in a language other than English. For these reasons, this handbook provides an overview of typical uses of commonly encountered radioactive materials, their identification, and a brief description of general radiation safety measures. The intended purpose of this handbook is to provide background information as an aid in the identification of sources of ionizing radiation and some basic radiation protection guidance. This handbook may be used in conjunction with specific procedures provided by senior echelon directives. This is the second edition of the handbook entitled Identification of Radiation Sources in a Peacetime Environment. The handbook has been expanded to include graphics of commonly encountered equipment seen in: (1) a nuclear medicine department or nuclear pharmacy, (2) radiation therapy sources, (3) industrial food irradiation facilities, and (4) small instrument check sources encountered in any facility using radiation detection equipment to validate equipment operation.
DTIC
Radioactive Materials; Radiation Sources; Peacetime; Ionizing Radiation; Safety Management; Radioactive Contaminants

19980203940 Los Alamos National Lab., NM USA
Physics-based generation of gamma-ray response functions for CdZnTe detectors
Prettyman, T. H., Los Alamos National Lab., USA; Mercer, D. J., Los Alamos National Lab., USA; Cooper, C., Los Alamos National Lab., USA; Russo, P. A., Los Alamos National Lab., USA; Rawool-Sullivan, M., Los Alamos National Lab., USA; Close, D. A., Los Alamos National Lab., USA; Luke, P. N., California Univ., Lawrence Berkeley Lab., USA; Amman, M., California Univ., Lawrence Berkeley Lab., USA; Soldner, S., eV Products, USA; [1997]; 16p; In English; 4th; Methods and Applications of Radioanalytical Chemistry, 6 - 11 Apr. 1997, Kona, HI, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1800; CONF-970424-17; DE97-008756; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

A physics-based approach to gamma-ray response-function generation is presented in which the response of CdZnTe detectors is modeled from first principles. Computer modeling is used to generate response functions needed for spectrum analysis for general detector configurations (e.g., electrode design, detector materials and geometry, and operating conditions). With computer modeling, requirements for calibration and characterization are significantly reduced. Elements of the physics-based model, including gamma-ray transport, charge drift-diffusion, and circuit response, are presented. Calculated and experimental gamma-ray spectra are compared for a coplanar-grid CdZnTe detector.
DOE
Computerized Simulation; Gamma Ray Spectra; Semiconductor Devices; Cadmium Tellurides; Zinc Tellurides; Spectrum Analysis

19980205787 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Precision physics at LHC
Hinchliffe, I., California Univ., Lawrence Berkeley Lab., USA; May 1997; 10p; In English; Symposium on Future High Energy Colliders, 21 - 25 Oct. 1996, Santa Barbara, CA, USA
Contract(s)/Grant(s): DE-AC03-76SF-00098
Report No.(s): LBNL-40337; CONF-961038-4; DE97-007897; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

In this talk the author gives a brief survey of some physics topics that will be addressed by the Large Hadron Collider currently under construction at CERN. Instead of discussing the reach of this machine for new physics, the author gives examples of the types of precision measurements that might be made if new physics is discovered.
DOE
Hadrons; Particle Accelerators; Research Management

19980205792 Los Alamos National Lab., NM USA
Proceedings of the nuclear criticality technology safety project
Sanchez, R.G., Compiler, Los Alamos National Lab., USA; Jun. 1997; 184p; In English; Nuclear Criticality Technology Safety Project Workshop, 10 - 11 May 1994, Williamsburg, VA, USA
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-13277-C; CONF-9405144; DE97-007297; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

This document contains summaries of the most of the papers presented at the 1994 Nuclear Criticality Technology Safety Project (NCTSP) meeting, which was held May 10 and 11 at Williamsburg, Va. The meeting was broken up into seven sessions, which covered the following topics: (1) Validation and Application of Calculations; (2) Relevant Experiments for Criticality Safety; (3) Experimental Facilities and Capabilities; (4) Rad-Waste and Weapons Disassembly; (5) Criticality Safety Software and Development; (6) Criticality Safety Studies at Universities; and (7) Training. The minutes and list of participants of the Critical Experiment Needs Identification Workgroup meeting, which was held on May 9 at the same venue, has been included as an appendix. A second appendix contains the names and addresses of all NCTSP meeting participants. Separate abstracts have been indexed to the database for contributions to this proceedings.
DOE
Conferences; Computer Programming; Radiation Protection; Safety; Computerized Simulation; Computation; Nuclear Weapons; Radioactive Wastes

19980206277 Los Alamos National Lab., NM USA
Physics design of the National Spallation Neutron Source linac
Takeda, H., Los Alamos National Lab., USA; Billen, J. H., Los Alamos National Lab., USA; Nath, S., Los Alamos National Lab., USA; [1997]; 5p; In English; IEEE Particle Accelerator Conference, 12 - 16 May 1997, Vancouver, Canada
Contract(s)/Grant(s): W-7405-ENG-36; AC05-96OR22464
Report No.(s): LA-UR-97-1704; CONF-970503-228; DE97-008188; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The National Spallation Neutron Source (NSNS) requires a linac that accelerates a H(-) beam to 1.0 GeV. The linac starts with a radio-frequency quadrupole (RFQ) accelerator, which is followed by a drift-tube linac (DTL), a coupled-cavity drift-tube linac (CCDTL), and a conventional coupled-cavity linac (CCL). In this paper, the authors focus on the DTL, CCDTL, and CCL parts of the accelerator. They discuss the linac design parameters and beam dynamics issues. The design rationale of no separate matching sections between different accelerating sections maintains the current independence of beam behavior.
DOE
Linear Accelerators; Neutron Sources; Spallation; Beam Injection; Cavity Resonators

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OPTICS

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

19980203220 Communications Research Lab., Tokyo, Japan
Generation of a Tunable-Frequency Sideband by use of Modulated Light From an Optically Pumped Submillimeter Wave Laser
Hori, Toshihiro, Communications Research Lab., Japan; Hiromoto, Norihisa, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 319-329; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

Frequency modulation of an optically pumped submillimeter wave laser output was achieved by use of a Schottky barrier diode (SBD). Modulated signals were detected by use of another SBD with the heterodyne technique. Then, these modulation

and detection techniques were applied to the tunable sideband spectrometer. The obtained results on the frequency modulation, the heterodyne detection and absorption measurements of a gas in submillimeter waves are shown in this report.
Author
Laser Outputs; Schottky Diodes; Sidebands; Spectrometers; Frequency Modulation; Heterodyning; Submillimeter Waves; Absorption Spectroscopy

19980203243 Northwestern Univ., Dept. of Cellular Molecular and Structural Biology, Chicago, IL USA
Cellular Detection of Infrared Sources ***Final Report, 15 Apr. 1995 - 15 Jul. 1998***
Albrecht-Buehler, Guenter, Northwestern Univ., USA; Apr. 15, 1998; 4p; In English
Contract(s)/Grant(s): DAAH04-95-1-0180
Report No.(s): AD-A344432; ARO-33938.3-LS; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During the past grant period we have developed a new assay to study the responses of large populations of cells to pulsating near infrared light signals. We propose to use them to determine the optimal light pulse patterns and to study the photo behavior of different cell types, states of transformation and phases of the cell cycle to artificially generated light signals. In addition we have developed the first infrared fluorescent microscope which we propose to develop further in order to test the hypothesis that the natural infrared light signals are emitted by the mitochondria of the cells. The concept of photo behavior of cells is entirely new and is potentially very important for biology and medicine. As more and more details of this phenomenon emerge we may become able to imitate the signals of specific cell types in order to be able to influence their behavior during development, wound healing, immune response and metastasis. In addition, the dependency of the photo behavior on pulse patterns rather than on total energy points to an elaborate data integration systems in cells that are, so far, unknown to biology and promise to revolutionize our concepts of cells.
DTIC
Cells (Biology); Infrared Radiation; Radiation Effects; Physiological Responses; Light Sources

19980203270 Notre Dame Univ., Dept. of Electrical Engineering, IN USA
Artificial Quantum Solids: Physics, Fabrication, and Applications ***Final Report, 1 Sep. 1995 - 31 Dec. 1997***
Bandyopadhyay, S., Notre Dame Univ., USA; Miller, A. E., Notre Dame Univ., USA; Apr. 16, 1998; 128p; In English
Contract(s)/Grant(s): DAAH04-95-1-0586
Report No.(s): AD-A344391; ARO-34619.18-PH; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report describes research carried out at the University of Nebraska and at the University of Notre Dame in the physics and fabrication of self-assembled arrays of quantum dots and wires. Such arrays have shown enhanced optical non-linearities, novel giant magnetoresistance and other intriguing properties.
DTIC
Fabrication; Quantum Dots; Nonlinear Optics; Quantum Wires

19980203279 Advanced Concepts Analysis, Inc., Falls Church, VA USA
Medical Applications of IR Focal Plane Arrays ***Final Report***
Diakides, Nicholas A., Advanced Concepts Analysis, Inc., USA; Mar. 15, 1998; 75p; In English
Contract(s)/Grant(s): DAAH04-94-C-0020
Report No.(s): AD-A344309; ARO-32870.1-EL-S; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The motivation for this effort was to transfer the highly developed advanced DOD infrared technology to the field of medicine, with a view to achieving a low cost, non-invasive, non-ionizing and effective imaging modality. As such, it could be used on its own or as an adjunct to other imaging methods presently available in order to enhance the overall performance. The major results of this work were the following: (1) established the status of medical IR imaging worldwide and highlighted results of this survey; (2) identified ten major areas of IR imaging uses in medicine through in-depth literature review, contacts, visits, and special workshops; (3) analyzed and defined performance requirements in terms of thermal sensitivity and spatial resolution for several critical medical applications; (4) specified systems requirements for medical IR cameras, both cooled and uncooled types; (5) facilitated the collaborative efforts of researchers by creating a forum for presentations, discussions and workshops on medical infrared imaging; (6) all the above spurred collaborative efforts, teaming arrangements, new initiatives in clinical research; (7) initiated efforts to start clinical research for the quantification of data for the purpose of establishing infrared imaging as an imaging modality in medicine.
DTIC
Technology Transfer; Low Cost; Imaging Techniques; Infrared Imagery

19980203342 McDonnell-Douglas Aerospace, Saint Louis, MO USA

Active Materials for Photonic Systems (AMPS) ***Final Report, Jan. 1995 - Feb. 1998***

Pado, Lawrence E., McDonnell-Douglas Aerospace, USA; Haake, John, McDonnell-Douglas Aerospace, USA; Smith, Herb, McDonnell-Douglas Aerospace, USA; Apr. 13, 1998; 79p; In English

Contract(s)/Grant(s): DAAH04-95-C-0007

Report No.(s): AD-A344640; ST-98-02; ARO-33523.1-MS; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The AMPS program has created the first 3-axis Micro-Electro Mechanical Systems (MEMS) active fiber optic micro-aligner, which will allow for in-package alignment or fiber optic and microoptic components. The micro-aligner is a wafer level fabricated device, based on a combination of silicon micromachining and LIGA technology. The electrically controllable actuators demonstrate the high force and displacement necessary to overcome fiber optic cable, counterforce springs, friction, and wirebonds to perform in-package alignment of a fiber optic. AMPS has demonstrated movement of greater than 20 microns in all three axes in an in-package configuration The first prototype device are currently small enough (4 x 4 x 0.5 cu mm) to fit into a standard 14 pin butterfly package. Future devices with the same forces and displacements can be made smaller than 1 x 1 x 0.5 cu mm thus allowing for multiple single mode fiber optic attachments inside a standard package. The AMPS program bas developed a design/analysis tool. This program allows for fully coupled analysis of properties. This program runs on Windows machines and comes complete with a User's Manual.

DTIC

Fiber Optics; Lead Zirconate Titanates; Alignment; Photonics; Fabrication

19980203400 Virginia Polytechnic Inst. and State Univ., Fiber Electro-Optics Research Center, Blacksburg, VA USA

Miniaturized Optical Fiber Magnetic Field Sensors for On-Board Environmental Diagnostics ***Final Report, 15 Aug. 1995 - 30 Dec. 1997***

Wang, Anbo, Virginia Polytechnic Inst. and State Univ., USA; Claus, Richard O., Virginia Polytechnic Inst. and State Univ., USA; Dec. 30, 1997; 154p; In English

Contract(s)/Grant(s): F19628-95-C-0202; AF Proj. 2822

Report No.(s): AD-A343754; AFRL-VS-HA-TR-98-0006; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

A miniaturized optical fiber based sensor system has been developed for the measurement of vector magnetic fields. The operation of the sensor system is based on the detection of magnetostrictive dimensional changes in the sensor gage using a modified extrinsic Fabry Perot Interferometer configuration. Because of the magnetostrictive reflector the gap length of the Fabry Perot cavity formed by the two fiber ends depends on the magnetic fields applied to the sensor. Since the diameter of the magnetostrictive sensor gage is the same as that of the input output fiber, the sensor is simply constructed by inserting the sensor gage and the input output fiber into a small glass tube. The glass tube serves as both an aligner for the sensor gage and input output fiber, and a passive temperature compensator. This sensor design shows 98% suppression of the thermally induced sensor output changes. A 5 times increase in sensor sensitivity is obtained with the transverse field annealing and the use of a new magnetostrictive material. A modified sensor gage endface demonstrates 92% of fringe visibility, which further proves the performance of the interferometer. The system has been shown to have a resolution better than 100 nT over a measurement range from 100 to 40,000 nT.

DTIC

Miniaturization; Optical Fibers; Magnetic Fields; Product Development; Diagnosis; Measuring Instruments

19980203569 Illinois Univ., Dept. of Astronomy, Urbana, IL USA

Determination of an Infrared Reference Frame ***Final Report, 1 Sep. 1995 - 1 Sep. 1997***

Sutton, Edmund C., Illinois Univ., USA; Jan. 14, 1998; 3p; In English

Contract(s)/Grant(s): NAGw-4724

Report No.(s): NASA/CR-97-206770; NAS 1.26:206770; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The mission of the European Space Agency's Hipparcos satellite was to provide high precision astrometric and photometric data for over 100,000 stars and somewhat lower precision data on over a million additional stars. These observations were made in the optical band (340 - 850 nm) and resulted in median precisions of better than 1 milli-arcsec (mas) in position and parallax and I mas/yr in proper motion. The Hipparcos frame is inertial within an estimated uncertainty of +/- 0.25 mas/yr. The other important wavelength band for astrometry has been the radio band. A reference frame has been defined based on absolute Very Long Baseline Interferometry (VLBI) positions of several hundreds of radio sources. There have been a number of projects to refine the link between the optical and radio reference frames. In recent years there has been increasing interest in the astrometry of infrared sources. For example, stars with circumstellar shells can be observed in both the optical and radio (e.g. SiO maser emission). The infrared emission from such sources is dominated by thermal dust emission. The spatial distribution of radiation in the three bands is expected to be quite different. In 1982 we proposed a number of infrared-selected sources (S(sub 10 micron) greater

than or approx. equal to 100 J(sub y)) for inclusion in the Hipparcos Input Catalog. Most of those sources were observed, and in Sutton (1997) we report the optical astrometric results (position, proper motion, and parallax) for 87 such sources. These sources were selected to have reasonable agreement between infrared and optical positions, and so may be used as primary standards for future infrared astrometry. They are well distributed across the sky, but exhibit some bias towards the galactic plane and the northern hemisphere. We have also obtained a set of 1480 secondary standards (unpublished) A comparison between optical positions and 86 GHz SiO maser positions for 10 sources indicates coincidence at the 0.15 arcsec level, consistent with current uncertainties in the SiO positions. Improved measurements of the SiO maser positions are needed. VLBI data show that SiO maser spots can be distributed in broken rings of radii 10 - 30 mas, presumably centered on the stellar position. However the SiO flux may be distributed asymmetrically, in which case the flux-weighted center of the SiO emission can be different from the stellar position. We have also published a related paper on phase fluctuations in millimeter interferometry (Sutton and Hueckstaedt 1996). Radiometric monitoring of emission from atmospheric water vapor may be a method for correcting for such fluctuations. This is relevant to positional determinations at centimeter and millimeter wavelengths. The integration of visible, infrared, and radio astrometry is one of our principal goals.
Derived from text
Data Acquisition; Astrometry; Estimating; Hipparcos Satellite; Infrared Radiation; Northern Hemisphere

19980203728 Army Aeromedical Research Lab., Fort Rucker, AL USA
Peripheral Vision Sensitivity with Night Vision Devices ***Final Report***
McLean, William E., Army Aeromedical Research Lab., USA; Feb. 1998; 54p; In English
Contract(s)/Grant(s): Proj-30162787A879
Report No.(s): AD-A341282; USAARL-98-19; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Peripheral retinal sensitivities were measured for right and left eyes using a monocular night vision device (NVD) (single tube AN/AVS-6 Aviator's Night Vision Imaging System) in front of the right eye under simulated high and low night illuminations. Small circular targets were projected with a modified Goldman perimeter for six subjects. The color of the targets were white, green, and red. Targets were presented in the temporal field along the horizontal meridian at 10, 30, and 45 degrees to the unaided left eye, and at 30, 45, and 60 degrees for the NVD viewing eye. The results showed a decrease in sensitivity for the peripheral retina with the NVD and no effect on the nondisplay viewing eye, including the targets that were located within the projected field of view of the display eye (10-degree point). The nondisplay viewing eye (left) remained dark adapted to either the high or low night light level. Changes in the detection of green and white colored targets with peripheral vision by the display eye showed more effect in decreased retinal sensitivity than the red targets. However, the decreases in dark adaptation from viewing the display were similar to the differences in retinal sensitivity between the two simulated night illuminations for the nondisplay viewing eye.
DTIC
Peripheral Vision; Visual Perception; Electro-Optics; Visual Fields; Night Vision; Field of View; Imaging Techniques; Sensitivity; Retina

19980203759 University of Central Florida, Center for Research in Electro-Optics and Lasers, Orlando, FL USA
Cascading for Large Effective Third Order Nonlinearities ***Final Report, Mar. 1995 - Oct. 1997***
Stegeman, G., University of Central Florida, USA; Dec. 18, 1997; 10p; In English
Contract(s)/Grant(s): DAAH04-95-1-0153
Report No.(s): AD-A344452; ARO-34226.19-PH; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal was to investigate phenomena associated with the cascading of second order nonlinear optical processes and identify potential applications. Two categories of cascading effects were found: effects due to the periodic power exchange between beams leading to a nonlinear phase shift; and the formation and properties of quadratic spatial solitons. In the first category, high throughput, all-optical switching has been demonstrated in a nonlinear directional coupler, a mode mixer and a Mach-Zehnder interferometer implemented in LINbO3 channel waveguides. Also, a novel approach to optical diode action based on second harmonic generation in asymmetric structures was demonstrated. In the soliton case, beam steering, all-optical switching, and a new family of quadratic solitons have been demonstrated experimentally in bulk media. Solitons due to down conversion via the seeded parametric instability have been observed and applications to high gain, output limiting devices identified. It has been shown that high intensity beams are unstable in quadratic media and can lead to the generation of single solitons (beam clean-up) and multiple solitons in one and two dimensions. In slab waveguides, quadratic solitons have been generated in LINbO3 waveguides and their interactions shown to closely resemble those obtained in bulk saturable third order media.
DTIC
Harmonic Generations; Nonlinear Optics; Optical Switching

19980203904 Michigan Univ., Randall Lab. of Physics, Ann Arbor, MI USA

Coherent Nonlinear Laser Spectroscopy Near Field Scanning Microscope (DURIP) ***Final Report, 15 Jul. 1995 - 14 Jul 1997***

Steel, Duncan G., Michigan Univ., USA; Jul. 14, 1997; 8p; In English

Contract(s)/Grant(s): DAAH04-95-1-0371

Report No.(s): AD-A344483; ARO-34744.1-PH-RIP; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This program supported the acquisition of instrumentation for the development of a system for coherent nonlinear optical spectroscopy of semiconductor heterostructures at liquid helium temperatures with sub-wavelength resolution. The design of the system is based on the super-resolution imaging technology developed for near field optical scanning microscopy (NSOM). The work included design and construction of an NSOM head capable of working reliably at low temperature with minimal vibration. Additional instrumentation acquired for this program was a low temperature cryostat with insert and associated electronics for NSOM control and signal acquisition. Special challenges in this work included the design and development of an all electrical feedback system to locate the tip relative to surface with improved performance over standard more cumbersome optical techniques. The system remains under development (supported by a separate grant from ARO), but at the time of this report, initial low temperature performance has been demonstrated.

DTIC

Microscopes; Nonlinearity; Laser Spectroscopy; Near Fields; Microscopy; Imaging Techniques; Optical Scanners

19980203915 Polish Academy of Sciences, Inst. of Physics, Warsaw, Poland

Proceedings of the International Conference "Quantum Optics 4", Volume 93

Jan. 1998; ISSN 0587-4246; 244p; In English; 4th; Quantum Optics, 17-24 Jun. 1997, Jaszowiec, Poland

Contract(s)/Grant(s): F61708-97-W0093

Report No.(s): AD-A343354; EOARD-CSP-97-1041-Vol-93-No-1; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This volume contains lectures presented at the Quantum Optics IV meeting which took place at Jaszowiec (Poland) from June 17 to June 24,1997. The leading themes of the meeting were: cold atoms, strong laser field-atom interactions and quantum chaos. It turned out that the first topic got most attention. It is worth noting that our meeting took place before the announcement of the Nobel Prize in physics for 1997. This Nobel Prize was awarded to C. Cohen-Tannoudji, W. Philips and S. Chu for their contribution to cooling and trapping of atoms. Of particular interest were lectures on the "hot topic" of ultracold atoms forming Bose-Einstein condensate. This effect is often considered as a part of condensed matter physics but it became accessible to experiments due to progress in laser cooling of dilute atomic gases. Thus we have witnessed yet another example of a new subject encompassed by quantum optics. Some earlier examples include classical and quantum chaos. Although not directly related to quantum optics they draw from experimental possibilities provided by modern laser techniques. Our third theme: strong laser field-atom interactions is a more traditional subject of quantum optics. Some 140 physicists from 13 countries participated in the meeting. We had 25 invited lectures, of which 18 are included in this volume. In addition there were 120 posters presented at two poster sessions. The conference offered an overview of the most important issues of quantum optics in its broad sense.

DTIC

Conferences; Quantum Theory; Quantum Optics; Lasers; Condensed Matter Physics; Laser Cooling; Bose-Einstein Condensates

19980203996 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium

Surface Integral Method to Quantify the Droplet Non-Sphericity Effect on Rainbow Thermometry

vanBeeck, J. P. A. J., Von Karman Inst. for Fluid Dynamics, Belgium; Riethmuller, M. L., Von Karman Inst. for Fluid Dynamics, Belgium; May 1998; 8p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A theoretical model is presented to compute the monochromatic rainbow interference pattern formed by ellipsoidal homogeneous, transparent particles. The model is applied to predict the effect of droplet nonsphericity on the errors in the particle temperature and size measurements, performed by rainbow thermometry. These results have been employed to achieve a quantitative validation of the experimental nonsphericity detection method, based on the comparison of different types of size measurements of the same droplet, derived from different interference structures that are visible in the rainbow pattern. As such, confidence can be established in the temperature measurement as far as the selected spherical droplets are concerned.

Author

Temperature Measurement; Drops (Liquids); Laser Doppler Velocimeters; Laser Beams

19980204002 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia

Application of Optical and Interference Methods in Experimental Aerodynamics

Koulech, V. P., Tsentralni Aerogidrodinamicheskii Inst., Russia; Fonov, S. D., Tsentralni Aerogidrodinamicheskii Inst., Russia; Yakovlev, V. A., Tsentralni Aerogidrodinamicheskii Inst., Russia; May 1998; 12p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The review of optical methods, which were developed and used during the last years in TsAGI for investigations of aircraft aerodynamics and aeroelasticity, is presented. Non-traditional methods of flow investigations are considered in more detail: a raster-type shadowgraph method of flow visualization, laser interferometry with a narrow reference beam, shift interferometry and laser holographic interferometry, a laser-knife method. The combination of visualization by a laser-knife method with local measurements of velocity distribution with the help of a laser Doppler velocimeter (LDV) is offered, which allows to optimize a grid of nodes of velocity measurement. To study the shape, motion and deformation of the aerodynamic models and aircraft structure elements in aerodynamic wind tunnels a number of optical, laser and videogrammetric systems ensuring high sensitivity and processing of results in real time is developed.

Author

Aerodynamics; Velocity Measurement; Velocity Distribution; Real Time Operation; Laser Interferometry; Laser Doppler Velocimeters; Holographic Interferometry; Flow Visualization

19980204003 Institut de Mecanique des Fluides de Lille, France

Recording and Processing of Interferograms by Spectral Description of the Optical Sequence ***Enregstrement et Traitement des Interferogrammes par Caracterisation Spectrale de la Chaine Optique***

Desse, J. M., Institut de Mecanique des Fluides de Lille, France; May 1998; 8p; In French; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The recording and processing of interferograms are greatly improved by the opportunity to be able to recreate in a microcomputer equipped with an image processing card the scale of experimental shadings of an interferometer equipped with a known white source and a given Wollaston prism. Considering the spectral characteristics of the light source and the three filters of the RVB video camera, one is able to express analytically the luminous strength of the interference fringes when the operating difference varies and to reproduce on the monitor the colors which are going to be displayed experimentally. Knowledge of the shading scale of the interferometer will allow one on the one hand to control in an optimal way the position of the prism during recording of the photographs, and on the other hand to process the interferograms automatically and with very high precision.

Transl. by Schreiber

Interferometers; Image Processing; Interferometry

19980204706 National Inst. of Standards and Technology, Optical Technology Div., Gaithersburg, MD USA

NIST Measurement Services: Spectral Reflectance

Barnes, P. Y., National Inst. of Standards and Technology, USA; Early, E. A., National Inst. of Standards and Technology, USA; Parr, A. C., National Inst. of Standards and Technology, USA; Mar. 1998; 166p; In English; Figures in this document may not be legible in mic

Report No.(s): PB98-149016; NIST/SP-250-48; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This document describes the instrumentation, standards, and techniques used at the National Institute of Standards and Technology to measure spectral reflectance over the ultraviolet, visible, and near infrared wavelength ranges. Part I describes the motivation for maintaining reference and transfer spectrophotometers for spectral reflectance measurements, the basics of reflection, and the standards and services that are available from NIST. Part II develops the necessary theory of reflection, beginning with basic definitions and equations and ending with the relevant measurement equations for the experiments described in this documentation. The NIST Spectral Tri-function Automated Reference Reflectometer is described in Part III. This instrument provides the basis for the development of absolute NIST standards of diffuse and specular reflectance. Part IV describes the NIST transfer spectrophotometers, high precision commercial instruments used for calibrating Standard Reference Materials such as diffuse reflectance and specular reflectance standards. References containing details are reproduced in the appendices.

NTIS

Spectrophotometers; Bidirectional Reflectance; Reflectometers; Optical Measuring Instruments; Wavelengths; Specular Reflection

19980205002 Rochester Univ., Inst. of Optics, NY USA

Electronic Imaging ***Final Report, Sep. 1994 - Feb. 1997***

George, Nicholas, Rochester Univ., USA; Oct. 1997; 40p; In English

Contract(s)/Grant(s): DAAH04-94-G-0323
Report No.(s): AD-A344222; ARO-30402.1-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Theoretical and experimental research was proposed on topics of strategic importance in electronic imaging with an emphasis on problems of basic research significance which also have relevance to novel systems for imaging, automatic pattern recognition, and remote sensing. Our goal has been to make contributions in imaging science that will lead to a better understanding of hybrid systems combining optical imaging, photosensors, and digital computers for signal processing. In the statement of work we had proposed research on three related topics. First, we proposed to study the controlled blurring caused by an idealized point spread function, i.e. the random walk or speckle like psf. This novel method for controlled blurring appears to be useful in secure transmission and in image compression; and this psf has many interesting mathematical properties that we have investigated. Secondly, we proposed a study of image recovery in the Fresnel zone (incoherent case) when the imaging system is misfocused. We applied modern coherence theory together with current computer science techniques in order to obtain optimal recovery and, as well, to establish theoretical limits on the image quality of the restoration. In this research we also established an operator independent method for the identification of the focusing errors. For the third topic, we had intended to continue with the remote sensing of particulates to include extension of the inversion theory (formulated in 1990-1991) to the case of moving aerosols. Unfortunately, work in this area has not progressed as we had hoped, yet future plans remain to include the use of variable wavelength as a tool in particulate diagnostics.

DTIC

Images; Pattern Recognition; Signal Processing; Photoelectricity; Image Reconstruction

19980205619 Lawrence Livermore National Lab., Livermore, CA USA

Modeling for deformable mirrors and the adaptive optics optimization program

Henesian, M. A., Lawrence Livermore National Lab., USA; Haney, S. W., Lawrence Livermore National Lab., USA; Trenholme, J. B., Lawrence Livermore National Lab., USA; Thomas, M., Massachusetts Inst. of Tech., USA; Mar. 18, 1997; 12p; 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-124897; CONF-9610225-33; DE97-053205; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We discuss aspects of adaptive optics optimization for large fusion laser systems such as the 192-arm National Ignition Facility (NIF) at LLNL. by way of example, we considered the discrete actuator deformable mirror and Hartmann sensor system used on the Beamlet laser. Beamlet is a single-aperture prototype of the 11-0-5 slab amplifier design for NIF, and so we expect similar optical distortion levels and deformable mirror correction requirements. We are now in the process of developing a numerically efficient object oriented C++ language implementation of our adaptive optics and wavefront sensor code, but this code is not yet operational. Results are based instead on the prototype algorithms, coded-up in an interpreted array processing computer language.

DOE

Optimization; Models; Deformable Mirrors; Actuators; Adaptive Optics; Research Facilities

19980206019 Innovative Scientific Solutions, Inc., Beavercreek, OH USA

Optical Measurements of Surface Pressure and Temperature in Turbomachinery

Navarra, Kelly, Innovative Scientific Solutions, Inc., USA; Goss, Larry, Innovative Scientific Solutions, Inc., USA; Jordan, Jeffery, Innovative Scientific Solutions, Inc., USA; Rabe, Doug, Wright Lab., USA; Gord, Jim, Wright Lab., USA; Car, David, Wright Lab., USA; May 1998; 14p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A new pressure-measurement technique which employs the tools of molecular spectroscopy has recently received considerable attention in the aerospace community. Measurements are made via oxygen-sensitive molecules attached to the surface of interest as a coating, or paint. The pressure-sensitive-paint (PSP) technique is now commonly used in stationary wind-tunnel tests; this paper presents extension of the technique to advanced turbomachinery applications. New pressure- and temperature-sensitive paints (TSPs) have been developed for application to a state-of-the-art transonic compressor where pressures up to 2 atm and surface temperatures to 140 C are expected for the first-stage rotor. PSP and TSP data images have been acquired from the suction surface of the first-stage rotor at 85% of the correct design speed for the compressor peak-efficiency condition. The shock structure is clearly visible in the pressure image, and visual comparison to the corresponding computer prediction shows quantitative pres-

sures similar to the PSP data. The measurement error is estimated to range from 0.36 kPa in low pressure regions to 4 kPa in high-pressure regions. The errors were significantly increased by a failure mode of the camera which will be described.
Author
Paints; Surface Temperature; Optical Measurement; Pressure Measurement; Molecular Spectroscopy; Transonic Compressors; Wind Tunnel Tests; CCD Cameras

19980206028 Massachusetts Inst. of Tech., Gas Turbine Lab., Cambridge, MA USA
Optical Instrumentation for Temperature and Velocity Measurements in Rig Turbines
Ceyhan, I., Massachusetts Inst. of Tech., USA; dHoop, E. M., Massachusetts Inst. of Tech., USA; Guenette, G. R., Massachusetts Inst. of Tech., USA; Epstein, A. H., Massachusetts Inst. of Tech., USA; Bryanston-Cross, P. J., Warwick Univ., UK; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Non-intrusive optical measurement techniques have been examined in the context of developing robust instruments which can routinely yield data of engineering utility in high speed turbomachinery test rigs. The engineering requirements of such a measurement are presented. of particular interest were approaches that provide both velocity and state-variable information in order to be able to completely characterize transonic flowfields. Consideration of all of the requirements lead to the selection of particle image velocimetry (PIV) for the approach to velocity measurement while laser induced fluorescence of oxygen (O2 LIF) appeared to offer the most promise for gas temperature measurement. A PIV system was developed and demonstrated on a transonic turbine stage in the MIT blowdown turbine facility. A comprehensive data set has been taken at one flow condition. Extensive calibration established the absolute accuracy of the velocity measurements to be 3-5 %. The O2 LIF proved less successful. Although accurate for low speed flows, vibrational freezing of O2 prevented useful measurements in the transonic, 300-600 K operating range of interest here.
Author
Laser Induced Fluorescence; Particle Image Velocimetry; Velocity Measurement; Temperature Measurement; Test Stands; Gas Temperature; Supersonic Turbines

19980206031 Technische Univ., Electronics and Measurement Technology Dept., Munich, Germany
Optical Blade Vibration Measurement at MTU
Zielinski, M., Technische Univ., Germany; Ziller, G., Technische Univ., Germany; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Compressor rotor blade vibration measurements are crucial to the proper assessment of critical operating conditions and the prediction of blade life. General]y, at MTU these measurements arc performed using strain gauges or the frequency-modulated grid system. In an attempt to provide an advanced alternative solution to the two standard techniques, MTU commenced work on an optical blade vibration measurement (OBM) system some years ago. For OBM, several optical trigger probes are installed in the compressor casing above the rotor, and the blade transit times between the probes are measured. An analysis of these transit times then provides information on blade vibrations. This paper describes the details of MTU's experimental OBM system and the analysis methods used. The capability of the system is demonstrated by means of various measurement tasks: vibrations excited by resonances with amplitudes as low as 10 micro-m(p) can be measured. Blade vibrations caused by compressor surges were analysed successfully. Comparative measurements show good agreement between OBM and strain gauge results. As an option the untwistness of the blades with increasing rotational speed can be measured.
Author
Vibration Measurement; Optical Measuring Instruments; Compressor Blades; Structural Vibration

19980206034 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Non-Intrusive Measurement of an Energetic Material Regression Rate ***Mesure Non-Intrusive de la Vitesse de Regression d'un Materiau Energetique***
Cauty, Franck, Office National d'Etudes et de Recherches Aerospatiales, France; May 1998; 12p; In French; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The non-intrusive method of an energetic material regression rate determination developed by ONERA is based on the ultrasound wave propagation time through the tested material. This direct, local and quasi-instantaneous method is aimed at determining the classical burning rate law of solid propellants in large pressure and initial temperature ranges. This technique demonstrates a good accuracy in various combustion regimes, specially in erosive burning, and for different solid propellants. Significant examples are presented in solid propellant domain. The application field of the ultrasound method extends to other materials for hybrid propulsion or thermal protective insulator degradation. The ONERA ultrasonic method and its associated electronic devices are

operating either as an industrial procedure tool for solid propellant manufacturing or as a helpful diagnostic tool for research engineers.
Author
Ultrasonics; Nonintrusive Measurement; Solid Propellants; Propellant Combustion; Burning Rate

19980206036 Rolls-Royce Ltd., Applied Science Lab., Derby, UK
Developments in High Energy X-Ray Radiography of Running Engines
Allen, M. J., Rolls-Royce Ltd., UK; Rogers, J. D., Rolls-Royce Ltd., UK; May 1998; 8p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

There has been substantial industrial development of radiographic techniques for quantitative measurement of component and/or material clearances or movement within static or operating test pieces or machinery. Important examples of applications are in the fields of aeronautics, armaments, space sciences, and nuclear engineering. Following the demonstration and installation of a suitable high energy X-ray source for use with operating aero-engines, Rolls-Royce has been routinely carrying out high-energy X-ray radiography of engines on test beds since 1971. The current Rolls-Royce X-ray imaging equipment includes a film plate changer system, used for analysis of steady-state or slow transient events that enables sequences (up to 10 shots) of high-resolution film radiographs to be obtained at short (approx. 2 s) exposure times. A real-time X-ray video imaging system producing up to 25 frames/s is used for faster transients or where cyclic behavior is being investigated by strobing with the pulsed X-ray source. An Electronic Radiography imaging system, based on a cooled high-resolution CCD camera, has been developed to replace film radiography. This system enables long sequences (more than 100 images) of high resolution images to be obtained at fast data acquisition and transfer rates (up to 8 x 10(exp 6) pixel/s). Movements of regions of interest in sequences of images during an engine operating cycle are measured using cross correlation tracking software. The performance of a new Rolls-Royce imaging system for test bed use is discussed and the results of an X-ray test on an Adour engine are described.
Author
Radiography; X Ray Inspection; X Ray Imagery; CCD Cameras; Static Tests; Real Time Operation; Nondestructive Tests; Images

19980206182 Alabama Univ., Dept. of Electrical and Computer Engineering, Huntsville, AL USA
Diffractive Optical Elements for Lidar Beam Scanning
Nordin, Gregory P., Alabama Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Wind measurement from space can provide critical data for understanding weather patterns and large-scale storm phenomena. An instrument for providing such measurements is currently under development at NASA's Marshall Space Flight Center. The instrument utilizes a pulsed coherent lidar system operating at a wavelength of 2.06 micrometers in order to achieve decreased weight, size, and cost compared to systems operating at longer wavelengths, and it is being developed to be compatible with the capabilities of small satellites. A key aspect of such an orbital lidar system is that the beam must be conically scanned after it exits the final beam expansion telescope. Previous work indicates that the aperture of the beam expansion telescope should be 50 cm with a scanner half-angle of 300 and a rotation rate of 10 RPM. The critical requirements for the beam scanning element include a 50 cm aperture, an induced wavefront error of less than lambda/10, and high efficiency deflection (i.e., 95+ % of the incident light is deflected). This report is intended to provide a brief overview and discussion of potential technologies for space-borne laser radar (lidar) beam scanning.
Derived from text
Diffractive Optics; Optical Radar; Conical Scanning; Light Beams; Wind Measurement; Radar Beams

19980206183 Mercer Univ., Dept. of Electrical abd Computer Engineering, Macon, GA USA
Strehl Ratio Meter for Focusing Segmented Mirrors 1
Olivier, Philip D., Mercer Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Initial focusing segmented mirrors that must be deployed in space, such as the Next Generation Space Telescope (NGST), provide challenges not faced before in the area of adaptive optics. The devices used to focus the mirror must minimize the power used and unnecessary mechanical movement. The device described in this report requires no movable parts except for the essential actuators required to move the mirror segments. Detail description of the components can be found in Coker, 1996. The primary mirror of the NGST will consist of 9 segments, a central annular segment, surrounded by 8 segments. The entire mirror assembly will be an 8 meter nearly filled circle (with the corners of the segments clipped to allow for storage in an Atlas IIe shroud). As the segments of the primary mirror are deployed to their operational positions, they must be positioned to within small fractions of a wavelength of near infrared light. When focused, the NGST will put most of its collected li-ht into the small region near the

center of its focal plane. The ratio of the total light in the diffraction limited spot about the center of the focal plane to the total light in the focal plane. The purpose of this research effort is to design and build a device that will measure Strehl ratio and to use demonstrate that the Strehl ratio can be used to focus a segmented mirror.
Derived from text
Segmented Mirrors; Measuring Instruments; Telescopes; Wave Diffraction; Focusing

19980206186 Albany Coll. of Pharmacy, Dept. of Physical Sciences and Mathematics, Albany, NY USA
Synthesis and Characterization of a Chitosan Derivative for Electro-Optical Applications
Prastofer, Thomas, Albany Coll. of Pharmacy, USA; Oct. 1996; 4p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Chitin is a naturally occurring polymer of alpha(1-4) poly N-acetylglucosamine found primarily in the shells of crustaceans and insects. This polymer is chemically and thermally stable and physically durable as a consequence of hydrogen bonding which causes the alignment and ordering of the polymer chains into microcrystals which aggregate into sheets with chiral nematic order. Industry has attempted to take advantage of chitin's properties and low cost (chitin is a waste product of the shellfish industry) to produce durable fibers and other products. This has been largely unsuccessful because of chitin's non reactivity and insolubility. Chitosan is the deacetylation product of chitin and retains many of the structural properties of chitin. Unlike chitin, chitosan is soluble in aqueous solution at reduced pH making it easier to be processed into fibers and films than chitin. Chitosan and its derivatives are now used in such commercial applications as wound dressings, waste water treatment, and in pharmaceuticals. In this study, we have synthesized a chitosan derivative, N-para-nitrophenyl chitosan (NPNPC), as a model material with potential applications in electro optics.
Author
Synthesis (Chemistry); Chitin; Chemical Reactions; Polymer Chemistry; Filtration

19980206190 Texas A&M Univ., Physics Dept., Kingsville, TX USA
Scattering and the Point Spread Function of the New Generation Space Telescope
Schreur, Julian J., Texas A&M Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Preliminary design work on the New Generation Space Telescope (NGST) is currently under way. This telescope is envisioned as a lightweight, deployable Cassegrain reflector with an aperture of 8 meters, and an effective focal length of 80 meters. It is to be folded into a small-diameter package for launch by an Atlas booster, and unfolded in orbit. The primary is to consist of an octagon with a hole at the center, and with eight segments arranged in a flower petal configuration about the octagon. The comers of the petal-shaped segments are to be trimmed so that the package will fit atop the Atlas booster. This mirror, along with its secondary will focus the light from a point source into an image which is spread from a point by diffraction effects, figure errors, and scattering of light from the surface. The distribution of light in the image of a point source is called a point spread function (PSF). The obstruction of the incident light by the secondary mirror and its support structure, the trimmed corners of the petals, and the grooves between the segments all cause the diffraction pattern characterizing an ideal point spread function to be changed, with the trimmed comers causing the rings of the Airy pattern to become broken up, and the linear grooves causing diffraction spikes running radially away from the central spot, or Airy disk. Any figure errors the mirror segments may have, or any errors in aligning the petals with the central octagon will also spread the light out from the ideal point spread function. A point spread function for a mirror the size of the NGST and having an incident wavelength of 900 nm is considered. Most of the light is confined in a circle with a diameter of 0.05 arc seconds. The ring pattern ranges in intensity from 10(exp -2) near the center to 10(exp -6) near the edge of the plotted field, and can be clearly discerned in a log plot of the intensity. The total fraction of the light scattered from this point spread function is called the total integrated scattering (TIS), and the fraction remaining is called the Strehl ratio. The angular distribution of the scattered light is called the angle resolved scattering (ARS), and it shows a strong spike centered on a scattering angle of zero, and a broad , less intense distribution at larger angles. It is this scattered light, and its effect on the point spread function which is the focus of this study.
Derived from text
Point Spread Functions; Image Processing; Spaceborne Telescopes; Equipment Specifications; Light Scattering; Imagery

19980206195 Mississippi Delta Community Coll., Dept. of Science, Moorhead, MS USA
Design, Fabrication and Testing of Multilayer Coated X-Ray Optics for the Water Window Imaging X-Ray Microscope
Spencer, Dwight C., Mississippi Delta Community Coll., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Hoover et. al. built and tested two imaging Schwarzschild multilayer microscopes. These instruments were constructed as prototypes for the ”Water Window Imaging X-Ray Microscope,” which is a doubly reflecting, multilayer x-ray microscope configured to operate within the ”water window.” The ”water window” is the narrow region of the x-ray spectrum between the K absorption edges of oxygen (lamda = 23.3 Angstroms) and of carbon (lamda = 43.62 Angstroms), where water is relatively highly transmissive and carbon is highly absorptive. This property of these materials, thus permits the use of high resolution multilayer x-ray microscopes for producing high contrast images of carbon-based structures within the aqueous physiological environments of living cells. We report the design, fabrication and testing of multilayer optics that operate in this regime.
Author
Imaging Techniques; Image Contrast; High Resolution; X Ray Analysis; X Ray Apparatus; Microscopy; Microscopes; X Ray Optics

19980206329 Los Alamos National Lab., NM USA
Ultrafast and nonlinear optical characterization of optical limiting processes in fullerenes
Kohlman, R., Los Alamos National Lab., USA; Klimov, V., Los Alamos National Lab., USA; Shi, X., 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; DAAH04-96-C-0077
Report No.(s): LA-UR-97-3520; CONF-970706; DE98-000244; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors present recent results of broadband femotosecond (fs) transient absorption (TA) and broadband nanosecond (ns) optical limiting (OL) studies of C60 and derivatized C60. Improvements in measurement techniques for fs TA spectra provide sensitivity to 10(exp -5) in differential transmission, allowing detailed comparison of excited-state spectra with established energy level diagrams, as well as comparison of the ratio of triplet to singlet excited-state absorption cross sections from TA spectra with those obtained by modeling time transients at different wavelengths. For derivatized fullerenes, which provide enhanced solubility and a ground-state absorption extended into the infrared compared with C60 there is no spectral region where the triplet absorption cross section dominates the singlet as strongly as demonstrating broadband limiting in all 6, 6 mono-adducts and neat C60. The authors report new approaches to processing sol-gel encapsulated fullerenes to improve the OL performance of solid-state materials to approach the response of solution limiters.
DOE
Fullerenes; Sol-Gel Processes; Infrared Radiation; Mechanical Properties; Spectral Bands; Ground State; Excitation

19980206339 Syracuse Univ., Dept. of Chemistry, NY USA
Dual-Mode Photonic Devices *Final Report, Jun. 1996 - Jun 1997*
Chalken, Joseph, Syracuse Univ., USA; Apr. 1998; 34p; In English
Contract(s)/Grant(s): F30602-96-C-0171; AF Proj. 4600
Report No.(s): AD-A345404; AFRL-SN-RS-TR-1998-30; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this effort was to exploit the physical interactions underlying the newly discovered Photochromic Optical Memory Ssystem (POMS) in a different type of photonic device. The POMS approach had been used to implement optical control of optical data but now, because of the interrelated photochromism and electrochromism of the WO3-W2O5 system, hybrid devices can be envisioned. Such hybrid or ”dual mode” devices would allow electrical control and manipulation of optical data, or conversely, optical control and manipulation of electronic domain data. POMS based devices could also allow simultaneous electronic or optical access to a single data set stored in a single location.
DTIC
Optical Switching; Photochromism; Optical Equipment; Optical Memory (Data Storage); Electrochromism

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19980203554 Princeton Univ., Plasma Physics Lab., NJ USA
ICRF heating and current drive experiments on TFTR
Rogers, J. H., Princeton Univ., USA; Hosea, J. C., Princeton Univ., USA; Phillips, C. K., Princeton Univ., USA; 1996; 7p; In

English; 16th; Plasma Physics and Controlled Nuclear Fusion Research, 7-11 Oct. 1996, Montreal, Canada; Sponsored by International Atomic Energy Agency, Austria
Contract(s)/Grant(s): DE-AC02-76CH-03073
Report No.(s): PPPL-CFP--3639; IAEA-CN--64/EP-2; CONF-961005--29; DE97-005295; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Direct electron heating in Enhanced Reverse Shear (ERS) plasmas has been found to delay the back transition out of the ERS state. D-T mode conversion of the fast magnetosonic wave to an Ion Berstein Wave (IBW) for off-axis heating and current drive has been successfully demonstrated for the first time.
DOE
Fusion Reactors; Ion Cyclotron Radiation; Magnetoacoustic Waves

19980203676 Canadian Fusion Fuels Technology Project, Mississauga, Ontario Canada
ITER TASK T252 (1995):Gamma radiation testing of a GaAs operational amplifier for instrument applications
Hiemstra, D., Spar Aerospace Ltd., Canada; Mar. 1996; 25p; In English
Report No.(s): CFFTP-G-9613; DE97-637120; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

The purpose of this 1995 ITER task was : to build an improved operational amplifier using GaAs MESFET technology, to build a reference voltage subcircuit using GaAs MESFET technology and to investigate the potential of GaAs HBT's to improve the noise performance of the GaAs MESFET operational amplifier. This work addresses the need for instrumentation-grade components to read sensors in an experimental fusion reactor, where the anticipated total dose for a useful service life is 3Grad(GaAs). It is an extension of our 1994 work.
DOE
Gamma Rays; Thermonuclear Reactions; Fusion Reactors; Electric Potential

19980203677 Canadian Fusion Fuels Technology Project, Mississauga, Ontario Canada
ITER TASK T299 (1995): HITEX demonstration tests
Rodrigo, L., Atomic Energy of Canada Ltd., Canada; Miller, J. M., Atomic Energy of Canada Ltd., Canada; Senohrabek, J. A., Atomic Energy of Canada Ltd., Canada; Sood, S., Institut de Recherche de l'Hydro-Ontario, Canada; Fong, C., Institut de Recherche de l'Hydro-Ontario, Canada; Busigin, A., NITEK Corp., Canada; Gierszewski, P., NITEK Corp., Canada; Jan. 1996; 42p; In English
Report No.(s): CFFTP-G-9602; DE97-637116; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Hardcopy, Microfiche

The objective of this task is to demonstrate processes for different cleanup and detritiation of the plasma exhaust. In this subtask, the objectives were to provide further design data on the HITEX process, and to build and demonstrate 2-stage high-detritiation HITEX performance.
DOE
Plasmas (Physics); Thermonuclear Reactions

19980203678 Canadian Fusion Fuels Technology Project, Mississauga, Ontario Canada
ITER TASK T26/28 (1995): Solubility, diffusion and absorption of hydrogen isotopes in potential fusion reactor ceramics
Thompson, D. A., McMaster Univ., Canada; Macauley-Newcombe, R. G., Canadian Fusion Fuels Technology Project, Canada; Apr. 1996; 31p; In English
Report No.(s): CFFTP-G-9586; DE97-637115; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Ceramic insulators are integral parts of numerous components essential for the heating control and diagnostic measurement of fusion plasmas. For safe and reliable reactor operations it is necessary to be able to predict the resultant tritium inventories and permeation fluxes through these materials. Some materials being considered are Al(sub 2)O(sub 3) (both as single crystal sapphire and polycrystalline alumina) and BeO. This report contains results of ion-implantation, thermal absorption (diffusion loading) and ion-beam analysis experiments performed in 1994 and 1995 for ITER task T26/28. The combination of implantation and thermal absorption capabilities enable us to load samples with hydrogen isotopes under differing conditions.
DOE
Ion Implantation; Polycrystals; Ceramics; Hydrogen Isotopes; Plasmas (Physics); Diffusion

19980203679 Netherlands Energy Research Foundation, Petten, Netherlands

Analysis of the mechanical behaviour of the ITER magnet system

Jong, C. T. J., Netherlands Energy Research Foundation, Netherlands; Mar. 1996; 282p; In English

Contract(s)/Grant(s): ERB5000-CT-950003-NET-(NET/94/

Report No.(s): ECN-C-96-011; DE97-637109; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The International Thermonuclear Experimental Reactor (ITER) is a tokamak fusion device with the objective of demonstrating controlled ignition and an extended burn for a duration sufficient to achieve stationary conditions. The design of ITER will be based on extensive new design work supported by new physical and technological results. As part of the ITER Engineering Design Activities, the mechanical behaviour of the toroidal field coil (TF coil) system during normal operating conditions and fault conditions has to be analyzed. The displacements and/or stresses in the components must be limited to prevent mechanical failure of parts of the overall structure. These Engineering Design Activities are supported by R and D programs in the European Union. This final report describes the work carried out by ECN to develop a finite element model (FE model) of the TF-coil system which is suitable for the analysis of the mechanical behaviour and presents results obtained with this model. For the analysis of the mechanical behaviour, a large three dimensional (3D) non-linear finite element model has been developed. With this FE model a large number of load cases has been analyzed which correspond with several time points during multiple pulses.

DOE

Finite Element Method; Thermonuclear Reactions; Three Dimensional Models; Tokamak Devices; Toroidal Plasmas; Mathematical Models; Fusion Reactors

19980203720 Department of Energy, Office of Energy Research, Washington, DC USA

DIII-D Research Operations ***Annual Report, 1 Oct. 1995 - 30 Sep. 1996***

1996; 102p; In English

Contract(s)/Grant(s): W-7405-eng-48; DE-AC03-89ER-51114

Report No.(s): GA-A22550; DE97-009053; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The mission of the DIII-D research program is to advance fusion energy science understanding and predictive capability and to improve and optimize the tokamak concept. A long term goal remains to integrate these products into a demonstration of high confinement, high plasma pressure (plasma (beta)), sustained long pulse operation with fusion power plant relevant heat and particle handling capability. The DIII-D program is a world recognized leader in tokamak concept improvement and a major contributor to the physics R and D needs of the International Thermonuclear Experimental Reactor (ITER). The FY96 DIII-D research program was highly successful, as described in this report. A moderate sized tokamak, DIII-D is a world leader in tokamak innovation with exceptional performance, measured in normalized parameters.

DOE

Tokamak Devices; Thermonuclear Reactions; Fusion Reactors

19980203829 Los Alamos National Lab., NM USA

Rayleigh-Taylor Mix experiment on Pegasus

Sheppard, M. G., Los Alamos National Lab., USA; Atchison, W. L., Los Alamos National Lab., USA; Anderson, W. E., 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-97-2393; CONF-9706113-17; DE97-008619; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Rayleigh-Taylor Mix project will attempt to diagnose and understand the growth of a mixing layer at the interface between an imploding metal liner and a polystyrene foam core in a series of pulsed power experiments on the Pegasus capacitor bank. Understanding the effects of material strength will be an important part of the study. During the initial phase of the implosion, the linear/foam interface is Rayleigh-Taylor (RT) stable; however, as the foam is compressed, it decelerates the liner, causing it to bound and to go RT unstable. This paper reports 1D and 2D MHD simulations of the first experiment in the series and preliminary results.

DOE

Capacitors; Mixing Layers (Fluids); Polystyrene; Magnetohydrodynamics; Foams; Magnetohydrodynamic Stability

19980203857 Oak Ridge National Lab., TN USA

Fast pressure measurements of the local island divertor on the compact helical system

Lyon, J. F., Oak Ridge National Lab., USA; Klepper, C. C., Oak Ridge National Lab., USA; England, A. C., Oak Ridge National Lab., 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-AC05-96OR-22464

Report No.(s): CONF-9706131-18; DE97-008456; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Development of an effective divertor is critical for the viability of the stellarator (helical system) concept. In the local island divertor (LID) concept particle and heat fluxes are channeled to the back of the LID head by the magnetic field structure of an externally produced m = 1, n = I island that is outside the last closed flux surface. The leading edge of the LID head is protected from the outward heat flux from the plasma because it is located inside the 1/1 island and the particles that strike the target plates on the back of the LID head in the throat of the LID pump module are then pumped efficiently. A set of 16 coils was used to create a 1/1 island in the Compact Helical System (CHS). The current (I(sub LID)) in the LID coils was chosen to position either the 0-point or the X-point of the external 1/1 magnetic island at the location of the LID head. The principal diagnostic in this study was an ASDEX-style ionization gauge that allowed fast ((approx)1-ms) measurements of the neutral pressure buildup behind the divertor head in the LID module.

DOE

Magnetic Field Configurations; Pressure Measurement; Stellarators; Plasma Control; Ionization Gages; Diverters

19980203939 Wisconsin Univ., Dept. of Physics, Madison, WI USA

Enhanced confinement with plasma biasing in the MST reversed field pinch

Craig, D., Wisconsin Univ., USA; Almagri, A. F., Wisconsin Univ., USA; Anderson, J. K., Wisconsin Univ., USA; Jun. 1997; 24p; In English

Contract(s)/Grant(s): DE-FG02-96ER-54345

Report No.(s): DOE/ER/54345-288; DE97-008721; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We report an increase in particle confinement with plasma biasing in a reversed field pinch. Miniature plasma sources are used as electrodes to negatively bias the plasma at the edge (r/a approx. 0.9). Particle content increases and H(alpha) radiation decreases upon application of bias and global particle confinement roughly doubles as a result. Measurements of plasma potential, impurity flow, and floating potential fluctuations indicate that strong flows are produced and that electrostatic fluctuations are reduced.

DOE

Electric Fields; Electrodes; Plasma Control; Reverse Field Pinch; Potential Flow; Alpha Particles; Magnetohydrodynamic Flow

19980204721 Georgia Inst. of Tech., Fusion Research Center, Atlanta, GA USA

Numerical Study of Density Limit Mechanisms in Tokamaks

Stacey, W. M., Georgia Inst. of Tech., USA; Mar. 1998; 40p; In English

Report No.(s): PB98-145642; GTFR-139; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A core particle and power balance model with radiative cooling, a ballooning-mode-limit pedestal model, a '2-point' plasma divertor model with radiative and atomic recycling cooling, and a 2D neutral transport model have been combined to model the coupled plasma core-edge physics in a tokamak. This model has been applied to examine the physical mechanisms which limit the attainable core density. The first limitation is fueling rate and core penetrability. For fueling that is able to penetrate the core, the core density increases with fueling rate up to a limit set by one of two other mechanisms. When a sufficient impurity concentration is present, the mechanism that limits the maximum density attainable in the core seems to be an impurity-driven thermal instability that produces a thermal collapse of the core plasma. At lower impurity concentrations, the buildup of plasma density in the divertor and the associated increase in atomic recycling and ionization cooling causes a collapse of the divertor plasma temperature, leading to a thermal collapse of the core plasma. An increase in core heating input power or in plasma confinement extends the point of thermal collapse to higher density.

NTIS

Tokamak Devices; Plasma Density; Magnetohydrodynamic Stability; Ballooning Modes; Diverters; Ionization

19980204722 Georgia Inst. of Tech., Fusion Research Center, Atlanta, GA USA

Considerations on ITER

Stacey, W. M., Georgia Inst. of Tech., USA; Mar. 1998; 26p; In English

Report No.(s): PB98-145634; GTFR-138; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The continued participation of the USA in the ITER project is being widely discussed within (and without) the US fusion community. This report combines two separate documents which address this issue. The first document provides background material relative to the logic that led to the establishment of the present ITER mission, vis-a-vis the 'two-step' strategy for the development of fusion energy. The second document presents the results of a series of systems studies of 'reduced-cost' ITER options vis-a-vis ITER mission and physics design guidelines.

NTIS

Thermonuclear Reactions; Mission Planning; Fusion Reactors

19980205609 Lawrence Livermore National Lab., Livermore, CA USA

Observation of multiple mechanisms for stimulating ion waves in ignition scale plasmas

Kirkwood, R. K., Lawrence Livermore National Lab., USA; MacGowan, B. J., Lawrence Livermore National Lab., USA; Montgomery, D. S., Lawrence Livermore National Lab., USA; Mar. 03, 1997; 47p; In English, 11-15 Nov. 1996, Denver, CO, USA

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

Report No.(s): UCRL-JC-124651-Rev-1; CONF-961102-12; DE97-053164; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The laser and plasma conditions expected in ignition experiments using indirect drive inertial confinement have been studied experimentally. It has been shown that there are at least three ways in which ion waves can be stimulated in these plasmas and have significant effect on the energy balance and distribution in the target. First ion waves can be stimulated by a single laser beam by the process of Stimulated Brillouin Scattering (SBS) in which an ion acoustic and a scattered electromagnetic wave grow from noise. Second, in a plasma where more than one beam intersect, ion waves can Lie excited at the 'beat' frequency and wave number of the intersecting beams,, causing the side scatter instability to be seeded, and substantial energy to be transferred between the beams. and third, ion waves may be stimulated by the decay of electron plasma waves produced by Stimulated Raman Scattering (SRS), thereby inhibiting the SRS process.

DOE

Ion Beams; Electron Plasma; Plasma Waves; Brillouin Effect; Stimulation; Ignition; Ion Acoustic Waves; Laser Plasmas

19980205692 Lawrence Livermore National Lab., Livermore, CA USA

Chamber technology concepts for inertial fusion energy: Three recent examples

Meier, W. R., Lawrence Livermore National Lab., USA; Moir, R. W., Lawrence Livermore National Lab., USA; Abdou, M. A., California Univ., USA; Feb. 27, 1997; 31p; In English; 4th; Fusion Nuclear Technology, 6 - 11 Apr. 1997, Tokyo, Japan

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

Report No.(s): UCRL-JC-126817; CONF-970404-5; DE97-053180; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The most serious challenges in the design of chambers for Inertial Fusion Energy (IFE) are: (1) protecting the first wall from fusion energy pulses on the order of several hundred megajoules released in the form of X-rays, target debris, and high energy neutrons, and (2) operating the chamber at a pulse repetition rate of 5-10 Hz (i.e., re-establishing, the wall protection and chamber conditions needed for beam propagation to the target between pulses). In meeting these challenges, designers have capitalized on the ability to separate the fusion burn physics from the geometry and environment of the fusion chamber. Most recent conceptual designs use gases or flowing liquids inside the chamber. Thin liquid layers of molten salt or metal and low pressure, high-Z gases can protect the first wall from x rays and target debris, while thick liquid layers have the added benefit of protecting structures from fusion neutrons thereby significantly reducing the radiation damage and activation. The use of thick liquid walls is predicted to: (1) reduce the cost of electricity by avoiding the cost and down time of changing damaged structures, and (2) reduce the cost of development by avoiding the cost of developing a new, low-activation material. Various schemes have been proposed to assure chamber clearing and renewal of the protective features at the required pulse rate. Representative chamber concepts are described, and key technical feasibility issues are identified for each class of chamber. Experimental activities (past, current, and proposed) to address these issues and technology research and development needs are discussed.

DOE

Fusion Reactors; Fusion (Melting); Technology Assessment; Design Analysis; Walls; Protection; Pulse Repetition Rate; Radiation Damage

19980205793 Los Alamos National Lab., NM USA

The role of Z-pinches and related configurations in magnetized target fusion

Lindemuth, I. R., Los Alamos National Lab., USA; Jul. 10, 1997; 6p; In English; Dense Z-pinches, 28 - 30 May 1997, Vancouver, Canada

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

Report No.(s): LA-UR-97-2723; CONF-9705120; DE98-000837; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The use of a magnetic field within a fusion target is now known as Magnetized Target Fusion in the US and as MAGO (Magnitnoye Obzhatiye, or magnetic compression) in Russia. In contrast to direct, hydrodynamic compression of initially ambient-temperature fuel (e.g., ICF), MTF involves two steps: (a) formation of a warm, magnetized, wall-confined plasma of intermediate density within a fusion target prior to implosion; (b) subsequent quasi-adiabatic compression and heating of the plasma by imploding the confining wall, or pusher. In many ways, MTF can be considered a marriage between the more mature MFE and ICF approaches, and this marriage potentially eliminates some of the hurdles encountered in the other approaches. When compared to ICF, MTF requires lower implosion velocity, lower initial density, significantly lower radial convergence, and larger targets, all of which lead to substantially reduced driver intensity, power, and symmetry requirements. When compared to MFE, MTF does not require a vacuum separating the plasma from the wall, and, in fact, complete magnetic confinement, even if possible, may not be desirable. The higher density of MTF and much shorter confinement times should make magnetized plasma formation a much less difficult step than in MFE. The substantially lower driver requirements and implosion velocity of MTF make z-pinch magnetically driven liners, magnetically imploded by existing modern pulsed power electrical current sources, a leading candidate for the target pusher of an MTF system.

DOE

Magnetic Compression; Magnetic Fields; Hydrodynamics; Plasma Heating; Plasma Density; Zeta Pinch; Inertial Confinement Fusion; Thermonuclear Power Generation

19980205805 Los Alamos National Lab., NM USA

Progress with developing a target for magnetized target fusion

Wysocki, F. J., Los Alamos National Lab., USA; Chrien, R. E., Los Alamos National Lab., USA; Idzorek, G., Los Alamos National Lab., USA; Oona, H., Los Alamos National Lab., USA; Whiteson, D. O., Los Alamos National Lab., USA; Kirkpatrick, R. C., Los Alamos National Lab., USA; Lindemuth, I. R., Los Alamos National Lab., USA; Sheehey, P. T., 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-97-2386; CONF-9706113-25; DE97-009108; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Magnetized Target Fusion (MTF) is an approach to fusion where a preheated and magnetized plasma is adiabatically compressed to fusion conditions. Successful MTF requires a suitable initial target plasma with an embedded magnetic field of at least 5 T in a closed-field-line topology, a density of roughly 10(exp 18) per cu cm, a temperature of at least 50 eV, and must be free of impurities which would raise radiation losses. Target plasma generation experiments are underway at Los Alamos National Laboratory using the Colt facility; a 0.25 MJ, 2--3 micro-s rise-time capacitor bank. The goal of these experiments is to demonstrate plasma conditions meeting the minimum requirements for a MTF initial target plasma. In the first experiments, a Z-pinch is produced in a 2 cm radius by 2 cm high conducting wall using a static gas-fill of hydrogen or deuterium gas in the range of 0.5 to 2 torr. Thus far, the diagnostics include an array of 12 B-dot probes, framing camera, gated OMA visible spectrometer, time-resolved monochrometer, filtered silicon photodiodes, neutron yield, and plasma-density interferometer. These diagnostics show that a plasma is produced in the containment region that lasts roughly 10 to 20 micro-s with a maximum plasma density exceeding 10(exp -18) per cu cm. The experimental design and data are presented.

DOE

Capacitors; Plasma Generators; Thermonuclear Power Generation; Zeta Pinch; Plasma Diagnostics

19980205840 Wisconsin Univ., Madison, WI USA

Required conditions for and coincident 1/1-mode activity associated with the nonlocal electron heat transport effect on TFTR

Kissick, M. W., Wisconsin Univ., USA; Callen, J. D., Wisconsin Univ., USA; Fredrickson, E. D., Wisconsin Univ., USA; Aug. 1997; 14p; In English

Contract(s)/Grant(s): DE-FG02-92ER-54139

Report No.(s): UW-CPTC-97-11; DE98-000019; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A database of 71 distinct and randomly collected cold pulse cases from TFTR is analyzed. Observations show a striking parameter regime cutoff for the presence of nonlocal transient transport and coincident MHD (1/1-mode) activity as well as for changes in the radial speed of the nonlocal transport effect and changes in the sawtooth period. A nontrivial link is demonstrated between electron heat transport and MHD properties through observation of a common cutoff in the parameter n(sub e)(0)/T(sub e)(0)(sup 1/2) and a common threshold in injection size for radial speed and sawtooth period changes. Auxiliary heating (via energetic neutral beams) destroys whatever process is responsible for the nonlocal transport effect, unless the discharge contains significant amounts of injected tritium. These observations are preliminary, but they represent important circumstantial evidence for mysterious propagation of changes in some MHD-related phenomenon as being responsible for a large fraction of electron heat transport. This propagation is then probably a function of n(sub e)(0)/T(sub e)(0)(sup 1/2), ion mass, and possibly beam power. An analysis of Ohmic cases shows that the cutoff in n(sub e)(0)/T(sub e)(sup 1/2) indicates the nonlocal transport effects may occur when the electrons are collisionally thermally decoupled from the ions.

DOE

Ion Beams; Heat Transfer; Transport Properties; Magnetohydrodynamics; Electron Transfer; Heating; Electron Energy

19980205841 Wisconsin Univ., Madison, WI USA

Geometrical influences on neoclassical magnetohydrodynamic tearing modes

Kruger, S. E., Wisconsin Univ., USA; Hegna, C. C., Wisconsin Univ., USA; Callen, J. D., Wisconsin Univ., USA; Jul. 1997; 27p; In English

Contract(s)/Grant(s): DE-FG02-86ER-53218

Report No.(s): UW-CPTC-97-10; DE98-000018; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The influence of geometry on the pressure drives of nonideal magnetohydrodynamic tearing modes is presented. In order to study the effects of elongation, triangularity, and aspect ratio, three different machines are considered to provide a range of tokamak configurations: TFTR (circular), DIII-D (D-shaped), and Pegasus (extremely low aspect ratio). For large aspect ratio tokamaks, shaping does very little to influence the pressure gradient drives, while at low aspect ratios, a very strong sensitivity to the profiles is found. In particular, this sensitivity is connected to the strong dependence on the magnetic shear. This suggests that at low aspect ratio it may be possible to stabilize neoclassical tearing modes by flattening the q profile near low order rational surfaces (e.g., q = 2/1) using a combination of shaping and localized current drive, whereas at large aspect ratio it is more difficult.

DOE

Magnetohydrodynamics; Pressure Gradients; Tokamak Devices; Transport Theory

19980206304 Wisconsin Univ., Madison, WI USA

Two novel compact toroidal concepts with Stellarator features

Moroz, P. E., Wisconsin Univ., USA; Jul. 1997; 6p; In English; Innovative Approaches to Fusion Energy, 20 - 23 Oct. 1997, Pleasanton, CA, USA; Sponsored by International Atomic Energy Agency, Austria

Contract(s)/Grant(s): DE-FG02-97ER-54395

Report No.(s): UW-CPTC-97-9; CONF-971079; DE98-000362; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Two novel compact toroidal concepts are presented. One is the Stellarator-Spheromak (SSP) and another is the Extreme-Low-Aspect-Ratio Stellarator (ELARS). An SSP device represents a hybrid between a spherical stellarator (SS) and a spheromak. This configuration retains the main advantages of spheromaks and has a potential for improving the spheromak concept regarding its main problems. The MHD equilibrium in an SSP with very high (beta) of the confined plasma is demonstrated. Another concept, ELARS, represents an extreme limit of the SS approach, and considers devices with stellarator features and aspect ratios A approx. 1. We have succeeded in finding ELARS configurations with extremely compact, modular, and simple design compatible with significant rotational transform, large plasma volume, and good particle transport characteristics.

DOE

Stellarators; Spheromaks; Toroidal Plasmas; Magnetohydrodynamics

19980206326 Los Alamos National Lab., NM USA

High-resolution X-ray spectroscopy of hollow atoms created in plasma heated by subpicosecond laser radiation

Faenov, A.Ya., All-Union Research Inst. for Physical and Radiotechnical Measurements, USSR; Magunov, A. I., All-Union Research Inst. for Physical and Radiotechnical Measurements, USSR; Pikuz, T. A., All-Union Research Inst. for Physical and

Radiotechnical Measurements, USSR; 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-36
Report No.(s): LA-UR-97-3482; CONF-970706; DE98-000259; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The investigations of ultrashort (0.4-0.6 ps) laser pulse radiation interaction with solid targets have been carried out. The Trident subpicosecond laser system was used for plasma creation. The X-ray plasma emission was investigated with the help of high-resolution spectrographs with spherically bent mica crystals. It is shown that when high contrast ultrashort laser pulses were used for plasma heating its emission spectra could not be explained in terms of commonly used theoretical models, and transitions in so called 'hollow atoms' must be taken into account for adequate description of plasma radiation.
DOE
Crystals; Emission Spectra; X Ray Spectroscopy; Plasma Radiation; Plasmas (Physics); Plasma Heating

19980206373 Los Alamos National Lab., NM USA
Fast ignitor coupling physics
Mason, R. J., Los Alamos National Lab., USA; Tabak, M., California Univ., Lawrence Berkeley Lab., USA; 1997; 4p; In English; 11th; Biennial Nuclear Explosive Design Explosive Physics Conference, 20 - 24 Oct. 1997, Livermore, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2456; CONF-971082; DE98-000280; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Fast Ignitor is an alternate approach to ICF in which short pulse lasers are used to initiate burn at the surface of the compressed DT fuel. The aim is to avoid the need for careful central focussing of final shocks, and possibly to lower substantially the energy requirements for ignition. Ultimately, both goals may prove crucial to Stockpile Stewardship. For success with the Fast Ignitor, the laser energy must be efficiently deposited into megavolt electrons, which must, in turn, couple to the background ions within an alpha particle range. to understand this coupling, we have used ANTHEM plasma simulation code to model the transport of hot electrons generated by an intense (greater than or equal 3 x 10(exp 18) W/sq cm) short pulse 1.06 micro-m laser into plasma targets over a broad range of densities (0.35 to 10(exp 4) x n(sub crit)). Ponderomotive effects are included as a force on the cold background and hot emission electrons of the form, F(sub h,c) = -(omega(sup 2)(sub Ph,c)/2(omega)(sup 2))del(I), in which I is the laser intensity and omega(sub p)(sup 2) = 4(pi)e(sup 2)n/m(sub 0)(gamma) with m(sub 0) the electron rest mass.
DOE
Inertial Confinement Fusion; Ignition; Hot Electrons; Pulsed Lasers; Laser Plasmas

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SOLID-STATE PHYSICS

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

19980203292 Army Research Lab., Aberdeen Proving Ground, MD USA
Molecular Packing and NPT-Molecular Dynamics Investigation of the Transferability of the RDX Intermolecular Potential to 2,4,6,8,1O,12- Hexanitrohexaazaisowurtzitane (HNIW) ***Final Report, Jun. - Oct. 1997***
Sorescu, Don C., Army Research Lab., USA; Thompson, Donoald L., Army Research Lab., USA; Rice, Betsy M., Army Research Lab., USA; May 1998; 35p; In English
Contract(s)/Grant(s): Proj-1L161102AH43
Report No.(s): AD-A344341; ARL-TR-1657; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have explored the degree to which an intermolecular potential for the explosive hexahydro-1,3,5-trinitro-1,3,5-s- triazine (RDX) is transferable for predictions of crystal structures (within the approximation of rigid molecules) of a similar chemical system-in this case, polymorphic phases of the 2,4,6,8,10,12-hexanitrohexaazaisowurtzitane (HNIW) crystal. Molecular packing and isothermal-isobaric molecular dynamics calculations performed with this potential reproduce the main crystallographic feature of the epsilon, Beta-, and Gamma-HNFW crystals. Thermal expansion coefficients calculated using the present model predict near isotropic expansion for the epsilon-, Beta and Gamma-HNIW crystal phases and anisotropic expansion for Beta-HNIW.
DTIC
RDX; Crystallography; Molecular Dynamics; Potential Energy; Molecular Interactions

19980203327 Pennsylvania State Univ., University Park, PA USA

Scale-up Equipment for Nanosize Particle Synthesis ***Final Report, 1 Aug. 1996 - 31 Jul. 1997***

Messing, Gary L., Pennsylvania State Univ., USA; Jan. 22, 1998; 4p; In English

Contract(s)/Grant(s): F49620-96-1-0427

Report No.(s): AD-A341016; AFRL-SR-BL-TR-98-0294; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goal of the ARPA/AFOSR supported research program is to establish a scientific foundation for the low cost preparation of bulk single crystal quality materials by Templated Grain Growth (TGG); a process in which solid phase epitaxy is used to initiate solid state grain growth of a specific orientation in a polycrystalline matrix. We are investigating two classes of TGG; surface TGG in which a single crystal is contacted with a dense, polycrystalline ceramic and in situ TGG in which anisometric particles are uniformly dispersed and oriented in a polycrystalline matrix. The matrix must be fully dense and consist of sub 100 nm scale grains for TGG to work. Bi4Ti3O12 and SR2Nb2O7 have been selected because of the need for high temperature piezoelectrics. These materials can be poled only when they are highly oriented materials. We are also studying TGG for the low cost preparation of bulk single crystal quality BaTiO3 and (Ba(1-x)SR(x)TiO3. This process is designed to provide large single crystals at considerably less expense than top-seeded solution grown BaTiO3 which cost on the order of $5000 per crystal (Sanders Inc., Nashua, New Hampshire). Ultimately, such crystals are attractive for photorefractive applications including optical storage, phase conjugate mirrors, and multiple wave mixing.

DTIC

Single Crystals; Research and Development; Low Cost; Crystal Growth; Procedures

19980203406 Argonne National Lab., IL USA

Two-dimensional intrinsic and extrinsic ferromagnetic behavior of layered La(sub 1.2)SR(sub 1.8)Mn(sub 2)O(sub 7) single crystals

Potter, C. D., Argonne National Lab., USA; Swiatek, M., Argonne National Lab., USA; Bader, S. D., Argonne National Lab., USA; Argyriou, D. N., Argonne National Lab., USA; Mitchell, J. F., Argonne National Lab., USA; Miller, D. J., Argonne National Lab., USA; Hinks, D. G., Argonne National Lab., USA; Jorgensen, J. D., Argonne National Lab., USA; Jun. 06, 1997; 18p; In English

Contract(s)/Grant(s): W-31109-ENG-38; DMR91-20000 (DNA)

Report No.(s): ANL/MSD/PP-93854; DE97-008266; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The low-field magnetization M and susceptibility (chi) are reported for the two-layered Ruddleson-Popper phase SRO(La(sub 1(minus)x)SR(sub x)MnO(sub 3))(sub 2) for x = 0.4 (denoted La(sub 1.2)SR(sup 1.8)Mn(sub 2)O(sub 7)) with an in-plane magnetic easy axis. As T approaches the Curie temperature (T(sub C) = 116 K) on cooling, where the metal-insulator transition occurs in zero-field, (chi) diverges as H(sup (minus)1/(delta)(prime)), with (delta)(prime) = 21 (+-) 5. Also, near an extrinsic Curie transition attributed to (approximately) 0.1% volume fraction of intergrowths at T* = 2.47T(sub C), M scales as (1 (minus) T/T*)(sup (beta)), with (beta) = 0.25 (+-) 0.02. These results can be understood within the context of 2D XY models, and provide a new perspective of the layered manganites.

DOE

Ferromagnetic Materials; Two Dimensional Models; Single Crystals; Magnetization

19980203455 Intermagnetics General Corp., Latham, NY USA

Mechanism of Microstructure Development in Melt-Textured Y-Ba-Cu-O Superconductors ***Final Report, 15 Mar. 1995 - 14 Mar 1998***

Selvamanickam, V., Intermagnetics General Corp., USA; Apr. 24, 1998; 27p; In English

Contract(s)/Grant(s): F49620-95-C-0023; AF Proj. 2305

Report No.(s): AD-A343738; AFRL-SR-BL-TR-98-0431; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this program was to study the growth process in melt-texturing of YBCO and reduce the overall processing time. Melt-texturing had been used to achieve high current densities in bulk YBCO as well as attain high levitation forces and trapped fields. The melt-texturing process was however too slow to be economical for large-scale manufacturing. The objective of the program was modified in September 1996 towards development of YBCO superconducting thin films using Metal Organic Chemical Vapor Deposition (MOCVD) on biaxially-textured metal substrates. Both the buffer layer and YBCO deposition processes were developed for metal substrates.

DTIC

YBCO Superconductors; Melts (Crystal Growth); Current Density; Time

19980203470 Princeton Univ., NJ USA

Low-Dimension Electronic Processes in High Mobility GaAs/Al(x) Ga(1-x)As Nanostructures ***Final Report, 1 Mar. 1993 - 31 Jan. 1997***

Tsui, D. C., Princeton Univ., USA; Shayegan, M., Princeton Univ., USA; Jan. 1998; 5p; In English

Contract(s)/Grant(s): DAAH04-93-G-0071

Report No.(s): AD-A344651; ARO-30889.4-PH; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This final report briefly describes the construction and installation of an in situ MBE cleave-edge overgrowth apparatus and accomplishments in the following two research areas: (1) Novel cleaved-edge overgrowth structures for tunneling into and between one-dimensional (1D) and two-dimensional (2D) electron systems, and (2) the Terahertz emission from and the emission spectroscopy of low dimensional electron systems.

DTIC

Gallium Arsenides; Aluminum Gallium Arsenides; Electrons; Electron Mobility; Nanostructures (Devices); Emission Spectra

19980203471 University of Southern California, Dept. of Materials Science and Engineering, Los Angeles, CA USA

All Ultra-High Vacuum In-Situ Growth and Processing Approaches to Realization of Semiconductor Nanostructure Arrays ***Final Report, 1 Jun. 1993 - 31 Dec. 1996***

Madhukar, Anupam, University of Southern California, USA; Chen, Ping, University of Southern California, USA; May 15, 1997; 12p; In English

Contract(s)/Grant(s): DAAH04-93-G-0231

Report No.(s): AD-A344658; ARO-30950.5-EL; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Final Technical Report summarizes the most important accomplishments resulting from the work on semiconductor quantum wire and box synthesis and optical characterization carried out under the above noted grant. These accomplishments included: (1) Creation of GaAs/AlGaAs quantum wires and boxes via purely growth control on appropriately patterned mesas on GaAs(001) and GaAs(111) substrates, (2) Demonstration of their high optical quality, including the first time-resolved cathodoluminescence studies, (3) Demonstration of focused ion beam assisted Cl2 etching of GaAs(001) to create mesa stripes for subsequent size-reducing growth on such mesas for realization of quantum wires, (4) Demonstration of vertically self-organized growth of coherent 3D strained InAs on GaAs island quantum dots, and (5) Demonstration of the first quantum boxes laser based upon such quantum dots.

DTIC

Semiconductors (Materials); Quantum Wires; Quantum Dots; Aluminum Gallium Arsenides; Nanostructure (Characteristics); Gallium Arsenides; Epitaxy; Ultrahigh Vacuum; Arrays; Optical Properties

19980203532 Institute of Nuclear Physics, Cracow, Poland

Investigation of the crystal lattice defects by means of the positrons annihilations ***Badania defektow sieci krystalicznej metoda anihilacji pozytonow***

Dryzek, J., Institute of Nuclear Physics, Poland; 1994; 160p; In Polish

Contract(s)/Grant(s): No. 2P39202804

Report No.(s): INP-1679/PS; DE97-637165; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In this report the positrons annihilation methods as a tool for the crystal defects studies is presented. The short description of the positron - crystal interactions and different positron capture models are discussed.

DOE

Annihilation Reactions; Crystal Defects; Crystal Lattices

19980203680 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil

Magnetism, chemical bonding and hyperfine properties in the nanoscale antiferromagnet [Fe(O Me)(sub 2)(O(sub 2) C C H(sub 2) Cl)](sub 10)

Zeng, Z., Centro Brasileiro de Pesquisas Fisicas, Brazil; Duan, Y., Centro Brasileiro de Pesquisas Fisicas, Brazil; Guenzburger, Diana, Centro Brasileiro de Pesquisas Fisicas, Brazil; Sep. 1996; ISSN 0029-3865; 28p; In English

Report No.(s): CBPF-NF-060/96; DE97-637029; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The electronic and magnetic properties of the nanometer-size antiferromagnet (the ferric wheel molecule) are investigated with the first-principles spin-polarized Discrete Variational Method, in the framework of Density Functional theory. Magnetic moments, densities of the states and charge and spin-density maps are obtained. The Moessbauer hyperfine parameters Isomer

shift, Quadrupole Splitting and Hyperfine Field are obtained from the calculations and compared to reported experimental values when available.
DOE
Antiferromagnetism; Chemical Bonds; Magnetic Properties; Quadrupoles; Magnetic Moments; Isomers

19980203836 Ohio State Univ., Columbus, OH USA
Vortex Dynamics in Lightly-Doped Films of High Temperature Superconductors ***Final Report, 30 Jun. 1994 - 29 Jun 1997***
Lemberger, Ohio State Univ., USA; Jun. 1997; 5p; In English
Contract(s)/Grant(s): F49620-94-1-0274; AF Proj. 3484
Report No.(s): AD-A343495; AFRL-SR-BL-TR-98-0337; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Evidence is presented supporting the view that the inductance of vortices in films is due to columnar defects. The temperature dependence of the pinning strength is dominated by thermal supercurrent or ”phase” fluctuations rather than by the mean-field temperature dependence of basic superconducting quantities like the Helmholtz free energy and the magnetic penetration depth.
DTIC
Vortices; High Temperature Superconductors; Doped Crystals; Superconducting Films

19980203862 Los Alamos National Lab., NM USA
Lattice effect in perovskite and pyrochlore CMR materials
Kwei, G. H., Los Alamos National Lab., USA; Argyriou, D. N., Los Alamos National Lab., USA; Lawson, A. C., Los Alamos National Lab., USA; Neumeier, J. J., Los Alamos National Lab., USA; Thompson, J. D., Los Alamos National Lab., USA; Billinge, S. J. L., Michigan State Univ., USA; Ramirez, A. P., Bell Telephone Labs., Inc., USA; Subramanian, M. A., Du Pont de Nemours (E. I.) and Co., USA; [1997]; 14p; In English, 31 Mar. - 4 Apr. 1997, San Francisco, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36; W-7405-ENG-48
Report No.(s): LA-UR-97-1360; CONF-970302-22; DE97-007742; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Colossal magnetoresistance (CMR) in doped La manganite thin films (La(1-x)M(x)MnO3, where M = divalent ion, either Ca or Pb) has been shown to result in a factor of 10(sup 6) suppression of the resistance. The driving force for the CMR transition is thought to be the double-exchange interaction. Many studies of both the crystal structure and the local structure of the La(1-x)M(x)MnO3 (M = Ca, SR, Ba, Pb) system have now been carried out. As expected, these systems all show a strong coupling of the lattice to the CMR transition. On the other hand, neutron diffraction and X-ray absorption for the Tl2Mn2O7 pyrochlore, which also exhibits CMR, shows no deviations from ideal stoichiometry, mixed valency, or Jahn-Teller distortions of the MnO6 octahedron. We present results of crystallographic and local structural studies of these two important classes of CMR materials, compare the differences in structural response, and discuss the implications of these findings to our understanding of these materials.
DOE
Lattice Parameters; Perovskites; Magnetoresistivity; Calcium Compounds; Lanthanum Compounds; Lead Compounds

19980203863 Los Alamos National Lab., NM USA
Growth and magnetic structure of La(0.67)SR(0.33)MnO3 films
Brown, G. W., Los Alamos National Lab., USA; Jia, Q. X., Los Alamos National Lab., USA; Peterson, E. J., Los Alamos National Lab., USA; Hristova, D. K., Los Alamos National Lab., USA; Hundley, M. F., Los Alamos National Lab., USA; Thompson, J. D., Los Alamos National Lab., USA; Maggiore, C. J., Los Alamos National Lab., USA; Tesmer, J., Los Alamos National Lab., USA; Hawley, M. E., Los Alamos National Lab., USA; [1997]; 6p; In English, 31 Mar. - 4 Apr. 1997, San Francisco, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1502; CONF-970302-21; DE97-007738; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Growth of LaMnO3 films that exhibit colossal magnetoresistance (CMR) has concentrated heavily on Ca doped materials. However, since the 33% SR doped films are ferromagnetic at room temperature, they are ideal candidates for dual growth-magnetic structure studies using scanned probe techniques. In this study, interest was focused on the relations between growth/processing parameters, film morphology, and electronic/magnetic properties. In addition, films were grown on both LaAlO3 (LAO) and SRTiO3 (STO) to examine the results of stress induced by different substrate mismatches. La(0.67)SR(0.33)MnO3 (LSMO) was grown using Pulsed Laser Deposition (PLD) at temperatures between 500 C and 800 C. The film microstructure, crystallinity, and magnetic and electrical properties were characterized by room temperature scanning tunneling microscopy (STM), atomic force microscopy (AFM), Magnetic Force Microscopy (MFM), X-ray diffraction, and temperature dependent transport and mag-

netization measurements. The growth trends follow those previously reported for Ca doped films. Grains increase in size with increasing temperature and coalesce into extended layers after annealing. Although topographic contributions complicate interpretation of some MFM data, local magnetic structure observed here is generally associated with film defects.
DOE
Magnetic Properties; Magnetoresistivity; Oxide Films; Substrates; Electrical Properties

19980203865 Brookhaven National Lab., Upton, NY USA
Two-detector Doppler broadening profiles in Al
Mijnarends, P. E., Technische Hogeschool, Netherlands; Kruseman, A. C., Technische Hogeschool, Netherlands; vanVeen, A., Technische Hogeschool, Netherlands; Ghosh, V. J., Brookhaven National Lab., USA; Asoka-Kumar, P., Brookhaven National Lab., USA; Bansil, A., Northeastern Univ., USA; Kaprzyk, S., Academy of Mining and Metallurgy, Poland; Lynn, K. G., Washington State Univ., USA; [1997]; 5p; In English; Positron Annihilation, 25-30 May 1997, Kansas City, MO, USA
Contract(s)/Grant(s): DE-AC02-76CH-00016; W-31109-ENG-38
Report No.(s): BNL-64583; CONF-9705156-1; DE97-007733; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Low-background Doppler broadening profiles have been measured in Al. The KKR methodology has been used to calculate the profile and study the effect of positron-electron correlation.
DOE
Doppler Effect; Aluminum; Electromagnetic Measurement; Computation

19980203866 Sandia National Labs., Albuquerque, NM USA
Abnormal grain growth: The origin of recrystallization nuclei?
Rollett, A. D., Carnegie-Mellon Univ., USA; Holm, E. A., Sandia National Labs., USA; [1997]; 11p; In English; Recrystallization and Related Phenomena, 21-24 Oct. 1996, Monterey, CA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-1712C; CONF-9610242-6; DE97-007273; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The origin of recrystallization nuclei is reviewed with particular emphasis on materials in which well-developed cells are present in the deformed state. Nucleation is discussed in terms of coarsening of the subgrain network that develops on annealing and an analogy is made with abnormal grain growth. The results of a theoretical analysis of abnormal growth are summarized. The Monte Carlo model for grain growth is adapted for variable grain boundary energy and mobility in order to investigate the behavior of individual grains with special properties. The simulation results show that both energy and mobility affect abnormal growth as expected from the theoretical analysis. The results are discussed in terms of the stability that subgrain networks may exhibit depending on their mean misorientation.
DOE
Abnormalities; Grain Size; Crystal Growth; Recrystallization; Nucleation

19980203870 Argonne National Lab., IL USA
Sign reversal of the MN-O bond compressibility in La(1.2)SR(1.8)Mn2O7 below T(sub c): Exchange striction in the ferromagnetic state
Argyriou, D. N., Argonne National Lab., USA; Mitchell, J. F., Argonne National Lab., USA; Chmaissem, O., Argonne National Lab., USA; Short, S., Argonne National Lab., USA; Jorgensen, J. D., Argonne National Lab., USA; Goodenough, J. B., Texas Univ., USA; Mar. 1997; 16p; In English, 17-21 Mar. 1997, Kansas City, MO, USA
Contract(s)/Grant(s): W-31109-ENG-38; NSF-DMR 91-20000
Report No.(s): ANL/MSD/CP-91963; CONF-9703106-1; DE97-007006; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The crystal structure of the layered perovskite La(1.2)SR(1.8)Mn2O7 has been studied under hydrostatic pressure up to (approximately) 6 kbar, in the paramagnetic and ferromagnetic states, with neutron powder diffraction. The compressibility of the Mn-O apical bonds in the double layer of MnO6 octahedra changes sign from the paramagnetic insulator (PI) to the ferromagnetic metal (FM) state; in the Fm state the Mn-O-Mn linkage between MnO2 planes expands under applied pressure, whereas they contract in the PI state. This counterintuative behavior is interpreted in terms of exchange striction, which reflect the competition between super- and double-exchange. An increase of the Mn-moment with applied pressure in the FM state is consistent with a

positive dT(sub C)/dP, as well as a cant angle (theta)(sub 0) between the magnetizations of neighboring MnO2 sheets that decreases with pressure.
DOE
Crystal Structure; Compressibility; Bonding; Chemical Bonds; Surface Layers; Chemical Properties

19980203897 Purdue Research Foundation, IN USA
Electronic Conduction in Molecular Nanostructures ***Final Report, 1 Jul. 1992 - 31 Dec. 1997***
Datta, S., Purdue Research Foundation, USA; Andres, R. P., Purdue Research Foundation, USA; Janes, D. B., Purdue Research Foundation, USA; Kubiak, C. P., Purdue Research Foundation, USA; Reifenberger, R. G., Purdue Research Foundation, USA; Jan. 1998; 9p; In English
Contract(s)/Grant(s): DAAL-03-92-G-0144
Report No.(s): AD-A344360; ARO-30369.34-PH-URI; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A nanostructured material consisting of a superlattice of metallic dots separated by uniform tunnel barriers is expected to exhibit interesting electronic properties. One route to the synthesis of such a material is to self-assemble it from nanometer size, crystalline, metal clusters interconnected by rigid organic molecules. In this project techniques were developed that permit (1) the synthesis of organic molecular wires that provide uniform tunnel barriers between adjacent clusters, (2) the synthesis of metal clusters of sufficient uniformity to allow the assembly of a periodic network and, (3) the self-assembly of these elements to form a uniform 2-D network of interconnected metal clusters, a Linked Cluster Network (LCN). An important step in predicting the electronic properties of a cluster-based, nanostructured material is a theory for understanding the factors that influence electronic conduction through a single organic molecule connecting two metal surfaces. A theoretical treatment of this problem was developed and the calculated current-voltage characteristics show good quantitative agreement with experimental measurements on individual molecules using scanning tunneling microscopy.
DTIC
Molecules; Nanostructures (Devices); Electric Potential; Electrical Resistivity

19980203912 Cambridge Univ., Cavendish Lab., Cambridge, UK
High Frequency Investigations of Lateral Superlattice Structures ***Final Report***
Pepper, M., Cambridge Univ., UK; Jan. 26, 1998; 11p; In English
Contract(s)/Grant(s): DAAH04-95-1-0603
Report No.(s): AD-A344839; ARO-34601.1-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A description is given of work on the controlled movement of single electrons induced by a Surface Acoustic Wave in GaAs heterostructures and the formation of mini-gaps induced by a potential from patterned gates.
DTIC
Electrons; Sound Waves; Superlattices; Crystal Structure

19980204692 Lawrence Livermore National Lab., Livermore, CA USA
Crystal growth of optical materials for advanced lasers
Schaffers, K. I., Lawrence Livermore National Lab., USA; Payne, S. A., Lawrence Livermore National Lab., USA; Feb. 04, 1997; 8p; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-ID-126458; DE97-053425; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

During FY96, two specific projects were addressed, Yb-doped fluoroapatite and Cr:ZnSe crystals, which are being used as the gain media to develop diode-pumped solid-state lasers. Both materials have unique properties for near infrared to mid-infrared applications. However, defects in the crystals create optical losses and reduce the efficiency of the lasers. The source of the losses in the crystals were studied and techniques developed to reduce and/or eliminate defects to aid in the growth of high optical quality crystals to increase laser efficiency.
DOE
Doped Crystals; Laser Materials; Ytterbium Compounds; Chromium Compounds; Crystal Growth; Crystal Defects; Zinc Selenides; Losses

19980205013 Houston Univ., TX USA

Electronic Properties of Semimetal-Semiconductor (5/3-5) Heterostructures and Devices ***Final Report, 1994 - 1997***

Golding, Terry, Houston Univ., USA; Miller, J. H., Houston Univ., USA; Ting, C. S., Houston Univ., USA; Jul. 01, 1997; 10p; In English

Contract(s)/Grant(s): DAAH04-94-G-0075

Report No.(s): AD-A344656; ARO-32146.1-MS; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The project involved an experimental investigation of the synthesis and the electrical transport properties of semimetal- semiconductor based heterostructures and devices. The structures- consisted of elemental (Sb) semimetals in combination with antimonide based III-V semiconductors (GaSb). The investigation of these novel semimetal-semiconductor heterostructures was motivated by their unique electronic properties and potential device applications, including high conductivity interconnects, double-barrier semimetal-base resonant tunneling transistors, and nanostructures operating in the mesoscopic regime. The structures were synthesized using molecular beam epitaxy, and their structural and electrical transport properties were investigated. In addition to substantially enhanced understanding of this materials combination the project resulted in the demonstration of double barrier Sb/GaSb resonant tunneling structures exhibiting negative differential resistances and Sb submicron loops displaying Aharonov-Bohm oscillations.

DTIC

Metals; Gallium; Antimonides; Electrical Properties; Semiconductors (Materials); Semiconductor Devices; Nanostructures (Devices); Molecular Beam Epitaxy

19980205701 Lawrence Livermore National Lab., Livermore, CA USA

Bicrystals with strain gradient effects

Shu, J. Y., Lawrence Livermore National Lab., USA; Jan. 09, 1997; 9p; In English, 2 - 6 Dec. 1996, Boston, MA, USA; Sponsored by Materials Research Society, USA

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

Report No.(s): UCRL-JC-126205; CONF-961202-116; DE97-053149; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Boundary between two perfectly bonded single crystals plays an important role in determining the deformation of the bicrystals. This work addresses the role of the grain boundary by considering the elevated hardening of a slip system due to a slip gradient. The slip gradients are associated with geometrically necessary dislocations and their effects become pronounced when a representative length scale of the deformation field is comparable to the dominant microstructural length scale of a material. A new rate-dependent crystal plasticity theory is presented and has been implemented within the finite element method framework. A planar bicrystal under uniform in-plane loading is studied using the new crystal theory. The strain is found to be continuous but nonuniform within a boundary layer around the interface. The lattice rotation is also nonuniform within the boundary layer. The width of the layer is determined by the misorientation of the grains, the hardening of slip systems, and most importantly by the characteristic material length scales. The overall yield strength of the bicrystal is also obtained. A significant grain-size dependence of the yield strength, the Hall- Petch effect is predicted.

DOE

Bicrystals; Deformation; Grain Boundaries; Hardening (Systems); Edge Dislocations

19980205717 State Univ. of New York, Dept. of Materials Science and Engineering, Stony Brook, NY USA

Defects in SiC Single Crystals and their Influence on Device Performance ***Final Report, 1 Jan. 1996 - 30 Sep. 1997***

Dudley, Michael, State Univ. of New York, USA; Jan. 26, 1998; 5p; In English

Contract(s)/Grant(s): DAAH04-94-G-0091

Report No.(s): AD-A344549; ARO-33039.12-MS; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project constituted an extensive program of research aimed at applying the techniques of Synchrotron White Beam X-ray Topography (SWBXT), Nomarski Optical Microscopy, Stereo Transmission Optical Microscopy and Scanning Electron Microscopy to the detailed analysis of defect structures in SiC crystals of various polytypes, and to determine how these defect structures can influence the performance of various kinds of device manufactured therein. It has served to establish a heightened awareness of the importance of a detailed understanding of growth defect microstructure to the future of SiC technology. Results obtained in this project have helped prioritize SiC crystal quality improvements. Two kinds of defect have been identified in 6H and 4H-SiC, basal plane dislocations, and dislocations with mostly screw component lying either at a small angle, or parallel, to the c-axis, with screw component of Burgers vector being equal to nc, where c is the lattice parameter. In 6H, dislocations with b greater than or equal 2c have hollow cores, the diameters of which conform to the theory of F.C. Frank. The same is true for dislocations in 4H

with b greater than equal 3c. Preliminary results show that all such dislocations (from n=1 to n greater than 8) can modify the I-V characteristics of diodes, giving rise to higher leakage currents and premature breakdown point-failures.
DTIC
Crystal Defects; Silicon Carbides; Single Crystals; Performance Prediction; Dislocations (Materials)

19980205796 Sandia National Labs., Albuquerque, NM USA
Processing challenges for GaN-based photonic and electronic devices
Pearton, S. J., Florida Univ., USA; Ren, F., Bell Telephone Labs., Inc., USA; Shul, R. J., Sandia National Labs., USA; 1997; 19p; In English, 31 Mar. - 4 Apr. 1997, San Francisco, CA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000; NSF DMR-94-21109
Report No.(s): SAND-97-2236C; CONF-970302-23; DE97-009352; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The wide gap materials SiC, GaN and to a lesser extent diamond are attracting great interest for high power/high temperature electronics. There are a host of device processing challenges presented by these materials because of their physical and chemical stability, including difficulty in achieving stable, low contact resistances, especially for one conductivity type, absence of convenient wet etch recipes, generally slow dry etch rates, the high temperatures needed for implant activation, control of suitable gate dielectrics and the lack of cheap, large diameter conducting and semi-insulating substrates. The relatively deep ionization levels of some of the common dopants (Mg in GaN; B, Al in SiC; P in diamond) means that carrier densities may be low at room temperature, and thus contact resistances will be greatly improved provided the metallization is stable and reliable. Some recent work with CoSi(sub x) on SiC and W-alloys on GaN show promise for improved ohmic contacts. The issue of unintentional hydrogen passivation of dopants will also be covered - this leads to strong increases in resistivity of p-SiC and GaN, but to large decreases in resistivity of diamond. Recent work on development of wet etches has found recipes for AlN (KOH), while photochemical etching of SiC and GaN has been reported. In the latter cases p-type materials is not etched, which can be a major liability in some devices. The dry etch results obtained with various novel reactors, including ICP, ECR and LE4 will be compared - the high ion densities in the former techniques produce the highest etch rates for strongly-bonded materials, but can lead to preferential loss of N from the nitrides and therefore to a highly conducting surface. This is potentially a major problem for fabrication of dry etched, recessed gate FET structures.
DOE
Gallium Nitrides; Silicon Carbides; Crystal Growth; Semiconductors (Materials); Photochemical Reactions

19980206080 Sandia National Labs., Albuquerque, NM USA
The growth of mid-infrared emitting InAsSb/InAsP strained-layer superlattices using metal-organic chemical vapor deposition
Biefeld, R. M., Sandia National Labs., USA; Allerman, A. A., Sandia National Labs., USA; Kurtz, S. R., Sandia National Labs., USA; Burkhart, J. H., Sandia National Labs., USA; 1997; 5p; In English; 24th; Compound Semiconductors, 7 - 11 Sep. 1997, San Diego, CA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2166C; CONF-970947-1; DE98-000048; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

We describe the metal-organic chemical vapor deposition os InAsSb/InAsP strained-layer superlattice (SLS) active regions for use in mid-infrared emitters. These SLSs were grown at 500 C, and 200 torr in a horizontal quartz reactor using trimethylindium, triethylantimony, AsH3, and PH3. by changing the layer thickness and composition we have prepared structures with low temperature ((le)20 K) photoluminescence wavelengths ranging from 3.2 to 5.0 micron. Excellent performance was observed for an SLS light emitting diode (LED) and both optically pumped and electrically injected SLS layers. An InAsSb/InAsP SLS injection laser emitted at 3.3 microns at 80 K with peak power of 100 mW.
DOE
Crystal Growth; Superlattices; Light Emitting Diodes; Phosphines; Low Temperature; Emittance

19980206308 Los Alamos National Lab., NM USA
Growth-related magnetic and physical structures in CMR films
Hawley, M. E., Los Alamos National Lab., USA; Brown, G. W., Los Alamos National Lab., USA; Hundley, M. F., Los Alamos National Lab., USA; 1997; 18p; 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-97-2074; CONF-970568; DE97-008965; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Scanning tunneling microscopy (STM), atomic force microscopy (AFM), and magnetic force microscopy (MFM) have proven to be powerful tools for revealing property-sensitive structures in magnetic materials. With the renewed interest in perovskite films as materials for read-heads in high density magnetic data storage, the same challenges faced by high temperature superconductor (HTS) film fabrication are repeated for these materials. to begin addressing these challenges, we used vapor phase epitaxy to fabricate La (SR, Ca,) based manganate films on single crystal perovskite substrates under different conditions and characterized them with scanning probe microscopies, x-ray diffraction, and temperature-dependent magnetization and resistivity measurements (M(T) and (rho)(T)). The as-grown films were polygranular with grain sizes increasing with increasing temperature (T). The post-deposition annealed films consisted of coalesced layers with improved transport properties. The room temperature magnetic structure of the SR-based films appeared to be related to defects and/or strain.

DOE

Magnetic Materials; Perovskites; Physical Properties; Vapor Phase Epitaxy; Microstructure; High Temperature Superconductors; Magnetization; Transport Properties

19980206324 Los Alamos National Lab., NM USA

Pressure dependence of magnetic order in single crystalline CePtGa(1-x)

Modler, R., Los Alamos National Lab., USA; Moshopoulou, E. G., Los Alamos National Lab., USA; Hundley, M. F., Los Alamos National Lab., USA; 1997; 5p; In English; High Pressure Science and Technology, 25 - 29 Aug. 1997, Kyoto, Japan

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

Report No.(s): LA-UR-97-3432; CONF-970886; DE98-000273; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The authors present measurements of the susceptibility, the specific heat and the resistivity under hydrostatic pressure on a single crystals of an antiferromagnetically ordered Kondo compound CePtGa(1-x) (T(sub N) = 4.2K). They observe a positive temperature response of T(sub N) on application of hydrostatic pressure up to 1.7 GPa.

DOE

Antiferromagnetism; Hydrostatic Pressure; Specific Heat; Single Crystals

77
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.

19980203695 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil

(theta)-vacua in the light-front quantized Schwinger model

Srivastava, Prem P., Universidade do Estado do Rio de Janeiro, Brazil; Sep. 1996; ISSN 0029-3865; 22p; In English

Report No.(s): CBPF-NF-063/96; IF-UERJ-034/96.; DE97-636873; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The light-front quantization of the bosonized Schwinger model is discussed in the continuum formulation. The proposal, successfully used earlier for describing the spontaneous symmetry breaking on the light-front, of separating first the scalar field into the dynamical condensate and the fluctuation fields before employing the standard Dirac method works here as well. Some topics on the front form theory are summarized in the Appendices and attention is drawn to the fact that the theory quantized, at x(sup +) seems already to carry information on equal x(sup -) commutators as well.

DOE

Broken Symmetry; Continuums; Higgs Bosons

19980203703 Los Alamos National Lab., NM USA

Femtosecond chirp-free studies of energy relaxation in semiconductor quantum dots: Search for a phonon bottleneck

Klimov, V., Los Alamos National Lab., USA; McBranch, D., Los Alamos National Lab., USA; [1997]; 6p; In English; Quantum Electronics and Laser Science, 18-23 May 1997, Baltimore, MD, USA

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

Report No.(s): LA-UR-97-1572; CONF-970515-3; DE97-007756; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Contrary to the predictions of phonon bottleneck theories, we observe very fast subpicosecond energy relaxation in strongly confined semiconductor nanocrystals with electron level spacing as large as 20 LO phonon energies.
DOE
Predictions; Semiconductors (Materials); Quantum Dots; Energy of Formation

19980203734 Oak Ridge National Lab., TN USA
Thermodynamics and kinetics of ion speciation in supercritical aqueous solutions: A molecular based study
Chialvo, A. A., Tennessee Univ., USA; Cummings, P. T., Tennessee Univ., USA; Simonson, J. M., Oak Ridge National Lab., USA; Mesmer, R. E., Oak Ridge National Lab., USA; May 01, 1997; 17p; In English; 13th; Thermophysical Properties, 22-27 Jun. 1997, Boulder, CO, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-970629-3; DE97-008240; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Molecular simulation of infinitely dilute NaCl aqueous solutions are performed to study the Na(+)/Cl(-) ion pairing in a polarizable and a nonpolarizable solvent at supercritical conditions. The Simple Point Charge, Pettitt-Rossky, and Fumi-Tosi models for the water-water, ion-water, and ion-ion interactions are used in determining the degree of dissociation, its temperature and density dependence, and the kinetics of the interconversion between ion-pair configurations in a nonpolarizable medium. to assess the effect of the solvent polarizability on the stability of the ion-pair configurations, we replace the Simple Point Charge by the Polarizable Point Charge water model and determine the anion-cation potential of mean force at T(sub r)=1.20 and (rho)(sub r)=1.5.
DOE
Kinetics; Thermodynamics; Ions; Sodium Chlorides; Molecular Interactions; Molecular Dynamics

19980203747 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil
The Weyl representation in classical and quantum mechanics
deAlmeida, Alfredo M. O., Centro Brasileiro de Pesquisas Fisicas, Brazil; Sep. 1996; ISSN 0029-3865; 125p; In English
Report No.(s): CBPF-NF-062/96; DE97-636831; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The position representation of the evolution operator in quantum mechanics is analogous to the generating function formalism of classical mechanics. Similarly, the Weyl representation is connected to new generating functions described by chords and centres. Both classical and quantal theories rely on the group of translations and reflections through a point in phase space. The composition of small time evolutions leads to new versions of the classical variational principle and to path integrals in quantum mechanics. The restriction of the motion to the energy shell in classical mechanics is the basis for a full review of the semiclassical Wigner function and the theory of scars of periodic orbits. by embedding the theory of scars in a fully uniform approximation, it is shown that the region in which the scar contribution is oscillatory is separated from a decaying region by a caustic that touches the shell along the periodic orbit and widens quadratically within the energy shell.
DOE
Quantum Mechanics; Classical Mechanics; Approximation; Integrals; Translating

19980203868 Los Alamos National Lab., NM USA
New approaches to thermoelectric cooling effects in magnetic fields
Migliori, A., Los Alamos National Lab., USA; Darling, T. W., Los Alamos National Lab., USA; Freibert, F., Los Alamos National Lab., USA; Trugman, S. A., Los Alamos National Lab., USA; Moshopoulou, E., Los Alamos National Lab., USA; Sarrao, J. L., Florida State Univ., USA; [1997]; 9p; In English; Strategic Outsourcing and HR, Mar. 1997, San Diego, CA, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-1311; CONF-970353-2; DE97-007198; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The authors review thermoelectric effects in a magnetic field at a phenomenological level. Discussions of the limiting performance and problems with its computation for both Peltier and Ettingshausen coolers are presented. New principles are discussed to guide the materials scientist in the search for better Ettingshausen materials, and a brief review of the subtle measurement problems is presented.
DOE
Thermoelectric Cooling; Magnetic Fields; Computation; Procedures; Peltier Effects

19980203889 Instituto de Fisica Teorica, Sao Paulo, Brazil

Compatibility of a model for the QCD-Pomeron and chiral-symmetry breaking phenomenologies

Natale, A. A., Instituto de Fisica Teorica, Brazil; daSilva, P. S. R., Instituto de Fisica Teorica, Brazil; Nov. 1996; 23p; In English

Report No.(s): IFT-P-045/96; DE97-636866; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The phenomenology of a QCD-Pomeron model based on the exchange of a pair of non-perturbative gluons,i.e. gluon fields with a finite correlation length in vacuum, is studied in comparison with the phenomenology of QCD chiral symmetry breaking, based on non-perturbative solutions of Schwinger-Dyson equations for the quark propagator including these non-perturbative gluon effects. We show that these models are incompatible, and point out some possible origins of this problem.

DOE

Quantum Chromodynamics; Quarks; Broken Symmetry; Gluons; Phenomenology

19980204689 Florida Univ., Inst. for Fundamental Theory, Gainesville, FL USA

Toward the classification of the realistic free fermionic models

Faraggi, A. E., Florida Univ., USA; Aug. 1997; 44p; In English

Contract(s)/Grant(s): DE-FG05-86ER-40272

Report No.(s): DOE/ER/40272-283; UFIFT-HEP-97-23; DE98-000023; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The realistic free fermionic models have had remarkable success in providing plausible explanations for various properties of the Standard Model which include the natural appearance of three generations, the explanation of the heavy top quark mass and the qualitative structure of the fermion mass spectrum in general, the stability of the proton and more. These intriguing achievements makes evident the need to understand the general space of these models. While the number of possibilities is large, general patterns can be extracted. In this paper the author presents a detailed discussion on the construction of the realistic free fermionic models with the aim of providing some insight into the basic structures and building blocks that enter the construction. The role of free phases in the determination of the phenomenology of the models is discussed in detail. The author discusses the connection between the free phases and mirror symmetry in (2,2) models and the corresponding symmetries in the case of (2,0) models. The importance of the free phases in determining the effective low energy phenomenology is illustrated in several examples. The classification of the models in terms of boundary condition selection rules, real world-sheet fermion pairings, exotic matter states and the hidden sector is discussed.

DOE

Fermions; Boundary Conditions; Quarks; String Theory

19980206267 NASA Lewis Research Center, Cleveland, OH USA

Experimental Performance of a Micromachined Heat Flux Sensor

Stefanescu, S., Case Western Reserve Univ., USA; DeAnna, R. G., Army Research Lab., USA; Mehregany, M., Case Western Reserve Univ., USA; Apr. 1998; 16p; In English; Joint Propulsion Conference, 6-9 jUL. 1997, sEATTLE, wa, USA; Also appears as NASA-E-10821

Report No.(s): AD-A345439; NASA-TM-107517; NAS 1.15:107517; ARL-MR-363; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Steady-state and frequency response calibration of a microfabricated heat-flux sensor have been completed. This sensor is batch fabricated using standard, micromachining techniques, allowing both miniaturization and the ability to create arrays of sensors and their corresponding interconnects. Both high-frequency and spatial response is desired, so the sensors are both thin and of small cross-sectional area. Thin-film, temperature-sensitive resistors are used as the active gauge elements. Two sensor configurations are investigated: (1) a Wheatstone-bridge using four resistors; and (2) a simple, two-resistor design. In each design, one resistor (or pair) is covered by a thin layer (5000 A) thermal barrier; the other resistor (or pair) is covered by a thick (5 microns) thermal barrier. The active area of a single resistor is 360 microns by 360 microns; the total gauge area is 1.5 mm square. The resistors are made of 2000 A-thick metal; and the entire gauge is fabricated on a 25 microns-thick flexible, polyimide substrate. Heat flux through the surface changes the temperature of the resistors and produces a corresponding change in resistance. Sensors were calibrated using two radiation heat sources: (1) a furnace for steady-state, and (2) a light and chopper for frequency response.

DTIC

Temperature Measuring Instruments; Heat Flux; Sensitivity; Calibrating; Measuring Instruments; Micromachining

80
SOCIAL SCIENCES (GENERAL)

Includes educational matters.

19980203594 Illinois Univ., Savoy, IL USA
Aviation/Aerospace Teacher Education Workshops: Program Development and Implementation
Green, Mavis F., Illinois Univ., USA; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 32-41; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A02, Microfiche

This proposal is for an Aviation/Aerospace Teacher Education Workshop. The workshop will be offered to elementary school teachers. During the course of the workshop, the teachers will become familiar with aviation fundamentals and issues, and with ways to incorporate aviation topics into their normal curricula to enhance education. The proposal is organized in two parts. Part I deals with issues of program development. These issues include program intent, benefit to the sponsoring institution, program model, credibility, co-sponsorship and potential problems. Part II deals with problems specifically related to program implementation.
Author
Education; Instructors; Learning; Aeronautics

19980205677 Lawrence Livermore National Lab., Livermore, CA USA
US Department of Energy standardized radiation safety training
Trinoskey, P. A., Lawrence Livermore National Lab., USA; Feb. 1997; 6p; In English; Radiation Dosimetry and Safety, 31 Mar. - 2 Apr. 1997, Taipei, Taiwan, Province of China
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-JC-126628; CONF-970322-6; DE97-053178; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The following working groups were formed under the direction of a radiological training coordinator: managers, supervisors, DOE auditors, ALARA engineers/schedulers/planners, radiological control personnel, radiation-generating device operators, emergency responders, visitors, Pu facilities, U facilities, tritium facilities, accelerator facilities, biomedical researchers. General courses for these groups are available, now or soon, in the form of handbooks.
DOE
Education; Handbooks; Standardization; Scheduling; Radiation Protection

19980206153 Alabama Univ., Tuscaloosa, AL USA
Research Reports: 1996 NASA/ASEE Summer Faculty Fellowship Program ***Final Report***
Freeman, M., Editor, Alabama Univ., USA; Chappell, C. R., Editor, NASA Marshall Space Flight Center, USA; Six, F., Editor, NASA Marshall Space Flight Center, USA; Karr, G. R., Editor, Alabama Univ., USA; Oct. 1996; 404p; In English; 32nd, 28 May - 2 Aug. 1996, Huntsville, AL, USA; Sponsored by NASA, USA; Also announced as 19980206154 through 19980206204
Contract(s)/Grant(s): NGT8-52819
Report No.(s): NASA-CR-205205; NAS 1.26:205205; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

For the 32nd consecutive year, a NASA/ASEE Summer Faculty Fellowship Program was conducted at the Marshall Space Flight Center (MSFC). The program was conducted by the University of Alabama and MSFC during the period May 28, 1996 through August 2, 1996. Operated under the auspices of the American Society for Engineering Education, the MSFC program, as well as those at other NASA centers, was sponsored by the Higher Education Branch, Education Division, NASA Headquarters, Washington, D.C. The basic objectives of the programs, which are in the 33rd year of operation nationally, are (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of the participants' institutions; and (4) to contribute to the research objectives of the NASA centers. The Faculty Fellows spent 10 weeks at MSFC engaged in a research project compatible with their interests and background and worked in collaboration with a NASA/MSFC colleague. This document is a compilation of Fellows' reports on their research during the summer of 1996. The University of Alabama presents the Co-Directors' report on the administrative operations of the program. Further information can be obtained by contacting any of the editors.
Author
NASA Programs; Education; University Program; Astrionics; Materials Science; Structural Engineering; Systems Integration; Systems Analysis; Propulsion; Technology Transfer; Aerospace Sciences; Neural Nets; Systems Health Monitoring; Welding; Space Processing

19980206164 Langston Univ., Dept. of Mathematics, Langston, OK USA

The Interpretation and Effective Implementation of the Stevenson-Wydler Technology Innovation Act of 1996

Heard, Pamala D., Langston Univ., USA; Oct. 1996; 6p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The purpose of this research is to develop a plan that gives schools the opportunity to acquire knowledge of the Stevenson-Wydler Technology Innovation Act. The law suggests that federal agencies give surplus equipment to educational entities. It would then become the school's choice to take advantage of the opportunity. The purpose of this proposal is to develop an ongoing partnership with schools around the USA. Its attempt is to inform schools about the law and organize a plan that will allow schools to take advantage of this opportunity. It would inform teachers about available resources and expose their students to educational opportunities.

Author

Law (Jurisprudence); Education; Schools; USA; Technology Utilization; Universities

19980206174 Florida Univ., Dept. of Astronomy, Gainesville, FL USA

Development of an Outreach Program for NASA: "NASA Ambassadors"

Lebo, George R., Florida Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

It is widely known that the average American citizen has either no idea or the wrong impression of what NASA is doing. The most common impression is that NASA's sole mission is to build and launch spacecraft and that the everyday experience of the common citizen would be impacted very little if NASA failed to exist altogether. Some feel that most of NASA's efforts are much too expensive and that the money would be better used on other efforts. Others feel that most of NASA's efforts either fail altogether or fail to meet their original objectives. Yet others feel that NASA is so mired in bureaucracy that it is no longer able to function. The goal of the NASA Ambassadors Program (NAP) is to educate the general populace as to what NASA's mission and goals actually are, to re-excite the "man on the street" with NASA's discoveries and technologies, and to convince him that NASA really does impact his everyday experience and that the economy of the U.S. is very dependent on NASA-type research. Each of the NASA centers currently run a speakers bureau through its Public Affairs Office (PAO). The speakers, NASA employees, are scheduled on an "as available" status and their travel is paid by NASA. However, there are only a limited number of them and their message may be regarded as being somewhat biased as they are paid by NASA. On the other hand, there are many members of NASA's summer programs which come from all areas of the country. Most of them not only believe that NASA's mission is important but are willing and able to articulate it to others. Furthermore, in the eyes of the public, they are probably more effective as ambassadors for NASA than are the NASA employees, as they do not derive their primary funding from it. Therefore it was decided to organize materials for them to use in presentations to general audiences in their home areas. Each person who accepted these materials was to be called a "NASA Ambassador".

Derived from text

NASA Programs; Missions; Education; Public Relations

19980206178 Berry Coll., Physics Dept., Mount Berry, GA USA

Planning an Effective Speakers Outreach Program

McDonald, Malcolm W., Berry Coll., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The National Aeronautics and Space Administration (NASA) and, in particular, the Marshall Space Flight Center (MSFC) have played pivotal roles in the advancement of space exploration and space-related science and discovery since the early 1960's. Many of the extraordinary accomplishments and advancements of NASA and MSFC have gone largely unheralded to the general public, though they often border on the miraculous. This lack of suitable and deserved announcement of these "miracles" seems to have occurred because NASA engineers and scientists are inclined to regard extraordinary accomplishment as a normal course of events. The goal in this project has been to determine an effective structure and mechanism for communicating to the general public the extent to which our investment in our US civilian space program, NASA, is, in fact, a very wise investment. The project has involved discerning important messages of truth which beg to be conveyed to the public. It also sought to identify MSFC personnel who are particularly effective as messengers or communicators. A third aspect of the project was to identify particular target audiences who would appreciate knowing the facts about their NASA investment. The intent is to incorporate the results into the formation of an effective, proactive MSFC speakers bureau. A corollary accomplishment for the summer was participation in the formation of an educational outreach program known as NASA Ambassadors. NASA Ambassadors are chosen from the participants in the various MSFC summer programs including: Summer Faculty Fellowship Program (SFFP), Science Teacher Enrichment Program (STEP), Community College Enrichment Program (CCEP), Joint Venture (JOVE) program, and the NASA

Academy program. NASA Ambassadors agree to make pre-packaged NASA-related presentations to non-academic audiences in their home communities. The packaged presentations were created by a small cadre of participants from the 1996 MSFC summer programs, volunteering their time beyond their normal NASA summer research commitment. A total of eight presentations were created and made available for use by NASA Ambassadors. A major segment of the research effort during the summer has been devoted to verifying and documenting certain ”spinoff’ contributions of NASA technology and in determining their relevance and impact to our society and our nation’s economy. The purpose behind the verification/documentation research has been to shed light on the question of whether or not our NASA investment is a wise investment. It has revealed that NASA is a wise investment.
Derived from text
NASA Programs; Public Relations; Public Speaking; Space Programs; Communicating; Instructors; Education

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19980203597 Cranfield Univ., Bedford, UK
Trends in Airline Labor Productivity and Cost in Europe
Alamdari, Fariba, Cranfield Univ., UK; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 71-88; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A02, Microfiche

Following the liberalization of air services in Europe in 1988 and more liberal agreements with countries outside Europe, European air carriers have come under increasing pressure to reduce costs. This has been in response to growing competition in their markets from fellow European carriers and the US airlines. Labor has been the most obvious area of costs for airlines to tackle. This paper analyzes trends in the numbers of employees, labor wages (labor costs per employee) and labor unit costs (labor expenses per available ton-kilometer) of European carriers from 1985 to 1995. Labor costs compare average take-home pay for employees, adjusted for cost-of-living differences between countries. It also compares labor pay between airline and manufacturing. The results indicate that European airlines reduced unit labor costs by increasing productivity. When taxes and social costs are deducted from the labor costs, there appears to be a large difference in take-home pay between countries. It was also found that most airlines in the sample pay their employees, on average, more than employees working in the manufacturing industry in their respective countries. The gap between the two however, was narrowing. It is recommended that incentives policies such as profit sharing or employee share ownership could become more effective in reducing real wage levels while leading to further improvements in productivity.
Author
Airline Operations; Labor; Productivity; Trends; Cost Reduction; Civil Aviation; Air Transportation; Operating Costs

19980205626 Small Business Administration, Office of Advocacy, Washington, DC USA
New American Evolution: The Role and Impact of Small Firms
Acs, Z., Small Business Administration, USA; Tarpley, F. A., Small Business Administration, USA; Phillips, B. D., Small Business Administration, USA; Jun. 1998; 38p; In English
Report No.(s): PB98-146236; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this white paper is to document the role of small and medium-sized enterprises in the new economy. Small firms make to indispensable contributions to the American economy. First, they are in integral part of the renewal process that pervades and defines market economies. New and small firms play a crucial role in experimentation and innovation that leads to technological change and productivity growth.
NTIS
Economic Impact; Productivity; Evolution

19980206263 RAND Corp., Santa Monica, CA USA
New Methods for Robust Science and Technology Planning
Lempert, Robert J., RAND Corp., USA; Bonomo, James L., RAND Corp., USA; Jan. 1998; 53p; In English
Contract(s)/Grant(s): DASW01-95-C-0059
Report No.(s): AD-A345574; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the fall of 1996, RAND researchers conducted a successful proof of concept demonstration for the Defense Advanced Research Projects Agency (DARPA) of new methods for science and technology (S&T) planning. These methods exploit new

information technologies in order to (1) improve the quality of the S&T planning process by using online computer assisted decision support tools that make relevant information more easily available to expert panelists meeting over the World Wide Web, and help panelists include and compensate for the effects of uncertainty by treating an S&T plan as a portfolio of technology investments hedged against a wide range of plausible futures. (2) Provide a lasting electronic archive of the expert discussions and other information that go into building an S&T plan. (3) Lower the travel related costs and scheduling constraints of the current planning process by supplementing face to face expert panel meetings with asynchronous meetings over the World Wide Web. The demonstration made use of two new RAND methodologies: HyperForum, a facilitated Web based collaborative exercise, conducted in a carefully crafted, information rich, online environment, and Exploratory Modeling, a new approach to generating systematic, quantitative comparisons among alternative policy decisions without relying on imperfect predictions of the future. This documented briefing describes that demonstration. It should be of interest to decisionmakers responsible for choosing, managing, and justifying portfolios of science and technology research projects in the Department of Defense and other federal agencies, and in the private sector. In addition, it should be informative to those readers interested in how new information technologies can provide new methods for planning and decisionmaking under uncertainty.
DTIC
Research Management; Decision Support Systems; Project Management; Research and Development; Technological Forecasting; Scheduling; Computer Techniques

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.

19980203212 Communications Research Lab., Tokyo, Japan
Development of Distributed Space Environment Database
Ishibashi, Hiromitsu, Communications Research Lab., Japan; Kawasaki, Kazuyoshi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 257-270; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

We have developed a distributed space environment database system with the NCSA HTTPD as the core of the WWW server. The new on-line data base system is called SERDIN/WWW and has the NCSA HTTPD as the front end and a CGI (Common Gateway Interface) program group as the back end. It uses the HTTP protocol for exchanging information with users. The major characteristic of the SERDIN/WWW is that it consists of two types of processes: the Interface Server and the Image Server. These two servers are independently implemented on two different machines over the Hiraiso STRC's LAN and are loosely connected with each other by the HTTP protocol. It is not necessary for both servers to be on the same LAN. As long as the network can be accessed using the HTTP protocol, it does not matter where the servers are running. We think this feature will play an important role in the future expansion of the distributed space environment database. Furthermore, there is no need for the two servers to be unique. A multiple number of interface servers and image servers can coexist on the Internet without any problem. Such expandability as that possessed by SERDIN/WWW is ideal for the initial concept of the space environment monitoring system. Author
Environmental Monitoring; Aerospace Environments; Data Bases; On-Line Systems; World Wide Web; Data Base Management Systems; Communication Networks

19980203213 Communications Research Lab., Tokyo, Japan
Space Environment Information Service
Kawasaki, Kazuyoshi, Communications Research Lab., Japan; Ishibashi, Hiromitsu, Communications Research Lab., Japan; Tokumaru, Munetoshi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 271-275; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

We provide our space environment products by various methods. Our space environment information service can be accessed via telephone, bulletin board systems, and the Internet. Once a week we send a summary by facsimile of the space environment information and we issue a special notice when a significant event occurs or when a large disturbance is expected. We have about fifty customers for our service, including space development agencies, satellite operators, and research organizations. The number of accesses to our services is clearly dependent on solar activity. When severe disturbances occur in the space environment, cus-

tomers want to know what happened. to provide this information, we are trying to keep our space environment database as up-to-date as possible by using the latest network and computer technology. This enables any customer to learn about the latest development in the space environment.
Author
Aerospace Environments; Computer Systems Design; Data Bases; Internets; Solar Activity; Information Flow; Information Management; Information Systems

19980203281 California Univ., Berkeley, CA USA
Efficient Models for Data Storage with References
Artemov, S. N., California Univ., USA; Krupski, V., California Univ., USA; Jul. 1997; 22p; In English
Contract(s)/Grant(s): DAAH04-98-1-0341
Report No.(s): AD-A344311; TR-97-04; ARO-35873.75-MA-MUR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We introduce reference structures; a basic mathematical model of a data organization capable to store and utilize information about its addresses. A propositional labeled modal language is used as a specification and programming language for reference structures; the satisfiability algorithm for modal language gives a method of building and optimizing reference structures satisfying a given formula. Corresponding labeled modal logics are presented, supplied with cut free axiomatizations, completeness and decidability theorems are proved. Initialization of typed variables in some programming languages is presented as an example of a reference structure building.
DTIC
Mathematical Models; Programming Languages; Data Storage; Standards

19980203392 Stanford Linear Accelerator Center, Menlo Park, CA USA
What is the Internet doing for and to you?
Cottrell, R. L. A., Stanford Linear Accelerator Center, USA; Logg, C. A., Stanford Linear Accelerator Center, USA; Martin, D.E., Fermi National Accelerator Lab., USA; Jun. 1997; 8p; In English; Computing In High Energy Physics, 7 - 12 Apr. 1997, Berlin, Germany
Contract(s)/Grant(s): DE-AC03-76SF-00515
Report No.(s): SLAC-PUB-7416; CONF-970410-4; DE97-007253; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Many HEP sites have been participating in a project to monitor end-to-end Internet performance. A few sites have acted as central collection, analysis and report generation points for the large amount of data generated. The reports are useful for short term trouble identification, long term projections, and the evaluation of Internet services. The work is illustrated by examples of both detailed and more general Internet performance.
DOE
Internets; Information Dissemination; Information Management

19980203492 Naval Research Lab., Center for Applied Research and Artificial Intelligence, Washington, DC USA
Comparing Simplification Procedures for Decision Trees on an Economics Classification *Final Report*
Aba, David W., Naval Research Lab., USA; Breslow, Leonard A., Naval Research Lab., USA; May 11, 1998; 22p; In English
Contract(s)/Grant(s): Proj. 55-6470
Report No.(s): AD-A343512; NRL/FR/5510-98-9881; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several commercial Case-Based Reasoning (CBR) shells now use decision trees to index cases, including Remind (Cognitive Systems, Inc.), Kate (AcknoSoft), and The Easy Reasoner (The Haley Enterprise). These trees serve to expedite case retrieval and to generate comprehensible explanations of case retrieval behavior. Unfortunately, induced trees are often large and complex, reducing their explanatory power. to combat this problem, some commercial systems contain an option for simplifying decision trees. However, while many methods for simplifying decision trees exist, they have not been systematically compared and most have not been applied to case retrieval. This report builds on our previous survey and initial empirical comparison of tree simplification procedures. In this report, we compare them on a specific, challenging task that is the focus of an existing CBR effort. We examine which tree simplification procedures are useful for this task and suggest which ones should be included in a commercial CBR tool.
DTIC
Information Retrieval; Classifications; Trees (Mathematics); Indexes (Ratios); Decision Support Systems

19980203654 Army Training and Doctrine Command, Fort Monroe, VA USA

Information Management: Automation, Standards for Electronic Staffing, Publishing, and Archiving

Apr. 01, 1997; 35p; In English

Report No.(s): AD-A343419; TRADOC-PAM-25-71; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This pamphlet describes the standards for automated systems based on an Open Systems philosophy supported by the Army Technical Architecture, version 4.0. It addresses standards for automating the staffing, publishing, and archiving of training and doctrinal products. This pamphlet applies to HQ TRADOC, TRADOC installations, schools, and activities that publish training and doctrinal products. It is provided as a guide to action officers who process training and doctrinal products. As TRADOC becomes more dependent on information technology in its transition to FORCE XXI, information systems must be able to connect and exchange data. This can be achieved by using commercially available software and compatible operating systems that enable properly engineered components to be used across a wide range of systems with minimum changes. These systems interoperate with other components on local and remote systems. Moreover, this pamphlet covers the processes for the digital dissemination of training and doctrine products within TRADOC.

DTIC

Data Management; Information Systems; Standards; Records Management; Information Management; Information Dissemination

19980203692 Oak Ridge Y-12 Plant, TN USA

Graphical Facility Information Center (GraFIC(TM))

Dunigan, J. J., Oak Ridge Y-12 Plant, USA; Gaby, J. E., Oak Ridge Y-12 Plant, USA; Hickerson, T. W., Oak Ridge Y-12 Plant, USA; Miller, M. A., Oak Ridge Y-12 Plant, USA; Jul. 1997; 9p; In English; 38th, 20-24 Jul. 1997, Phoenix, AZ, USA

Contract(s)/Grant(s): DE-AC05-84OS-21400

Report No.(s): Y/EN-5638; CONF-970744-19; DE97-008514; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Graphical Facility Information Center (GraFIC(TM)) is an information system that provides an inexpensive and flexible method of remotely verifying complete ”up-to-the-minute” inventory status of stored items and facility assets. In addition, GraFIC(TM) provides features needed for day to day management of storage and other facilities. GraFIC(TM) combines an easy to use graphical user interface with extensive online help so that users need little training. GraFIC(TM) can be configured to work with most sensor systems used to monitor facility assets.

Author

Information Systems; Information Retrieval; Graphical User Interface; Inventories

19980203767 Office of Management and Budget, Washington, DC USA

Getting Federal Computers Ready for 2000: Report of the US Office of Management and Budget

Feb. 06, 1997; 7p; In English

Report No.(s): AD-A343377; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Year 2000 computer problem is a seemingly simple one: assuring that computers will recognize the correct year when the year 2000 arrives. If software programs are not prepared to handle the change of date on January 1, 2000, there is a risk to government information systems and the programs they support. This report responds to 1997 appropriations language which directs Office of Management and Budget (0MB) to submit to the House Committee on Appropriations, the House Committee on Government Reform and Oversight, and the House Science Committee a report which includes: a cost estimate to ensure software code date fields conversion by the year 2000; a planned strategy to ensure that all information technology, as defined by the Information Technology Management Reform Act of 1996, purchased by an agency will operate in 2000 without technical modifications; and, a time table for implementation of the planned strategy

DTIC

Computer Programs; Information Systems; Coding

19980203772 Air Force Distance Learning Office, Maxwell AFB, AL USA

Distance Learning Resource Handbook

Mar. 30, 1998; 45p; In English

Report No.(s): AD-A343309; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When we first did a search of the Internet on distance learning, our search engine displayed more than 400,000 hits. A year later, using the same search engine, we had over 800,000 hits. Today, it is over a 1,000,000. Clearly there was and remains a need for some type of compass to help navigate the Net when trying to find distance learning sites. This handbook is such a compass.

We've compiled Web sites related to distance learning. They include definitions, history, conferences, certification programs, listservs, newsgroups, on-line resources, organizations, periodicals, books and bookstores. We've also added a section on search engines, so if there is something we've missed, you can find it on your own. You can add your favorite sites and other comments at the end of this document in the Notes section.
DTIC
Information Retrieval; Learning; On-Line Systems; Internets; Handbooks

19980203843 Army War Coll., Carlisle Barracks, PA USA
Information Warfare and Information Operations: Protecting The Global Information Environment
Cabral, Paul A., Army War Coll., USA; Mar. 06, 1998; 41p; In English
Report No.(s): AD-A344848; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The USA is an information and information systems dominated nation. Because of its dependence on information and information technology, the USA has become one of the most vulnerable nations to information warfare attacks. This study examines vulnerabilities in the global, national and defense information infrastructure and information operations attacks (information warfare) in the context of the national strategy for protecting the information infrastructure. It reviews directives, regulations, and policies currently in place to protect the information infrastructure and recommends the part government should play in this effort. It concludes with recommendations regarding a coordinated government and private sector office at the national level to provide the leadership required for such an effort.
DTIC
Defense Program; Information Systems; Regulations; Warfare

19980203894 Stanford Univ., Dept. of Computer Science, Stanford, CA USA
Efficient Management of Active Databases ***Final Report, 1 May 1995 - 31 Dec. 1997***
Ullman, Jeffrey D., Stanford Univ., USA; Widom, Jennifer, Stanford Univ., USA; Feb. 25, 1998; 5p; In English
Contract(s)/Grant(s): DAAH04-95-1-0192
Report No.(s): AD-A344235; ARO-33013.1-MA-SDI; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have made advances in the following areas: Data cubes: these recent data-warehouse products need a way to optimize the use of space by selecting some views to maintain permanently. We have identified the 'monotonicy' property choosing one view cannot increase the value of materializing another view as guaranteeing the existence of a polynomial-time competitive (guaranteed to come within a constant fraction of optimum) solution. In one important nonmonotone case, data cubes with indexes on views, we showed how to find a polynomial competitive algorithm. Self Maintenance of views: We have techniques for deciding whether or not a view that is defined by a conjunctive query can be maintained in the face of an update to a base relation, without issuing queries to one or more base relations. For a variety of situations, we showed how to express this 'self maintainability' condition as an SQL query. We also can take advantage of functional dependencies to simplify the test.
DTIC
Data Bases; Cubes (Mathematics); Data Base Management Systems

19980203923 General Services Administration, Washington, DC USA
General Services Administration: FY 1998 Congressional Justification
Mar. 20, 1997; 194p; In English
Report No.(s): AD-A343841; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

Budgetary constraints on federal customer agencies continue to present a challenge to CIC. Federal cutbacks in the variety and the quantity of printed publications available, combined with the public's desire for easier and quicker access to information, have spurred CIC to expand and strengthen two important programs. First, CIC has redoubled efforts to identify private sector partners who share federal information goals and can provide resources to stretch limited federal dollars. and secondly, CIC has implemented telephone ordering systems for both the Consumer Information Catalog and its publications. These efforts complement CIC's ongoing efforts to identify and obtain valuable federal information, its media and marketing programs, its centralized distribution system based in Pueblo, Colorado, and its widely acclaimed electronic information activities - all of which combine to make CIC an essential source for citizens desiring unbiased and vital consumer information from their federal government. CIC remains uniquely positioned among federal agencies to perform the services it has so effectively delivered to the American public since 1970.
DTIC
Marketing; Telephones

19980204731 National Inst. of Standards and Technology, Software Diagnostics and Conformance Testing Div., Gaithersburg, MD USA

Criteria for USA Geological Survey (USGS) Recognizing Testing Laboratory/ies Functions and Requirements Part of USA Geological Survey Recognition of Spatial Data Transfer Standard

Dashiell, W. H., National Inst. of Standards and Technology, USA; Johnson, L. A., National Inst. of Standards and Technology, USA; Rosenthal, L. S., National Inst. of Standards and Technology, USA; May 1998; 16p; In English

Report No.(s): PB98-144504; NISTIR-6128; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document describes the requirements for the USA Geological Survey (USGS) recognition of private sector Testing Laboratories which perform the conformance assessment of SDTS/TVP implementation of the SDTS/TVP standard. The Sponsoring Organization Model (SOM) for Recognition of Information Technology Certification System upon which this Testing Laboratory Recognition is built provides a practical approach to conformity assessment where: (1) minimal resources or expertise are available from the Sponsoring Organization for supporting such activities, (2) the software community needs such a validation program, and/or (3) the software community resources (costs, time, effort) are insufficient to seek accreditation from a formal accreditation organization.

NTIS

Geological Surveys; Information Systems; Data Transfer (Computers); Topology; Tests

19980205618 Lawrence Livermore National Lab., Livermore, CA USA

Mining scientific data archives through metadata generation

Springmeyer, R., Lawrence Livermore National Lab., USA; Werner, N., Lawrence Livermore National Lab., USA; Long, J., Lawrence Livermore National Lab., USA; Apr. 01, 1997; 11p; In English; 1stInstitute for Electrical and Electronics Engineers Metadata, 16 - 18 Apr. 1996, Silver Springs, MD, USA

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

Report No.(s): UCRL-JC-123863; CONF-9604215-1; DE97-053206; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Data analysis and management tools typically have not supported the documenting of data, so scientists must manually maintain all information pertaining to the context and history of their work. This metadata is critical to effective retrieval and use of the masses of archived data, yet little of it exists on-line or in an accessible format. Exploration of archived legacy data typically proceeds as a laborious process, using commands to navigate through file structures on several machines. This file-at-a-time approach needs to be replaced with a model that represents data as collections of interrelated objects. The tools that support this model must focus attention on data while hiding the complexity of the computational environment. This problem was addressed by developing a tool for exploring large amounts of data in UNIX directories via automatic generation of metadata summaries. This paper describes the model for metadata summaries of collections and the Data Miner tool for interactively traversing directories and automatically generating metadata that serves as a quick overview and index to the archived data. The summaries include thumbnail images as well as links to the data, related directories, and other metadata. Users may personalize the metadata by adding a title and abstract to the summary, which is presented as an HTML page viewed with a World Wide Web browser. We have designed summaries for 3 types of collections of data: contents of a single directory; virtual directories that represent relations between scattered files; and groups of related calculation files. by focusing on the scientists' view of the data mining task, we have developed techniques that assist in the ''detective work '' of mining without requiring knowledge of mundane details about formats and commands. Experiences in working with scientists to design these tools are recounted.

DOE

Mining; Document Markup Languages; Directories; Data Management; Collection; Data Acquisition

19980205651 General Accounting Office, Accounting and Information Management Div., Washington, DC USA

Executive Guide: Information Security Management: Learning from Leading Organizations: Exposure Draft

Nov. 1997; 74p; In English

Report No.(s): PB98-145691; GAO/AIMD-98-21; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This guide is designed to promote senior executives' awareness of information security issues and to provide information they can use to establish a management framework for more effective information security programs. The opening segments describe the problem of weak information security at federal agencies, identify existing federal guidance, and describe the issue of information security management in the context of other information technology management issues. The remainder of the guide describes 16 practices, organized under 5 management principles, that GAO identified during a study of nonfederal organi-

zations with reputations for having good information security programs. Each of these practices contains specific examples of the techniques used by these organizations to increase their security program's effectiveness.
NTIS
Information Management; Information Systems; Security; Procedures

19980205664 National Inst. of Standards and Technology, Software Diagnostics and Conformance Testing Div., Gaithersburg, MD USA
Criteria for USA Geological Survey (USGS) Recognizing Certificate Issuing Organizations Functions and Requirements. Part of USA Geological Survey Recognition of Spatial Data Transfer Standard (SDTS)
Dashiell, W. H., National Inst. of Standards and Technology, USA; Johnson, L. A., National Inst. of Standards and Technology, USA; Rosenthal, L. S., National Inst. of Standards and Technology, USA; May 1998; 14p; In English
Report No.(s): PB98-148745; NISTIR-6126; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document describes the requirements for the USA Geological Survey (USGS) recognition of privates sector Certification Issuing Organizations which provide conformity assessment of SDTS/TVP implementations to the SDTS/TVP standard. The Sponsoring Organization Model (SOM) for Recognition of Information Technology Certification System upon which this USGS Certificate Issuing Organization (CIO) Recognition is built provides a practical approach to conformity assessment where: (1) minimal resources or expertise are available from the Sponsoring Organization for supporting such activities, (2) the software community needs such a validation program, and/or (3) the software community resources (costs, time, effort) are insufficient to seek accreditation from a formal accreditation organization.
NTIS
Data Transfer (Computers); Topology; Certification; Data Bases; Vector Analysis

19980205778 Army War Coll., Carlisle Barracks, PA USA
The Department of Defense and the Age of Information Operations
Evans, Alan T., Army War Coll., USA; May 13, 1998; 33p; In English
Report No.(s): AD-A345602; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper explains the challenges and vulnerabilities the Nation and especially the military will face in the next century as our dependence on information systems and associated infrastructure continues to grow. It will highlight the results of the President's Commission on Critical Infrastructure Protection and discuss the steps necessary to protect the information systems upon which we have come to so heavily depend. It will highlight that without a comprehensive national policy in protecting information infrastructures poses a great risk to its military, commercial users and ultimately the Nation.
DTIC
Military Operations; Information Systems; Policies; Defense Program; Military Technology

19980206123 Meteorological Satellite Center, Tokyo, Japan
Outline of MeSDAS
Uchida, Shuji, Meteorological Satellite Center, Japan; Sakamoto, Takahiro, Meteorological Satellite Center, Japan; Kitada, Shigeki, Meteorological Satellite Center, Japan; Shimizu, Kazuyosi, Meteorological Satellite Center, Japan; Meteorological Satellite Center Technical Note; Feb. 1998; ISSN 0388-9653, No. 35, pp. 1-14; In Japanese; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The GMS observation and product data had been stored on magnetic tapes (MT) or VHS style cartridge tapes (CT) since GMS-1. The number of tapes at 13 June 1995, when GMS-4 ended its operation, was about 50,000. Since tapes are apprehensive in reading due to a secular deterioration, MSC constructed MeSDAS (Meteorological Satellite Data Archiving System) in 1996 to convert GMS MT/CT data to CD-ROM and to make a data base for climate monitoring. MSC started its operation in June 1997. This article introduces MeSDAS and the CD-ROM for infrared VISSR data.
Author
CD-ROM; Data Bases; Data Systems; Meteorological Parameters; Data Management; Climatology

19980206330 Brookhaven National Lab., Upton, NY USA
BNL-NYSERNet ATM project report
OConnor, M., Brookhaven National Lab., USA; Peskin, A., Brookhaven National Lab., USA; Rabinowitz, G., Brookhaven National Lab., USA; Jul. 1997; 12p; In English
Contract(s)/Grant(s): DE-AC02-76CH-00016

Report No.(s): BNL-64692; DE98-000149; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

In 1994, Brookhaven National Laboratory (BNL) and NYSERNet, Incorporated embarked on a joint project to develop a prototype Asynchronous Transfer Mode (ATM) Regional Network testbed. This project was funded as a three-year effort under a Cooperative Research and Development Activity (CRADA) agreement between the parties, with half the funds being provided directly by the U.S. Department of Energy and the remainder as an in-kind contribution by NYSERNet. This report documents that effort as it comes to a close, providing an account of the original goals, the accomplishments of the projects, and the results as they might apply to the future. It is useful to remember that, when the collaboration discussions first began in 1993, it was far from certain that ATM would be the technology of choice for the then-next generation of the Internet. That, of course, has turned out to be the case, which in retrospect makes this experience particularly valuable. The investigators were not totally present, however, and the project changed during its duration to account for changes in technology, available infrastructure, and other circumstances.

DOE

Research and Development; Asynchronous Transfer Mode; Prototypes

19980206344 Army War Coll., Carlisle Barracks, PA USA

Information Operations Challenges

Strawn, James C., Army War Coll., USA; Apr. 15, 1998; 36p; In English

Report No.(s): AD-A344942; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper examines the need for a coherent and well-defined national strategy for information operations. The impetus is today's environment and the realities of the environment we will face as we enter the next century. The paper begins by evaluating the present environment and highlighting key factors that contribute to the iniperative nature of this challenge followed by a review of the current status of national initiatives. Finally, the paper discusses key steps to be taken in this arena. The review of the present environment includes a macro-level look at the USA and its information needs. This look contrasts and compares the USA with its allies and its potential adversaries. With the review of the environment providing a foundation, a candid discussion of our nation's information operations initiatives helps to bring the issues into focus. The initiatives cannot be viewed solely from a Department of Defense perspective as they are addressing national challenges. These challenges share similarities with those in the arena of the asymmetric Weapons of Mass Destruction (WMD) threat. The solutions to those WMD threats demanded interagency and multi-national cooperation, the sarne is true for threats in cyber space.

DTIC

Information Systems; Evaluation; Threat Evaluation

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

19980203591 International Civil Aviation Organization, Montreal, Quebec Canada

The Proposed International Aeronautical Monetary Fund: Legal and Practical Implications

Abeyratne, Ruwantissa I. R., International Civil Aviation Organization, Canada; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 1-11; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A02, Microfiche

The proposed international aeronautical monetary fund has its genesis in the Latin American Civil Aviation Commission (LACAC), which proposed the inauguration of the fund to finance air navigation services provided by the satellite based Communications, Navigation, Surveillance/Air Traffic Management (CNS/ATM) system. It was the consensus of LACAC that the fund should be created by international agreement with an international bank established to receive and administer the financing of the CNS/ATM. The overriding principle of the aeronautical monetary fund remained that its administration should be supervised by the International Civil Aviation Organization. This paper will introduce the conceptual and practical evolution of the aeronautical monetary fund from its inception to date and analyze its legal and practical implications for the future of civil aviation.

Author

Finance; Law (Jurisprudence)

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

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

19980203223 Chilean Air Force, Santiago, Chile
The Aerospace System and the Possibilities of Collaboration in Latin America
RojasVender, Fernando, Chilean Air Force, Chile; Mar. 17, 1998; 8p; In English
Report No.(s): AD-A339355; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The South American continent is composed of countries whose valiant people are making an energetic effort to overcome current challenges. These countries are reaching for a future that would move them from a state of hope to one of growing well-being and continued sustainable development. It is not my intent to mislead you into believing that my presentation expresses the common thought prevalent in the countries of the region. Nevertheless, it is my intent to make you aware of how we in Chile visualize the so-called
DTIC
Aerospace Systems; Control Systems Design

19980203596 Seattle Univ., WA USA
Toward an International Open Skies Regime: Advances, Impediments, and Impacts
Toh, Rex S., Seattle Univ., USA; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 61-70; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A02, Microfiche

The International Air Transportation Competition Act of 1979 heralded the era of Open Skies in international aviation. This paper traces the post-war regulation and then deregulation of fares, rates, routes, and capacity all the way from Bermuda I through the partial dismantling of the International Air Transport Association (IATA) price fixing apparatus; and discusses the impediments to Open Skies and examines the impact on the IATA.
Author
Air Transportation; Competition; Control; Economic Impact; Airline Operations

85
URBAN TECHNOLOGY AND TRANSPORTATION

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

19980203592 Nebraska Univ., Aviation Inst., Omaha, NE USA
Intermodal Airport-to-City-Center Passenger Transportation at the 20 Largest US Air Carrier Airports: The Past, Present, and Future
Lehrer, Henry R., Nebraska Univ., USA; Freeman, Aimee, Nebraska Univ., USA; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 12-22; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A02, Microfiche

The 20 largest US air carrier airports handle close to 60 percent of all the passengers enplaned in the USA. While the intra-airport movement of these passengers has become more efficient in recent years, the most difficult and challenging airport-associated journey is still between the airport and the city-center. The root cause of this problem is likely due to the unexpected growth of air transportation following US airline deregulation in 1978. Most major US cities lacked a well-planned intermodal transportation infrastructure, particularly one that had an airport interface. Additionally, the automobile remains the predominant short-haul passenger transportation system in the USA. This paper presents an overview and analysis of the top 20 US air carrier airports' efforts in the past, present, and in the future to provide intermodal passenger transportation between the airport and city-center. Airport planners, developers, and management personnel in the targeted cities were surveyed concerning these issues. These data will be used to extend the knowledge-base concerning development of the US intermodal airport passenger transportation infrastructure.
Author
Air Transportation; Airline Operations; Airports; Cities; Passengers

88
SPACE SCIENCES (GENERAL)

19980203206 Communications Research Lab., Tokyo, Japan
Review of the Communications Research Laboratory, Volume 43
Jun. 1997; ISSN 0914-9279; 255p; In Japanese; Also announced as 19980203207 through 19980203220; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

The journal issue contains reviews of efforts mainly concerned with solar observations, space environments and space weather forecasting. Solar activity plays a major role in space weather forecasting which, in turn, helps in predicting interactions between spaceborne satellite instruments and their environment. Technology developments and instrumentation that are being developed to enhance the Space Weather Forecast Program are discussed.
CASI
Solar Activity; Space Programs; Weather Forecasting; Solar Activity Effects; Aerospace Environments; Radiation Effects

89
ASTRONOMY

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

19980203210 Communications Research Lab., Tokyo, Japan
The New Solar Radio Observation System at Hiraiso
Kondo, Tetsuro, Communications Research Lab., Japan; Isobe, Takeshi, Communications Research Lab., Japan; Igi, Seiji, Communications Research Lab., Japan; Watari, Shin-Ichi, Communications Research Lab., Japan; Tokumaru, Munetoshi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 231-248; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

The Hiraiso Solar Terrestrial Research Center has been engaged in the prediction of significant disturbances in the solar terrestrial environment, and has therefore been monitoring solar radio emissions for more than 40 years. These observations had been at fixed frequencies until 1988 when a spectrograph (70-500 MHz) with a 10-m antenna was built. In FY1992 (April 1992 - March 1993) the solar radio observation system at Hiraiso was renewed. Three old antennas were replaced by new ones, and total flux measurements at 2800 MHz were started. These were in addition to the fixed frequency measurements at 200 MHz and 500 MHz. by adding two antennas, the frequency range of the spectrograph was expanded from 70-500 MHz to 25-2500 MHz. Routine observations of the sun using the new spectrograph (HiRAS: Hiraiso radio spectrograph) began late in May 1993, and daily operation is now fully automated. Everyday the antennas automatically track the sun from sunrise to sunset, and the data acquired by the HiRAS are processed by a workstation computer to produce dynamic spectrograms. An algorithm that removes interferences due to radio, television, and other artificial signals has significantly improved the signal to noise ratio of the spectrogram, thereby considerably increasing the HiRAS' ability to monitor solar radio bursts.
Author
Spectrograms; Spectrographs; Signal to Noise Ratios; Radio Observation; Solar Observatories; Solar Activity; Radio Antennas

90
ASTROPHYSICS

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

19980203737 Los Alamos National Lab., NM USA
Neutron star evolution and emission
Epstein, R. I., Los Alamos National Lab., USA; Edwards, B. C., Los Alamos National Lab., USA; Haines, T. J., Los Alamos National Lab., USA; [1997]; 6p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2565; DE97-008685; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), 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 investigated the evolution and radiation characteristics of individual neutron stars and stellar systems. The work concentrated on phenomena where new techniques and observations are dramatically enlarging the understanding of stellar phenomena. Part of this project was a study of x-ray and gamma-ray emission from neutron stars and other compact objects. This effort included calculating the thermal x-ray emission from young neutron stars, deriving the radio and gamma-ray emission from active pulsars and modeling intense gamma-ray bursts in distant galaxies. They also measured periodic optical and infrared fluctuations from rotating neutron stars and search for high-energy TeV gamma rays from discrete celestial sources.

DOE

Neutron Stars; Stellar Evolution; Stellar Radiation; Pulsars; X Rays; Gamma Rays; Emission

19980203837 Chicago Univ., Dept. of Chemistry, Chicago, IL USA

Spectroscopic Studies of Neutral and Ionized Solid Hydrogen and Gaseous Hydrogen Plasmas ***Final Report, 1 Feb. 1994 - 31 Jul. 1997***

Oka, Takeshi, Chicago Univ., USA; Mar. 24, 1998; 10p; In English

Contract(s)/Grant(s): F49620-94-1-0145; AF Proj. 2303

Report No.(s): AD-A343636; AFRL-SR-BL-TR-98-0345; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is the final report and the total summary of my research effort with graduate students on my Air Force grant F49620-94-1-0145 from February 1, 1994 to July 31, 1997. According to my proposal submitted on March 31, 1993, this three year project was to study pure vibrational Qv(0)transitions v yields 0, J=0 yields 0 in para-hydrogen (p-H2) crystals. Such transitions are clearly highly forbidden in the ordinary electric dipole selection rules and the transitions have to be of the second-order Raman type in which the transition moment M is given by the Kramers-Heisenberg formula. In order to observe such transitions, we need an extra electric field E' in addition to the laser radiation field E. We used a variety of extra electric fields such as laser radiation field (stimulated Raman effect), external D.C. electric field (Condon effect), the quadrupolar field of ortho-hydrogen (o-H2) impurity, and the Coulomb field of electric charges deposited in the crystals by gamma ray radiolysis. Because of the nature of p-H2 as quantum crystals the field-induced spectra can be observed with extremely high resolution, and the observed intricate structure provides information on vibron dynamics, intermolecular interactions, crystal field interactions and crystal distortions with unprecedented clarity and accuracy. Most of these objects have been experimentally achieved and provided enormous amount of observed results to be analyzed and understood. Our work has also led to application of the high resolution solid hydrogen spectroscopy to matrix spectroscopy and to nonlinear optics.

DTIC

Hydrogen; Spectroscopy; Solid Cryogens; Neutral Gases; Ionized Gases; Hydrogen Plasma; Vibration; Crystal Field Theory

19980205794 Los Alamos National Lab., NM USA

Helium-induced reactions in astrophysics

Hale, G. M., Los Alamos National Lab., USA; [1997]; 7p; In English; Nuclear Data for Science and Technology, 20 - 24 May 1997, Trieste, Italy

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

Report No.(s): LA-UR-97-2655; CONF-970512; DE98-000836; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Helium-induced reactions play a crucial role in stellar nucleosynthesis. Carbon and oxygen are produced mainly during the helium-burning phase by the chain of reactions (sup 8)Be((alpha), (gamma) + e(sup +)e(sup -))(sup 12)C((alpha), (gamma))(sup 16)O. The first step, often called triple-(alpha) capture, was proposed by Hoyle to bypass the mass stability gap at (sup 8)Be. The second step gives rise to the largest uncertainty in most of the calculated stellar abundances. Later (alpha)-captures on (sup 13)C are believed to be a major source of s-process neutrons. The status of each of these important reactions is reviewed here.

DOE

Helium; Astrophysics; Alpha Decay; Capture Effect; Nuclear Fusion

19980206101 Argonne National Lab., IL USA

A compilation of information on the S-32(p, (gamma))CL-33 reaction and properties of excited levels in CL-33

Miller, R. E., Argonne National Lab., USA; Smith, D. L., Argonne National Lab., USA; Jul. 1997; 67p; In English

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

Report No.(s): ANL/NDM-143; DE98-000147; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

This report documents a survey of the literature, and provides a compilation of data contained therein, for the S-32(p, (gamma))CL-33 reaction. Considerable attention is paid to properties of the levels in CL-33 which are located in the vicinity of excitation of the compound-nuclear system S-32 + p near the proton separation energy for CL-33. It is this particular energy region which is especially important for applications in nuclear astrophysics. Summaries of all the located references are provided and numerical data contained in them are compiled in EXFOR format where applicable.
DOE
Chlorine; Data Flow Analysis; Proton Irradiation; Sulfur; Excitation

91
LUNAR AND PLANETARY EXPLORATION

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

19980203584 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
Constraints on the Magnitude of Vertical and Lateral Mass Transport on the Moon ***Final Report, 1 Jan. - 31 Dec. 1997***
Mustard, John F., Brown Univ., USA; 1997; 4p; In English
Contract(s)/Grant(s): NAGw-4896
Report No.(s): NASA/CR-1998-208203; NAS 1.26:208203; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The role of vertical and lateral mass transport of crustal materials on the observed patterns of lunar surface composition, and the effects on our understanding of the geologic evolution of the planet, have been the subject of much debate in the lunar science community. The primary consensus that emerged from analyses of these processes in the 1970's and 1980's was that vertical and lateral mixing through impact gardening was a relatively inefficient process, and not likely to have contributed significantly to compositional units and variations on the Moon. The supporting evidence for this view is that unit boundaries (e.g. mare-highland contacts, contacts between mare color units) are still apparently quite distinct and sharp despite several aeons of impact activity, and cores from the Apollo landing sites did not show any evidence of widespread homogenization of the surface composition, nor distinct compositional gradients across geologic boundaries. In addition, modeling of vertical and lateral transport generally showed that the effects on composition should be confined to horizontal scales of about a kilometer and vertical scales of a meter. The problem with this consensus is that there is ample contradictory evidence. The fundamental discovery of Wood et al. (1970) was made possible by significant horizontal transport of highland material to the center of Mare Tranquillitatis. The continuous and discontinuous ejecta from the crater Copernicus has clearly influenced the surface composition of a large area of the lunar maria, while rays and ejecta from many highland craters are easily recognized in and around the nearside maria. Despite this contrary evidence, there have been few detailed studies to quantify the amount and rate of material redistribution through impact processes (a notable exception is reported in the paper by Pieters et al, 1985), largely because data adequate to critically analyze this process were lacking. However, the multispectral images acquired by the Galileo and Clementine missions now permit the investigation of this process.
Derived from text
Clementine Spacecraft; Mass Transfer; Moon; Lunar Surface; Lunar Maria; Geological Surveys; Composition (Property)

92
SOLAR PHYSICS

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

19980203208 Communications Research Lab., Tokyo, Japan
Observation of Solar Chromosphere: Development of High Definition H-Alpha Solar Telescope and its Observation
Akioka, Maki, Communications Research Lab., Japan; Okano, Akemi, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 215-224; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

The high-definition H alpha telescope has been developed for the Space Weather Forecast Project and is in operation at Hiraiso Solar Terrestrial Research Center, CRL. Its advantageous features are: (1) high-resolution digital H alpha images with 2K by 2K CCD; (2) real-time data frame selection with software; (3) spectroscopic observation using the wavelength scanning method with Lyot filter; and (4) automatic control systems for daily observation monitoring. In daily solar terrestrial forecasts at Hiraiso, the data is used for finding active regions, flares, and filament eruptions and foreseeing the activity level of each active

region by evaluating the chromospheric feature and its change. Several fundamental research topics are also ongoing with the H alpha data. We have constructed a WWW image database consisting of images of daily active regions and some flares and movies showing solar active phenomena. The telescope will be one of the main facilities for the operational space weather forecast of the next solar maximum at the beginning of the 21st century.
Author
Chromosphere; Solar Activity; Solar Optical Telescope; H Alpha Line; Space Observations (From Earth)

19980203209 Communications Research Lab., Tokyo, Japan
Observation of Solar Photosphere: Development of Sunspot Monitoring Telescope and its Observation
Akioka, Maki, Communications Research Lab., Japan; Maejima, Yuki, Communications Research Lab., Japan; Anwar, Bachtiar, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 225-230; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

The Sunspot Monitoring Telescope has been developed and operated at the Hiraiso Solar Terrestrial Research Center, CRL. The main purpose of the telescope is daily full-disk observations of sunspots for the Space Weather Forecast Project in the Hiraiso/CRL. The telescope is a 15 cm refractor mounted on the equatorial mounting. The features of the telescope are: (1) one arc sec spatial sampling over full-disk sun with 2K by 2K CCD; (2) a full automatic system for routine observation; and (3) a five hole filter turret for interference filters with different wavelengths. The telescope has been operated since the end of November 1996 and its data is used for daily solar-terrestrial forecasts and related fundamental research. The data is also used for earth observation as fundamental data for data reduction. The software for automatic measurement of sunspot position, area, and for feature recognition is now being developed. The telescope will be operated along the ascending solar activity and will provide the fundamental data for Space Weather Forecast.
Author
Refracting Telescopes; Photosphere; Space Observations (From Earth); Sunspots; Solar Activity; Astronomical Photography

19980203215 Communications Research Lab., Tokyo, Japan
Real Time Solar Wind Monitor Using ACE Satellite
Maruyama, Takashi, Communications Research Lab., Japan; Watanabe, Shigeaki, Communications Research Lab., Japan; Ohtaka, Kazuhiro, Communications Research Lab., Japan; Shimazu, Hironori, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 285-290; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

An Advanced Composition Explorer (ACE) satellite will be launched by NASA at the libration point on the sun-earth line (L1), 1.5 million km upstream to the sun. The primary scientific purpose of ACE is to determine and compare the isotopic and elemental composition of the solar corona, the interplanetary medium, local interstellar medium and Galactic matter. Besides this, the basic parameters of the solar wind which are pertinent in forecasting space environment variations near the earth, especially the onset of geomagnetic storms will be predicted. This sub-mission has been proposed by NOAA/SEC and is called the RTSW option. RTSW data will be transmitted in real-time at a low-bit rate of 434 bps for 24 hours/day. to achieve 24-hour real-time monitoring we need at least three ground telemetry stations evenly spaced in longitude. The Communications Research Laboratory will operate one of these stations in the Far East longitude sector.
Author
Aerospace Environments; Real Time Operation; Solar Wind; Interplanetary Magnetic Fields; Explorer Satellites; Monitors

19980203217 Communications Research Lab., Tokyo, Japan
Space Environment Forecast Service
Nagatsuma, Tsutomu, Communications Research Lab., Japan; Ohyama, Kiyoko, Communications Research Lab., Japan; Okano, Akemi, Communications Research Lab., Japan; Akioka, Maki, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 301-308; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

Our geospace environment is affected by solar activity. Artificial satellites, telecommunications equipment, and human activ-

ities in space are adversely affected by intense X-ray radiation from solar flares and high-energy particles accelerated through the geomagnetic disturbance. to use the geospace environment safely, space weather forecast is needed. The space weather forecast project at the CRL started in 1988, when our radio-wave alert service was extended to space environment forecast service. We now provide our space environment forecast service to users in a variety of fields. The current space environment forecast service at the CRL/HSTRC is described in detail.
Author
Aerospace Environments; Magnetic Disturbances; Solar Activity; Weather Forecasting

19980203218 Communications Research Lab., Tokyo, Japan
Toward the Next Solar Maximum: Solar Observation and Forecast
Akioka, Maki, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 309-312; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

Future research plans of solar observations in the Space Weather Forecast Project at the Hiraiso/CRL are briefly described. Toward the next solar maximum around 2000, we have been making efforts to develop the comprehensive solar observation facilities consisting of a High-Definition H alpha Solar Telescope, Sunspot Monitoring Telescope, and Filter Magnetograph as well as data exchange facilities with computer networks. The observations with these telescopes and quasi real-time data exchange will play an important role for the forecasts of solar and magnetosphere disturbances in the next solar maximum. As well as the development of the monitoring facilities, research on state of the art solar observation techniques is planned. One of the main targets is research and development for spectroscopic polarimetry of the sun. For flare research and forecasting, polarimetry of spectral lines is required and precise derivation of physical parameters, especially of the magnetic field, from observations is crucial. We will develop the precise spectroscopic polarimetry technique after research and development of several required features and technologies. These include image stabilization technology, a no artificial polarization mirror in the oblique reflection, a telescope filled with Helium, and IR polarimetry.
Author
Spectroscopic Analysis; Telescopes; Space Observations (From Earth); Solar Activity; Astronomical Polarimetry; Magnetic Storms

19980203219 Communications Research Lab., Tokyo, Japan
Toward the Next Solar Maximum: Magnetosphere Activity Forecast
Sagawa, Eiichi, Communications Research Lab., Japan; Maruyama, Takashi, Communications Research Lab., Japan; Akioka, Maki, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 313-318; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

Variations in the solar wind cause disturbances in the earth's magnetosphere. The magnetosphere disturbances have a significant impact on human activities in space and on the ground. The space environment, particularly near the geosynchronous orbit where a number of satellites serve to support modern society, is one of the major concerns for satellite operators. On the ground, magnetospheric storms and substorms cause a wide variety of problems in short-wave communication, navigation, and technological systems such as the power grid. The CRL's "Space Weather Forecast Program" aims to improve the forecast of magnetosphere disturbances before the next solar maximum period (around 2000). In magnetosphere forecasting, it is important to understand the connection between the sun's surface and the magnetosphere. We are far from a complete understanding of this connection. The recent flood of observation data on the sun, interplanetary space, and the magnetosphere will enable us to find the empirical relationships between the causes and effects more easily than before. A comprehensive morphology is a good starting point for physical understanding, and also useful for forecasting. The ACE satellite, which will deliver real-time solar wind data continuously, will improve our ability to identify the current status of the magnetosphere activity and our understanding of the solar wind and magnetosphere coupling, through the use of a forecast model of the magnetosphere.
Author
Aerospace Environments; Earth Magnetosphere; Magnetospheric Instability; Solar Activity; Weather Forecasting; Solar Wind

19980203551 Los Alamos National Lab., NM USA
(sup 7)Be(p, (gamma)) (sup 8)B and the high-energy solar neutrino flux
Csoto, A., Los Alamos National Lab., USA; [1997]; 5p; In English; Exotic Nuclear Shapes Conference;, 12-17 May 1997, Debrecen, Hungary
Contract(s)/Grant(s): W-7405-eng-36

Report No.(s): LA-UR--97-1300; DE97-007200; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Despite thirty years of extensive experimental and theoretical work, the predicted solar neutrino flux is still in sharp disagreement with measurements. The solar neutrino measurements strongly suggest that the problem cannot be solved within the standard electroweak and astrophysical theories. Thus, the solar neutrino problem constitutes the strongest evidence for physics beyond the Standard Model.

DOE

Electroweak Interactions (Field Theory); Astrophysics; Neutrinos

19980205837 Los Alamos National Lab., NM USA

Overexpanding Coronal Mass Ejections at High Heliographic Latitudes: Observations and Simulations

Gosling, J. T., Los Alamos National Lab., USA; Riley, Pete, Los Alamos National Lab., USA; McComas, D. J., Los Alamos National Lab., USA; Pizzo, V. J., National Oceanic and Atmospheric Administration, USA; Journal of Geophysical Research; Feb. 01, 1998; ISSN 0148-0227; Volume 103, No. A2, pp. 1941-1954; In English

Contract(s)/Grant(s): NAGw-4582

Report No.(s): NASA/CR-1998-208188; NAS 1.26:208188; Paper-97JA01304; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

Ulysses observations reveal that most coronal mass ejections (CMES) observed in the solar wind far from the Sun at high heliographic latitudes have large radial widths and are still expanding as they pass the spacecraft. CME radial widths ranging between 0.5 and 2.5 AU have observed at heliocentric distances between 1.4 and 4.6 AU and at latitudes greater than 22 deg. A CME may expand simply because it is ejected from the Sun with a leading edge speed that is greater than its trailing edge speed. Rarefaction waves produced by relative motion between a CME and the surrounding wind also can cause a CME to expand. Finally, a CME may expand because it is ejected into the wind with an internal pressure that is greater than that of the surrounding wind. In the latter case, which we have called 'overexpansion,' the expansion tends to drive compressive waves into the surrounding solar wind; these waves commonly steepen into shocks at large distances from the Sun. The relative importance of these various expansion processes differs from event to event depending upon initial conditions within the CME and the surrounding wind. Using Ulysses observations and a simple one-dimensional, gasdynamic code, we have explored how initial conditions affect the radial evolution of solar wind disturbances associated with overexpanding CMES. We find good qualitative agreement between the results of our simulations and Ulysses observations of such disturbances.

Author

Coronal Mass Ejection; Ulysses Mission; Expansion; Simulation; Solar Corona; Satellite Observation; Solar Wind; Radial Distribution; Solar Activity Effects

19980206198 Austin Peay State Univ., Physics Dept., Clarksville, TN USA

A Real-Time Position-Locating Algorithm for CCD-Based Sunspot Tracking

Taylor, Jaime R., Austin Peay State Univ., USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

NASA Marshall Space Flight Center's (MSFC) EXperimental Vector Magnetograph (EXVM) polarimeter measures the sun's vector magnetic field. These measurements are taken to improve understanding of the sun's magnetic field in the hopes to better predict solar flares. Part of the procedure for the EXVM requires image motion stabilization over a period of a few minutes. A high speed tracker can be used to reduce image motion produced by wind loading on the EXVM, fluctuations in the atmosphere and other vibrations. The tracker consists of two elements, an image motion detector and a control system. The image motion detector determines the image movement from one frame to the next and sends an error signal to the control system. For the ground based application to reduce image motion due to atmospheric fluctuations requires an error determination at the rate of at least 100 hz. It would be desirable to have an error determination rate of 1 kHz to assure that higher rate image motion is reduced and to increase the control system stability. Two algorithms are presented that are typically used for tracking. These algorithms are examined for their applicability for tracking sunspots, specifically their accuracy if only one column and one row of CCD pixels are used. to examine the accuracy of this method two techniques are used. One involves moving a sunspot image a known distance with computer software, then applying the particular algorithm to see how accurately it determines this movement. The second

technique involves using a rate table to control the object motion, then applying the algorithms to see how accurately each determines the actual motion. Results from these two techniques are presented.
Author
Image Motion Compensation; Polarimeters; Algorithms; Optical Tracking; Computerized Simulation; Solar Activity

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.

19980203211 Communications Research Lab., Tokyo, Japan
High Energy Particle Environment
Goka, Tateo, Communications Research Lab., Japan; Matsumoto, Haruhisa, Communications Research Lab., Japan; Review of the Communications Research Laboratory; Jun. 1997; ISSN 0914-9279; Volume 43, No. 2, pp. 249-256; In Japanese; Also announced as 19980203206; Copyright; Avail: Issuing Activity (Communications Research Lab., Tokyo, Japan), Hardcopy, Microfiche

Space radiation has become a primary consideration in the design of modern spacecraft and in mitigating the risk factors for astronauts. Modern electronic devices and optical sensors are becoming more sensitive to high energy particle environments. This paper addresses engineering aspects of the radiation problem, by reviewing a brief history of radiation effects, the technical background to this problem, and current radiation model studies. Future plans to measure high energy particles are also presented.
Author
Aerospace Environments; Radiation Effects; Extraterrestrial Radiation; Radiation Belts; Solar Radiation

19980206173 University of Eastern Kentucky, Dept. of Physics and Astronomy, Richmond, KY USA
The Response of the BATSE LADs to Radiation From the Crab Nebula and Plans for Radioactivity Studies on Space Station
Laird, C. E., University of Eastern Kentucky, USA; Oct. 1996; 8p; In English; Also announced as 19980206153; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Burst and Transient Source Experiment (BATSE) onboard the Compton Gamma-Ray Observatory (CGRO) was designed to measure X-rays and gamma rays with energies from about 50 keV to above 2 MeV. As with many scientific investigations, the success of the original experiment lead to additional areas of research interest. In the case of BATSE the ability to observe the radiation from sources down to about 20 keV became readily apparent. This lead to a continuing program of measuring the spectrum of radiation from stellar objects at these lower energies. One of these, the Crab Nebula, has a very steady radiation flux and, thus, has become a ”standard candle” for such measurements. The Large Area Detectors (LADS) on BATSE contain a 1.27-cm thick, 25.4-cm radius NaI(Tl) detector behind a 6.35-mm thick polystyrene Charged Particle Detector (CPD) used to ”veto” charged particles signals. The detectors have been calibrated with a series of gamma and X-ray sources and the results carefully simulated with a Monte Carlo code. In the calibration process the computer simulation accounts for scattering from material in the counting room as well as the BATSE structure. For an orbiting detector, scattering from the entire spacecraft must be modeled as well as for all covering material over the detectors. Five years after CGRO was launched on April 5, 1991, a large body of observational data has been taken of the Crab Nebula. The technique used for these observations, and for many other X-ray sources, is Earth occultation. From the perspective of the spacecraft, the Earth occults most stellar objects once in orbit, i.e., the signal is lost as the source sets and is regained as the source rises. A careful analysis of the continuing signals from all sources measured allows for an accurate measurement of the spectrum of a given source. An analysis of this data from the Crab has indicated that the LADs are very responsive at energies as low as 20 keV-at energies below the range of calibration. While the model accounts for many of the interactions of the photons with the detectors, the observation of nonstatistical deviations at low energy and at small angles has suggested a need to recalibrate at energies where the attenuation effects are increasing exponentially.
Author
Calibrating; Radiation Detectors; Satellite-Borne Instruments; Gamma Ray Observatory; Mathematical Models

19980206287 Department of Energy, Office of Energy Research, Washington, DC USA

Laboratory technology research: Abstracts of FY 1997 projects

[1997]; 120p; In English

Report No.(s): DOE/ER-0714; DE98-001243; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); Abstracts Only, Microfiche

The Laboratory Technology Research (LTR) program supports high-risk, multidisciplinary research partnerships to investigate challenging scientific problems whose solutions have promising commercial potential. These partnerships capitalize on two great strengths of this country: the world-class basic research capability of the DOE Energy Research (ER) multi-program national laboratories and the unparalleled entrepreneurial spirit of American industry. A distinguishing feature of the ER multi-program national laboratories is their ability to integrate broad areas of science and engineering in support of national research and development goals. The LTR program leverages this strength for the Nation's benefit by fostering partnerships with US industry. The partners jointly bring technology research to a point where industry or the Department's technology development programs can pursue final development and commercialization. Projects supported by the LTR program are conducted by the five ER multi-program laboratories. These projects explore the applications of basic research advances relevant to DOE's mission over a full range of scientific disciplines. The program presently emphasizes three critical areas of mission-related research: advanced materials; intelligent processing/manufacturing research; and sustainable environments.

DOE

Commercialization; Energy Technology; Multidisciplinary Research

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